

R&S®FSW-K18

Power Amplifier and Envelope Tracking Measurements

User Manual



1176989302
Version 25



This manual applies to the following FSW models with firmware version 6.00 and later:

- R&S®FSW8 (1331.5003K08 / 1312.8000K08)
- R&S®FSW13 (1331.5003K13 / 1312.8000K13)
- R&S®FSW26 (1331.5003K26 / 1312.8000K26)
- R&S®FSW43 (1331.5003K43 / 1312.8000K43)
- R&S®FSW50 (1331.5003K50 / 1312.8000K50)
- R&S®FSW67 (1331.5003K67 / 1312.8000K67)
- R&S®FSW85 (1331.5003K85 / 1312.8000K85)

The following firmware options are described:

- R&S®FSW-K18 (1325.2170.02)
- R&S®FSW-K18D (1331.6845.02)
- R&S®FSW-K18F (1338.7230.02)
- R&S®FSW-K18M (1345.1470.02)

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Contents

1	Welcome to the amplifier measurement application.....	9
1.1	Starting the application.....	9
1.2	Understanding the display information.....	10
2	Measurements and result displays.....	12
2.1	Evaluation methods for amplifier measurements.....	12
2.2	Amplifier parameters.....	33
2.2.1	Modulation accuracy parameters.....	33
2.2.2	Power characteristics.....	37
2.2.3	Power supply characteristics.....	43
3	Configuration.....	45
3.1	Configuration overview.....	45
3.2	Performing measurements.....	47
3.3	Reference signals.....	48
3.3.1	Reference signal information.....	49
3.3.2	Using multi-segment waveform files.....	50
3.3.3	Transferring the reference signal.....	50
3.3.4	Current Generator Waveform.....	51
3.3.5	Custom Waveform File.....	52
3.3.6	Generate Own Signal.....	54
3.3.7	CFR (Crest Factor Reduction).....	57
3.4	Inputs and outputs.....	60
3.4.1	Selecting and configuring the input source.....	61
3.4.1.1	Configuring the RF input.....	61
3.4.1.2	External mixer.....	64
3.4.1.3	Configuring the analog baseband input.....	64
3.4.1.4	I/Q file.....	66
3.4.2	Configuring the frequency.....	67
3.4.3	Defining level characteristics.....	68
3.4.4	Power sensors.....	74
3.4.5	Using probes.....	79
3.4.6	Configuring outputs.....	79

3.4.7	Controlling a signal generator.....	79
3.4.8	Configuring the 2 GHz or 5 GHz bandwidth extension.....	84
3.4.9	Reference: I/Q file input.....	85
3.4.9.1	Basics on input from I/Q data files.....	85
3.4.9.2	I/Q data file format (iq-tar).....	86
	I/Q parameter XML file specification.....	87
	I/Q data binary file.....	92
3.5	Triggering.....	95
3.6	Data acquisition.....	95
3.7	Sweep configuration.....	99
3.8	Synchronization.....	100
3.9	Evaluation range.....	104
3.10	Signal error estimation and compensation.....	105
3.11	Equalizer.....	107
3.12	System models.....	108
3.13	Digital predistortion.....	111
3.13.1	Polynomial DPD.....	111
3.13.2	Direct DPD (FSW-K18D).....	114
3.13.3	(Generalized) memory polynomial DPD (FSW-K18M).....	118
3.13.4	Hammerstein model (FSW-K18M).....	122
3.14	Detailed MSE.....	124
3.15	Envelope measurements.....	126
3.16	Power measurements.....	127
3.17	Adjacent channel leakage error (ACLR) measurements.....	128
3.18	Parameter sweeps.....	131
3.19	Power servoing.....	134
3.20	Frequency domain.....	136
4	Analysis.....	138
4.1	Traces.....	138
4.1.1	Trace information.....	138
4.1.2	Trace export.....	141
4.1.3	Trace detector.....	142
4.2	Markers.....	143

4.2.1	General marker settings.....	143
4.2.2	Individual marker settings.....	144
4.2.3	Marker positioning.....	146
4.3	Numerical result tables.....	147
4.4	Result display settings.....	149
4.5	X-axis scaling.....	152
4.6	Y-axis scaling.....	154
5	Remote control commands for amplifier measurements.....	156
5.1	Introduction.....	156
5.1.1	Conventions used in descriptions.....	157
5.1.2	Long and short form.....	158
5.1.3	Numeric suffixes.....	158
5.1.4	Optional keywords.....	158
5.1.5	Alternative keywords.....	159
5.1.6	SCPI parameters.....	159
5.1.6.1	Numeric values.....	159
5.1.6.2	Boolean.....	160
5.1.6.3	Character data.....	161
5.1.6.4	Character strings.....	161
5.1.6.5	Block data.....	161
5.2	Common suffixes.....	161
5.3	Selecting the application.....	162
5.4	Configuring the screen layout.....	166
5.5	Performing amplifier measurements.....	174
5.5.1	Performing measurements.....	174
5.6	Configuring amplifier measurements.....	177
5.6.1	Designing a reference signal.....	178
5.6.2	Selecting and configuring the input source.....	194
5.6.2.1	RF input.....	194
5.6.2.2	Remote commands for external frontend control.....	200
	Commands for initial configuration.....	201
	Commands for test, alignment, and diagnosis.....	209
	Commands for external devices.....	211

Format of selftest result file.....	215
Programming example: Configuring an external frontend.....	219
Programming example 2: Configuring an external frontend with a connected amplifier	221
5.6.3 Power sensor measurements.....	222
5.6.3.1 Configuring power sensor measurements.....	223
5.6.3.2 Triggering with power sensors.....	232
5.6.4 Configuring the frequency.....	234
5.6.5 Defining level characteristics.....	235
5.6.6 Controlling a signal generator.....	242
5.6.7 Configuring the data capture.....	252
5.6.8 Sweep configuration.....	257
5.6.9 Synchronizing measurement data.....	259
5.6.10 Defining the evaluation range.....	263
5.6.11 Estimating and compensating signal errors.....	265
5.6.11.1 Error estimation and compensation.....	265
5.6.11.2 Equalizer.....	268
5.6.12 Applying a system model.....	271
5.6.13 Applying digital predistortion.....	273
5.6.13.1 Polynomial DPD.....	273
5.6.13.2 Direct DPD.....	281
5.6.13.3 Generalized memory polynomial.....	286
5.6.13.4 Hammerstein model.....	291
5.6.14 Detailed MSE.....	293
5.6.15 Trigger.....	294
5.6.16 Configuring envelope tracking.....	296
5.6.17 Configuring ACLR measurements.....	297
5.6.18 Configuring power measurements.....	303
5.6.19 Configuring parameter sweeps.....	303
5.6.20 Configuring power servoing.....	307
5.6.21 Frequency domain measurements.....	310
5.7 Analyzing results.....	312
5.7.1 Configuring traces.....	312
5.7.2 Using markers.....	317

5.7.2.1	General marker settings.....	317
5.7.2.2	Configuring individual markers.....	319
5.7.2.3	Positioning markers.....	324
5.7.3	Configuring numerical result displays.....	328
5.7.4	Configuring the statistics table.....	332
5.7.5	Configuring result display characteristics.....	333
5.7.6	Scaling the diagram axes.....	339
5.8	Retrieving results.....	344
5.8.1	Retrieving graphical measurement results.....	345
5.8.2	Retrieving numeric results.....	347
5.8.2.1	Retrieving general numeric results.....	347
5.8.2.2	Retrieving results of the result summary.....	348
	Retrieving all results.....	348
	Retrieving the modulation accuracy.....	349
	Retrieving power results.....	354
	Retrieving baseband characteristics.....	361
5.8.2.3	Retrieving results of the parameter sweep table.....	364
5.8.2.4	Retrieving results of the statistics table.....	371
5.8.3	Retrieving I/Q data.....	403
5.9	Managing measurement data.....	404
5.10	Deprecated remote commands for amplifier measurements.....	405
	List of Commands (Amplifier).....	406
	Index.....	426

1 Welcome to the amplifier measurement application

The R&S FSW-K18 is a firmware application that adds functionality to measure the efficiency of amplifiers with the FSW signal analyzer. You extend the amplifier application with the R&S FSW-K18D, which adds direct digital predistortion (DPD) functionality.

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

Functions that are not discussed in this manual are the same as in the base unit and are described in the FSW user manual. The latest versions of the manuals are available for download at the product homepage.

<http://www.rohde-schwarz.com/product/FSW.html>.

Find various videos on Rohde & Schwarz products and test and measurement topics on YouTube: <https://www.youtube.com/@RohdeundSchwarz>

Installation

Find detailed installing instructions in the getting started or the release notes of the FSW.

- [Starting the application](#).....9
- [Understanding the display information](#).....10

1.1 Starting the application

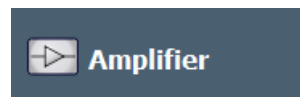
The amplifier measurement application adds a new type of measurement to the FSW.

To activate the amplifier application

1. Press [MODE] on the front panel of the FSW.

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

2. Select the "Amplifier" item.



The FSW opens a new measurement channel for the amplifier application. All settings specific to amplifier measurements are in their default state.



Sequencer

Note that you can use the Amplifier measurement application with the Sequencer that is available with the FSW. The functionality is the same as in the spectrum application. Refer to the FSW user manual for more information.

1.2 Understanding the display information

The following figure shows the display as it looks for amplifier measurements. All different information areas are labeled. They are explained in more detail in the following sections.



Figure 1-1: Screen layout of the amplifier measurement application

- 1 = Toolbar
- 2 = Channel bar
- 3 = Diagram header
- 4 = Result display
- 5 = Status bar
- 6 = Softkey bar

For a description of the elements not described below, refer to the getting started of the FSW.

Channel bar information

The channel bar contains information about the current measurement setup, progress and results.

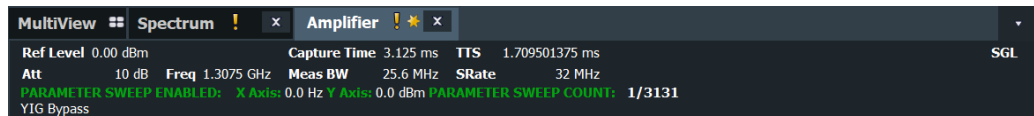


Figure 1-2: Channel bar of the amplifier application

"Ref Level"	Current reference level of the analyzer.
"Att"	Current attenuation of the analyzer.
"Freq"	Frequency the signal is transmitted on.
"Meas Time"	Length of the signal capture.
"Meas BW"	Bandwidth with which the signal is recorded.
"TTF"	Time difference between the trigger event and the first sample of the reference signal (= beginning of a frame).
"SRate"	Sample rate with which the signal is recorded.
"SGL"	Indicates that single sweep mode is active.
"Count"	The current signal count for measurement tasks that involve a specific number of subsequent sweeps (for example the parameter sweep).
"X Axis"	X-axis value that is currently measured.
"Y Axis"	Y-axis value that is currently measured.

Window title bar information

For each diagram, the header provides the following information:



Figure 1-3: Window title bar information of the amplifier application

- 1 = Window number
 - 2 = Window type
 - 3 = Trace color and number
 - 4 = Trace mode
- Blue color = Window is selected

Status bar information

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

2 Measurements and result displays

During an amplifier measurement, I/Q data from the input signal is captured for a specified time or for a specified record length. In addition, a reference signal is provided that describes the characteristics of the input signal. The Amplifier measurement application synchronizes the measured signal and compares it with the ideal reference signal, and determines deviations in characteristic parameters. These parameters can either be displayed as traces, in a table, or be evaluated statistically over a series of measurements.

- [Evaluation methods for amplifier measurements](#)..... 12
- [Amplifier parameters](#)..... 33

2.1 Evaluation methods for amplifier measurements

The data that was measured by the Amplifier measurement application can be evaluated using various different methods.

By default, the amplifier measurement results are displayed in the following windows:

- "Magnitude Capture" on page 22
- "Numeric Result Summary" on page 28
- "Spectrum FFT" on page 29
- "AM/AM" on page 14
- "Time Domain" on page 30
- "Phase deviation vs Input power"

The following evaluation methods are available for amplifier measurements:

Adjacent Channel Leakage Error (ACLR)	13
AM/AM	14
AM/PM	15
Channel Response Magnitude / Channel Response Phase / Group Delay (FSW-K18F)	16
DDPD Results (FSW-K18D)	18
EVM vs Power	19
Error Vector Spectrum	19
Gain Compression	20
Gain Deviation vs Time	21
Vcc vs Icc	22
Magnitude Capture	22
Memory DPD Coefficients	23
PAE vs Input Power / PAE vs Output Power	23
PAE vs Time	24
Parameter Sweep Table	25
Parameter Sweep: Diagram	26
Phase Deviation vs Time	26
Power vs Time	27

Raw EVM.....	27
Numeric Result Summary.....	28
Spectrum FFT.....	29
Time Domain.....	30
L Scale of the x-axis (display settings for the time domain).....	31
L Scale of the y-axis (display settings for the time domain).....	31
Statistics Table.....	32
Vcc vs Power / Icc vs Power.....	32

Adjacent Channel Leakage Error (ACLR)

The "ACLR" result display shows the power characteristics of the transmission (Tx) channel and its neighboring channel(s).

The ACLR measurement in the R&S FSW-K18 is a measurement based on I/Q data. Thus, its results are calculated by the same I/Q data as the rest of the results (like the EVM). Note that the supported channel bandwidth is limited by the I/Q bandwidth of the analyzer you are using.

The results are provided in numerical form in a table. The table is made up out of two parts, one part containing the characteristics of the Tx channel, the other containing those of the neighboring channels.

2 ACLR					
Channel	Bandw...	Offset	Power		
Tx1 (Re...	9.015 M...		10.902 ...		
Tx Total			10.902 ...		
Channel	Bandw...	Offset	Lower	Upper	Balanced
Adj	9.015 M...	10.000 ...	-2.628 ...	-3.306 ...	0.677 dB
Alt 1	9.015 M...	20.000 ...	-36.034...	-35.311...	-0.723 dB

The table contains the following information.

- **Channel**
Shows the type of channel.
- **Bandwidth**
Shows the channel's bandwidth.
- **Offset** (neighboring channels only)
Shows the frequency offset between the center frequency of the adjacent (or alternate) channel and the center frequency of the transmission channel.
- **Power**
Shows the power of the transmission channel, or the power of the upper / lower neighboring channel.
The result is calculated over the complete capture buffer, not just the evaluation range.
- **Balanced**
Shows the difference between the lower and upper adjacent channel power ("Lower Channel" - "Upper Channel").

For more information on configuring the ACP measurement, see [Chapter 3.17, "Adjacent channel leakage error \(ACLR\) measurements"](#), on page 128.

Remote command:

Selection: LAY:ADD? '1', LEFT, ACP

Result query: CALCulate<n>:MARKer<m>:FUNCTION:POWER:RESult?

on page 298

AM/AM

The "AM/AM" result display shows nonlinear effects of the DUT. It shows the amplitude at the DUT input against the amplitude at the DUT output.

The ideal "AM/AM" curve would be a straight line at 45°. However, nonlinear effects result in a measurement curve that does not follow the ideal curve. When you drive the amplifier into saturation, the curve typically flattens at high input levels.

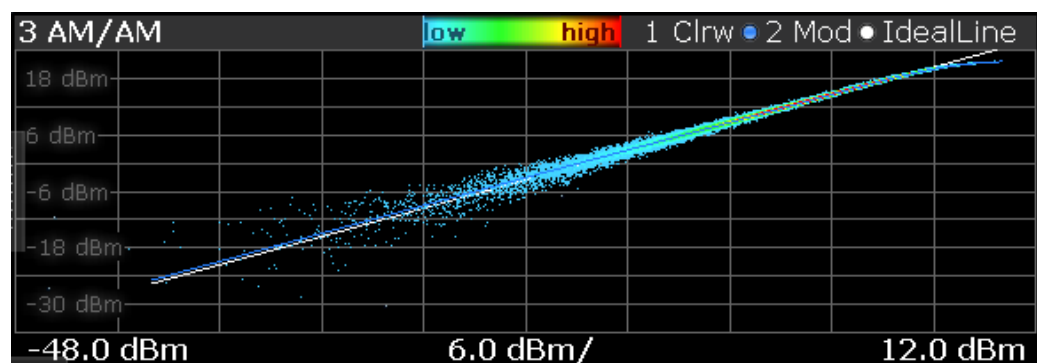
The width of the "AM/AM" trace is an indicator of memory effects: the larger the width of the trace, the more memory effects occur. The "AM/AM" Curve Width is shown in the numerical Result Summary.

Both axes show the power of the signal in dBm.

You can analyze the "AM/AM" characteristics of the measured signal and the modeled signal.

- Measured signal
 - Shows the "AM/AM" characteristics of the DUT.
 - The software uses the reference signal in combination with the synchronized measurement signal to calculate a software model that describes the characteristics of the device under test.
 - The measured signal is represented by a colored cloud of values. The cloud is based on the recorded samples. If samples have the same values (and would thus be superimposed), colors represent the statistical frequency with which a certain input / output level combination occurs. Blue pixels represent low statistical frequencies, red pixels high statistical frequencies. A color map is provided within the result display.
- Modeled signal
 - Shows the "AM/AM" characteristics of the model that has been calculated. The modeled signal is calculated by applying the [DUT model](#) to the reference signal.
 - When the model matches the characteristics of the DUT, the characteristics of the model signal are the same as those of the measured signal (minus noise).
 - The modeled signal is represented by a line trace.
 - When system modeling has been turned off, this trace is not displayed.

All traces include the digital predistortion, when you have turned on that feature.



Remote command:

Selection: `LAY:ADD? '1', LEFT, AMAM`

Result query: `TRACe<n>[:DATA]?` on page 345

AM/PM

The "AM/PM" result display shows nonlinear effects of the DUT. It shows the phase difference between DUT input and output for each sample of the synchronized measurement signal.

The ideal "AM/PM" curve is a straight line at 0°. However, nonlinear effects result in a measurement curve that does not follow the ideal curve. Typically, the curve drifts from a zero phase shift, especially at high power levels when you drive the amplifier into saturation.

The width of the "AM/PM" trace is an indicator of memory effects: the larger the width of the trace, the more memory effects occur. The "AM/PM" curve width is shown in the numerical "Result Summary".

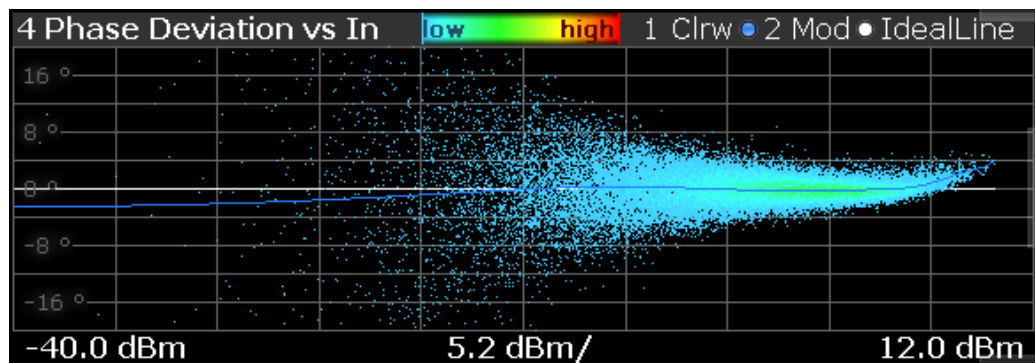
The x-axis shows the levels of all samples of the reference signal (input power) or the measurement signal (output power) in dBm. You can select the reference of the x-axis (input or output power) in the "Result Configuration" dialog box.

The y-axis shows the phase of the (unwrapped) signal for the corresponding power level. The unit is either rad or degree, depending on your phase unit selection in the "Result Configuration" dialog box.

You can analyze the "AM/PM" characteristics of the real DUT or of the modeled DUT.

- **Measured signal**
Shows the "AM/PM" characteristics of the DUT.
The software uses the reference signal together with the synchronized measurement signal to calculate a software model that describes the characteristics of the device under test.
The measured signal is represented by a colored cloud of values. The cloud is based on the recorded samples. If samples have the same values (and would thus be superimposed), colors represent the statistical frequency with which a certain input / output level combination occurs. A color map is provided within the result display.
- **Modeled signal**
Shows the "AM/PM" characteristics of the model that has been calculated. The modeled signal is calculated by applying the [DUT model](#) to the reference signal. When the model matches the characteristics of the DUT, the characteristics of the modeled signal are the same as those of the measured signal (minus noise).
The modeled signal is represented by a line trace.
When system modeling has been turned off, this trace is not displayed.

All traces include the digital predistortion, when you have turned on that feature.



Remote command:

Selection: LAY:ADD? '1', LEFT, AMPM

Result query: TRACe<n>[:DATA]? on page 345

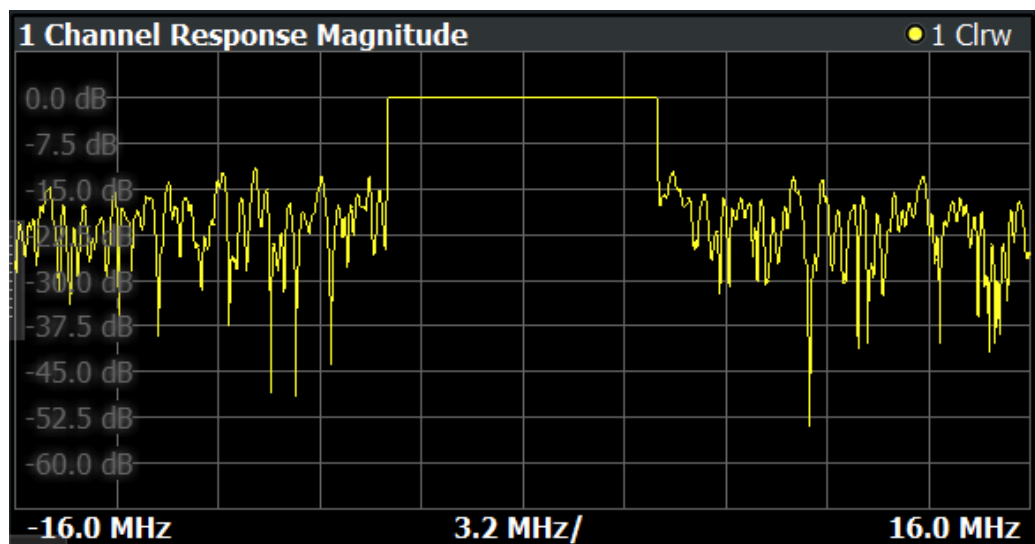
Channel Response Magnitude / Channel Response Phase / Group Delay (FSW-K18F)

The channel response and group delay result displays show the deviation of the measured signal compared to the reference signal within the measured channel. The result displays contain a single trace.

Outside of the occupied bandwidth, the reference signal values usually lie below the measured noise floor. This can result in large peaks on the trace in these areas (usually to the left and right of the channel). Note that because of the automatic [y-axis scaling](#), the trace can appear in parts as a straight horizontal line. In that case, adjust the scale of the y-axis manually.

Channel Response Magnitude

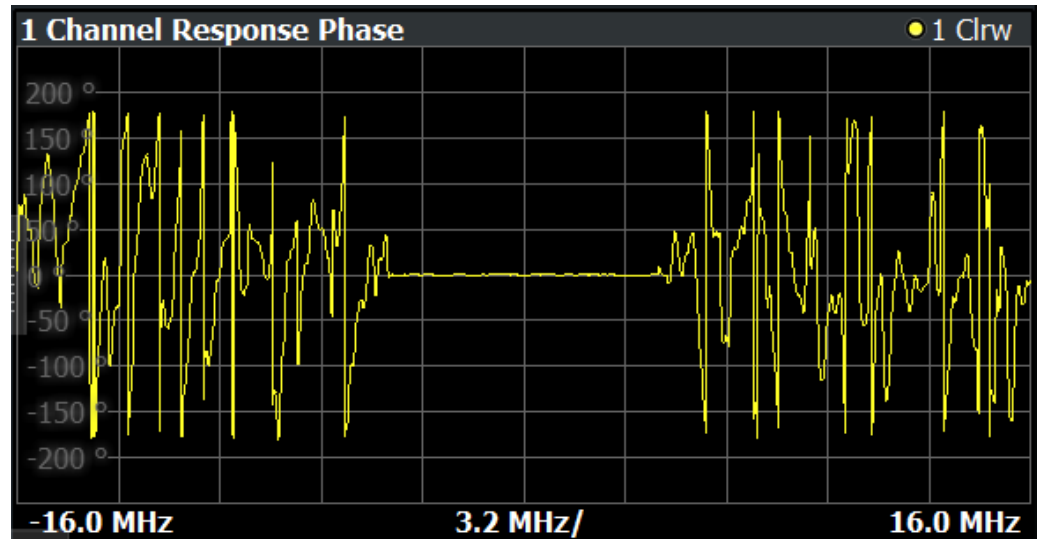
The "Channel Response Magnitude" result display analyzes the magnitude characteristics of the signal over the [measurement bandwidth](#).



For the "Channel Response Magnitude", the y-axis shows the deviation of the measured magnitude relative to the transmitted signal power of the signal generator in dB. The x-axis shows the frequency over which the signal was measured.

Channel Response Phase

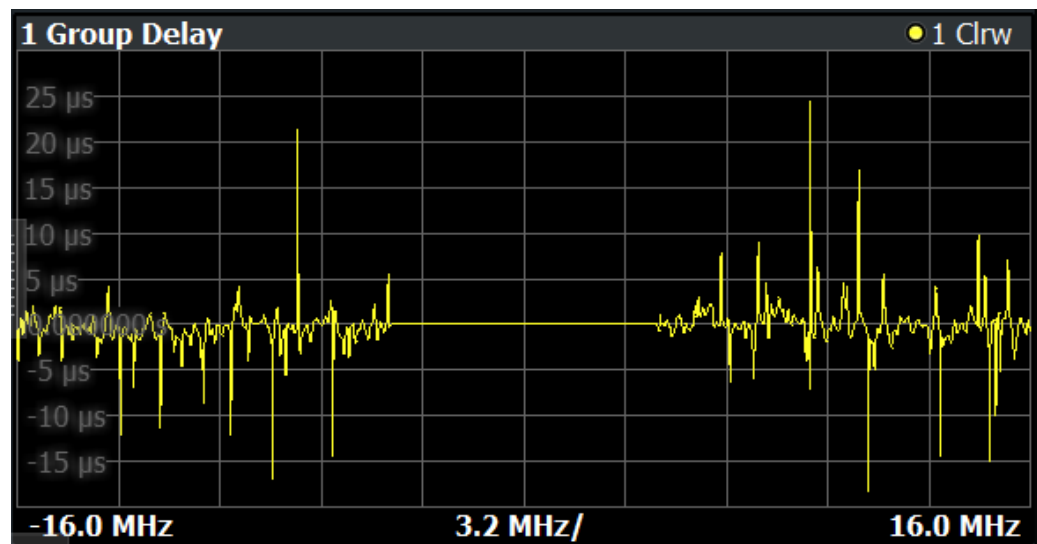
The "Channel Response Phase" result display analyzes the phase characteristics of the signal over the measurement bandwidth.



For the "Channel Response Phase", the y-axis shows the phase deviation relative to the reference signal. The unit depends on [your selection](#). The x-axis shows the frequency over which the signal was measured.

Group Delay

The "Group Delay" result display analyzes the relative group delay of the signal over the measurement bandwidth.



For the "Group Delay", the y-axis shows the measured time delay relative to the reference signal in seconds. The x-axis shows the frequency over which the signal was measured.

Remote command:

Selection (magnitude): `LAY:ADD? '1',LEFT,MRES`

Selection (phase): `LAY:ADD? '1',LEFT,PRES`

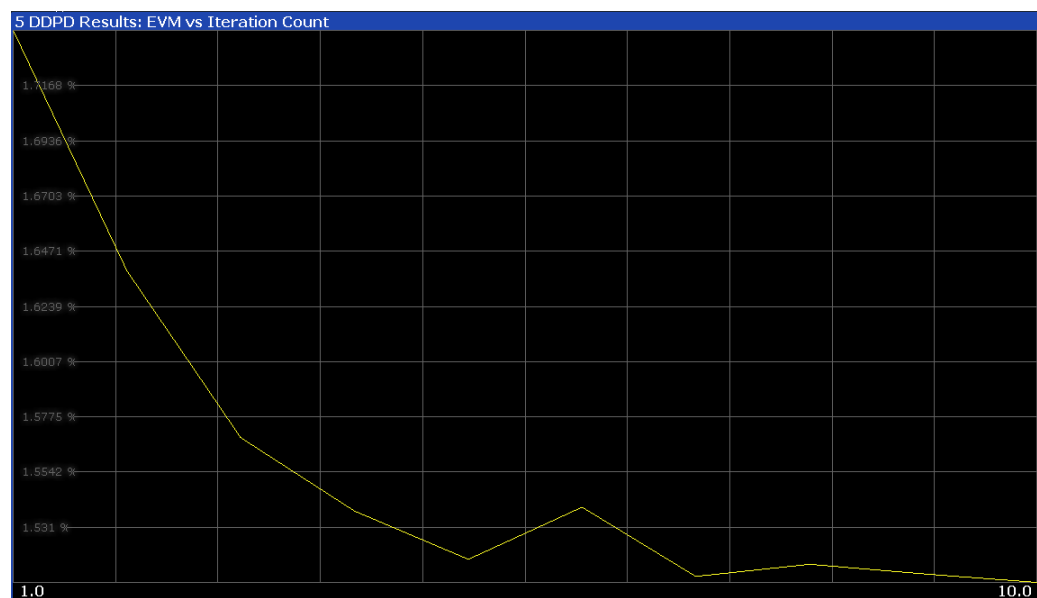
Selection (group delay): `LAY:ADD? '1',LEFT,GDEL`

Result query: `TRACe<n>[:DATA]? on page 345`

DDPD Results (FSW-K18D)

The "DDPD Results" result display shows a selectable result over all iterations of the direct DPD. This allows you to verify the direct DPD convergence, and to select the ideal iteration step for further processing (e.g. in FSW-K18M). It is only available with application FSW-K18D installed.

Select the result display before starting the direct DPD. Configure the result type in the [Chapter 4.4, "Result display settings"](#), on page 149.



The following result types are available:

"EVM" Error vector magnitude

Remote command:

`CONFigure:DDPD:WINDow<n>:RESult EVM`

"ACLR Adj Power of the upper adjacent channel

Upper"

Remote command:

`CONFigure:DDPD:WINDow<n>:RESult ACU1/`

"ACLR Adj Power of the lower adjacent channel

Lower"

Remote command:

`CONFigure:DDPD:WINDow<n>:RESult ACL1`

"Bal ACLR Difference between the lower and upper adjacent channel power

Magnitude"

Remote command:

`CONFigure:DDPD:WINDow<n>:RESult ACB1`

Remote command:

Selection: LAY:ADD? '1', LEFT, DDPD

Result query: TRACe<n>[:DATA]? on page 345

EVM vs Power

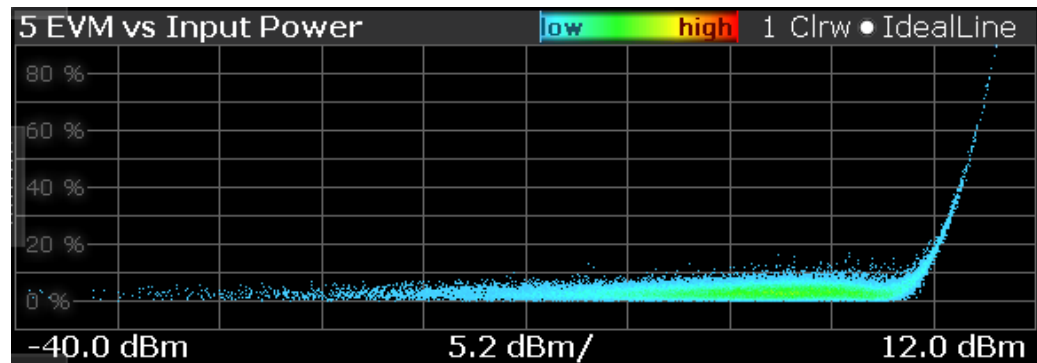
The "EVM vs Power" result display shows the EVM against the measured power values.

The ideal EVM vs power curve would be a straight line at 0 %. However, among other effects such as noise, nonlinear effects of the DUT cause an increase of the EVM. Nonlinear effects usually occur on high power levels that drive the power amplifier into saturation.

The x-axis shows the levels of all samples of the reference signal (input power) or the measurement signal (output power) in dBm. You can select the reference of the x-axis (input or output power) in the "Result Configuration" dialog box.

The y-axis shows the EVM of the signal for the corresponding power level in %.

All traces include the digital predistortion, when you have turned on that feature.



Remote command:

Selection: LAY:ADD? '1', LEFT, AMEV

Result query: TRACe<n>[:DATA]? on page 345

Error Vector Spectrum

The "Error Vector Spectrum" result display shows the error vector (EV) signal in the spectrum around the center frequency.

The EV is a measure of the modulation accuracy. It compares two signals and shows the distance of the measured constellation points and the ideal constellation points.

The unit is dB.

You can compare the measured signal against the reference signal and against the modeled signal.

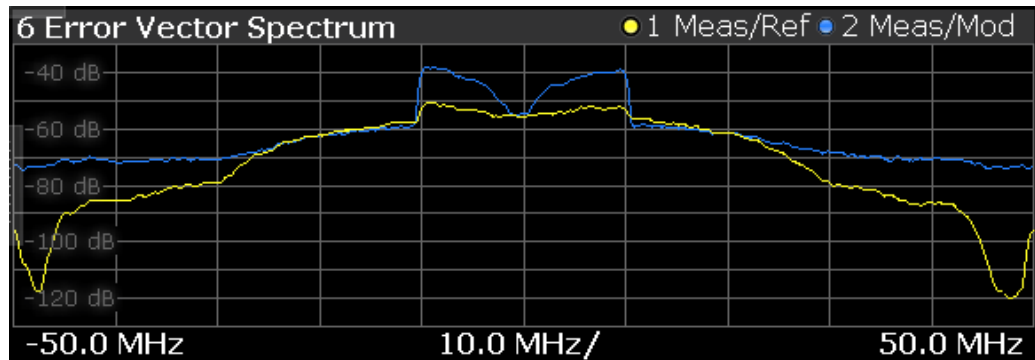
- Measured signal against reference signal
Trace 1 compares measured signal and the reference signal.
To get useful results, the calculated linear gain is compensated to match both signals.
Depending on the DUT, noise and nonlinear effects may have been added to the measurement signal. These effects are visualized by this trace.
- Measured signal against modeled signal

Trace 2 compares measured signal and the modeled signal.

The EVM between the measured and modeled signal indicates the quality of the DUT modeling. If the model matches the DUT behavior, the modeling error is zero (or is merely influenced by noise).

This result display shows changes in the model and its parameters and thus allows you to optimize the modeling.

When system modeling has been turned off, this trace is not displayed.



Remote command:

Selection: LAY:ADD? '1', LEFT, SEVM

Result query: TRACe<n> [:DATA] ? on page 345

Gain Compression

The "Gain Compression" result display shows the gain and error effects of the DUT against the DUT input or output power.

The gain is the ratio of the input and output power of the DUT.

The x-axis shows the levels of all samples of the reference signal (input power) or the measurement signal (output power) in dBm. You can select the reference of the x-axis (input or output power) in the "Result Configuration" dialog box.

The y-axis shows the gain in dB.

The ideal gain compression curve would be a straight horizontal line. However, nonlinear effects result in a measurement curve that does not follow the ideal curve. In addition, the curve widens at very low input levels due to noise influence.

The width of the gain compression trace is an indicator of memory effects: the larger the width of the trace, the more memory effects occur.

You can analyze the gain characteristics of the measured signal and the modeled signal.

- Measured signal

Shows the gain characteristics of the DUT.

The software uses the reference signal in combination with the synchronized measurement signal to calculate a software model that describes the characteristics of the device under test.

The measured gain is represented by a colored cloud of values. The cloud is based on the recorded samples. If samples have the same values (and would thus be superimposed), colors represent the statistical frequency with which a certain input / output level combination occurs. Blue pixels represent low statistical fre-

quencies, red pixels high statistical frequencies. A color map is provided within the result display.

- Modeled signal

Shows the gain characteristics of the model that has been calculated. The modeled signal is calculated by applying the **DUT model** to the reference signal.

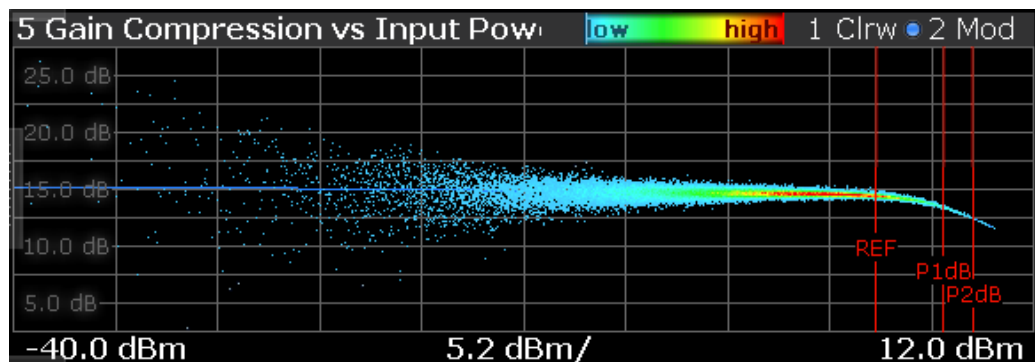
When the model matches the characteristics of the DUT, the characteristics of the model signal are the same as those of the measured signal (minus noise).

The modeled signal is represented by a line trace.

When system modeling has been turned off, this trace is not displayed.

In addition, one or more horizontal lines can appear in the result display.

- One line to indicate each compression point (1 dB, 2 dB and 3 dB).
- One line to indicate the reference point (0 dB compression) that the compression points refer to.



Remote command:

Selection: `LAY:ADD? '1',LEFT,GC`

Result query: `TRACe<n>[:DATA]?` on page 345

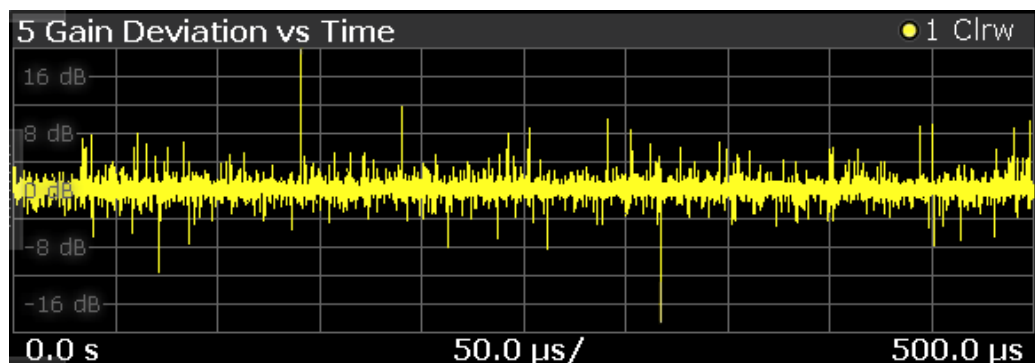
Gain Deviation vs Time

The "Gain Deviation vs Time" result display shows the deviation of each measured signal sample from the average gain of the measured signal.

The x-axis shows the time in seconds. The y-axis shows the gain deviation in dB.

The displayed results are based on the synchronized measurement data (represented by the green bar in the capture buffer).

Note that the result query and trace export only work for unencrypted reference signal waveform files.



Remote command:

Selection: LAY:ADD? '1', LEFT, GDVT

Result query: TRACe<n>[:DATA]? on page 345

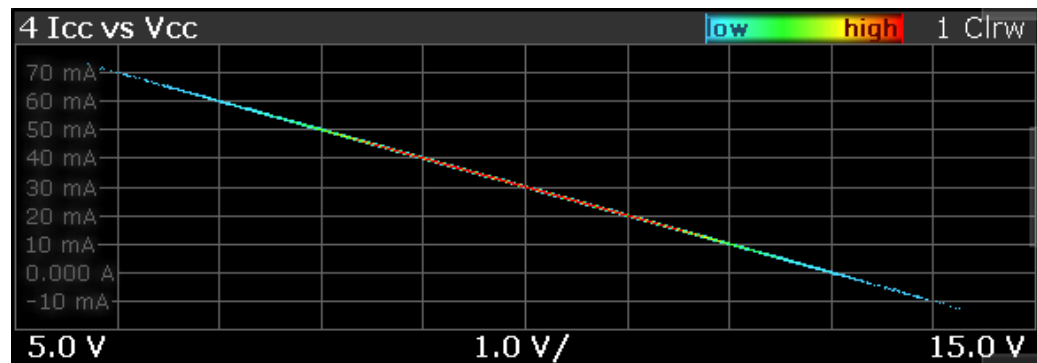
V_{cc} vs I_{cc}

Note: This result display requires you to turn on the [baseband input](#).

The "V_{cc} vs I_{cc}" result display shows the supply voltage that has been measured on baseband input Q against the current consumption that has been measured on baseband input I (using a shunt resistor or current probe).

The x-axis shows the voltage (V). The y-axis shows the current (A).

The resulting trace is usually represented by a cloud of values. The cloud is based on the recorded samples. If samples have the same values (and would thus be superimposed), colors represent the statistical frequency with which a certain level / gain combination occurs. Blue pixels represent low statistical frequencies, red pixels high statistical frequencies. A color map is provided within the result display.



Remote command:

Selection: LAY:ADD? '1', LEFT, VICC

Result query: TRACe<n>[:DATA]? on page 345

Magnitude Capture (RF, I and Q)

Note: The magnitude capture I and Q results displays require you to turn on the [baseband input](#).

The "Magnitude Capture" result display contains the raw data that has been recorded and thus represents the characteristics of the DUT.

It is available for the data recorded on the RF input and both baseband inputs (I and Q channels). (Note that the I and Q channel capture buffers are only available when [parallel baseband capture](#) is active.)

The capture buffer shows the signal level over time. The unit is either dBm (RF capture), V or A (baseband capture).

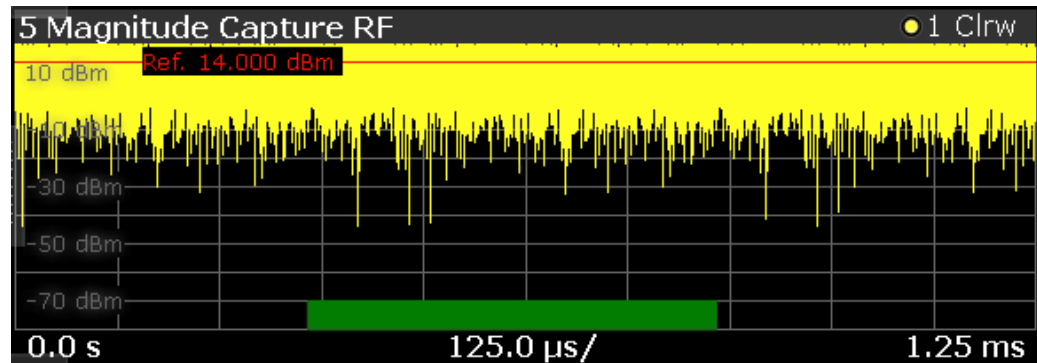
For a baseband capture, all [multipliers and offsets](#) are already included in the results.

The raw data is source for all further evaluations. You can also use the data in the capture buffer to identify the causes for possible unexpected results.

When you synchronize the reference signal and the measured signal, the synchronized area is indicated by a horizontal green bar on the bottom of the diagram.

The current reference level is indicated by a red horizontal line.

The green bar at the bottom shows the current frame. In I/Q averaging mode, the average value is shown. In trace statistics mode, multiple values are possible. The currently selected value is symbolized by a blue bar.



Remote command:

Selection (RF): `LAY:ADD? '1', LEFT, RFM`

Selection (I): `LAY:ADD? '1', LEFT, IMAG`

Selection (Q): `LAY:ADD? '1', LEFT, QMAG`

Result query: `TRACe<n>[:DATA]?` on page 345

Memory DPD Coefficients

The "Memory DPD Coefficients" result table shows basically complex filter coefficients for each polynomial degree. The two lines "1(Real)" and "1(Imag)" describe the complex impulse response for polynomial degree 1 (linear) of a filter from left to right. It is only available with application FSW-K18M installed.

Polynomial Order	Memory Order					
	0	1	2	3	4	5
1 (Real)	1.60787	-8.17859	18.4234	-19.2749	11.1634	-2.71031
1 (Imag)	0.360876	-1.83454	3.68814	-3.7469	1.8992	-0.345397
2 (Real)	0.0355388	-0.1169	-0.494853	-0.145286	0.138638	-0.0629907
2 (Imag)	0.0050489	0.000310979	-0.0457932	0.01782	-0.00895232	0.0174621
3 (Real)	-0.128389	0.47902	2.59296	0.453788	-0.556218	0.250055
3 (Imag)	-0.0142906	-0.0080389	0.224799	-0.017381	0.0013791	-0.062957
4 (Real)	0.155902	-0.681237	-5.47602	-0.356508	0.775582	-0.360015
4 (Imag)	-0.0101379	0.113657	-0.88731	0.0592651	-0.0296721	0.109657
5 (Real)	-0.0531163	0.317786	4.07806	-0.0292011	-0.389324	0.182799
5 (Imag)	0.021386	-0.118354	0.868153	-0.041535	0.0369386	-0.0794943

Remote command:

Selection: `LAY:ADD? '1', LEFT, MDPD`

Result query: `FETCh:MDPD:COEFFicients?` on page 290

PAE vs Input Power / PAE vs Output Power

Note: This result display requires you to turn on the [baseband input](#).

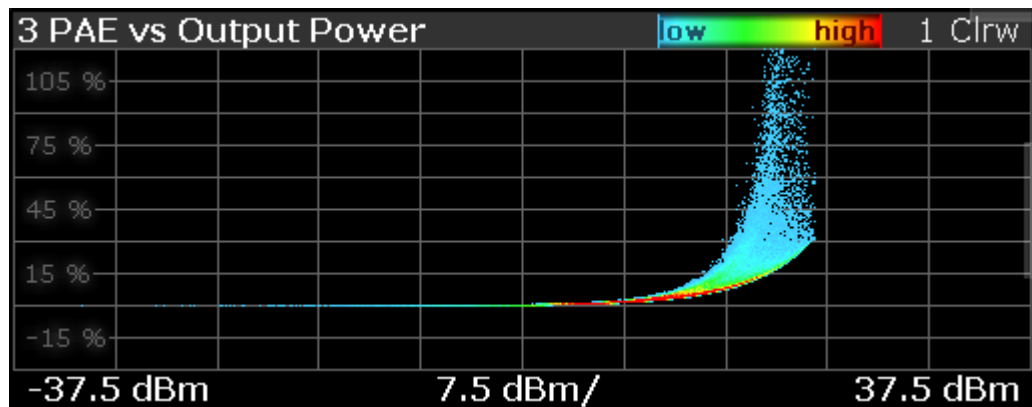
The "PAE vs Input Power" / "PAE vs Output Power" result displays show the power added efficiency (PAE) against the input or output power. It helps you to find the input or output levels at which the DUT works most efficiently.

The x-axis shows the levels of all samples of the reference signal (input power) or the measurement signal (output power) in dBm.

The y-axis shows the efficiency in %, based on the following formula:

$$\text{PAE} = (\text{RF output power} - \text{RF input power}) / \text{DC power}$$

The measured signal is represented by a colored cloud of values. The cloud is based on the recorded samples. If samples have the same values (and would thus be superimposed), colors represent the statistical frequency with which a certain input / output level combination occurs. Blue pixels represent low statistical frequencies, red pixels high statistical frequencies. A color map is provided within the result display.



Remote command:

Selection: LAY:ADD? '1', LEFT, PAEI

Result query: TRACe<n>[:DATA]? on page 345

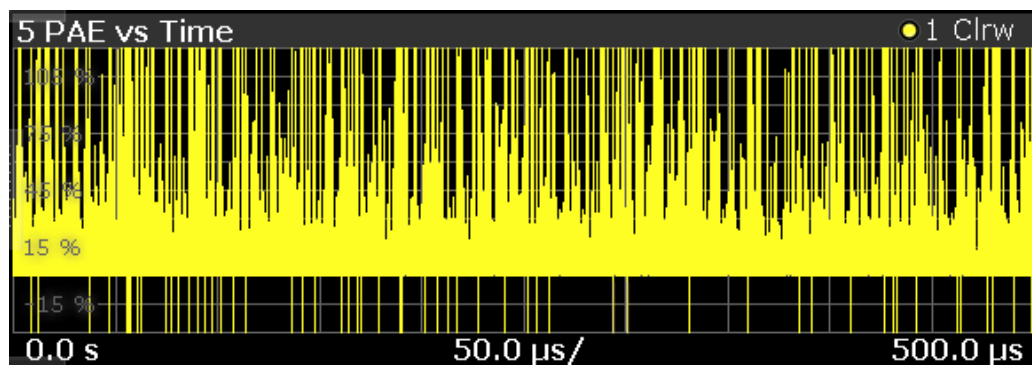
PAE vs Time

Note: This result display requires you to turn on the [baseband input](#).

The "PAE vs Time" result display shows the power added efficiency against time.

The x-axis represents the time in seconds. The y-axis shows the efficiency in %, based on the following formula:

$$\text{PAE} = (\text{RF output power} - \text{RF input power}) / \text{DC power}$$



Remote command:

Selection: LAY:ADD? '1', LEFT, PAET

Result query: TRACe<n>[:DATA]? on page 345

Parameter Sweep Table

The "Parameter Sweep" result display shows a result parameter of the DUT (for example the EVM) against two (custom) measurement parameters.

The parameter sweep is a good way, for example, to find the location of the ideal delay time of the RF signal and the envelope signal if you are measuring an amplifier that supports envelope tracking. You can also use the parameter sweep to determine the characteristics and behavior of an amplifier over different frequencies and levels.

The parameter sweep table shows the minimum and maximum results for all available result types in numerical form. For each result type, the position at which the minimum and maximum result occurred is displayed.

Example:

Result		Value	Frequency	Power
EVM	Min	0.878 %	1.23 GHz	-30.0 dBm
	Max	2.095 %	1.3 GHz	-30.0 dBm
ACLR Tx	Min	-20.460 d...	1.28 GHz	-30.0 dBm
	Max	-18.983 d...	1.01 GHz	-30.0 dBm
ACLR Adj 1 Lower	Min	-3.289 dBc	1.3 GHz	-30.0 dBm

A minimum EVM of 0.244 % and a maximum EVM of 0.246 % were measured (first and second row). The minimum EVM was measured at a frequency of 30 MHz and an output power of 0 dBm. The maximum EVM was measured at a frequency of 10 MHz and an output power of 0 dBm.

The following result types are evaluated in the parameter sweep.

- "ACLR Adj 1 Lower"
- "ACLR Adj 1 Upper"
- "ACLR Adj 1 Balanced"
- "ACLR Alt 1 Balanced"
- "ACLR Alt 2 Balanced"
- "AM/AM Curve Width"
- "AM/PM Curve Width"
- "Balanced ACLR Magnitude"
- Compression Point "P (1 dB / 2 dB / 3 dB)"
- "Crest Factor Out"
- "Current OBW"
- "EVM"
- "Gain"
- "Power Out"
- "RMS Power"
- "Voltage (V_{cc})"
- "Current (I_{cc})"
- "Power (V_{cc} * I_{cc})"

For details on the parameters, see [Chapter 2.2, "Amplifier parameters"](#), on page 33.

For more information about how to select the parameters, see ["Selecting the data to be evaluated during the parameter sweep"](#) on page 133.

Remote command:

Selection: `LAY:ADD? '1', LEFT, PTAB`

Result query: [Chapter 5.8.2.3, "Retrieving results of the parameter sweep table"](#), on page 364

Parameter Sweep: Diagram

The parameter sweep diagram is a graphical representation of the parameter sweep results. The results are either represented as a two-dimensional trace or as a three-dimensional trace, depending on whether you are performing a parameter sweep with one or two parameters.

In a two-dimensional diagram, the y-axis always shows the result. The displayed result depends on the [result type](#) you have selected. The information displayed on the x-axis depends on the [parameter](#) you have selected for evaluation (for example the EVM over a given frequency range). Values between measurement point are interpolated. Basically, you can interpret the two-dimensional diagram as follows (example): "at a frequency of x Hz, the EVM has a value of y."

In a three-dimensional diagram, the z-axis always shows the result. The information on the other two axes is arbitrary and depends on the parameters you have selected for evaluation. For a better readability, the result values in the three-dimensional diagram are represented by a colored trace: low values have a blue color, while high values have a red color. Values between measurement point are interpolated. Basically, you can interpret the three-dimensional diagram as follows (example): "at a frequency of x Hz and a level of y, the EVM has a value of z."

Remote command:

Selection: `LAY:ADD? '1', LEFT, PSW`

Result query: [TRACe<n>\[:DATA\]?](#) on page 345

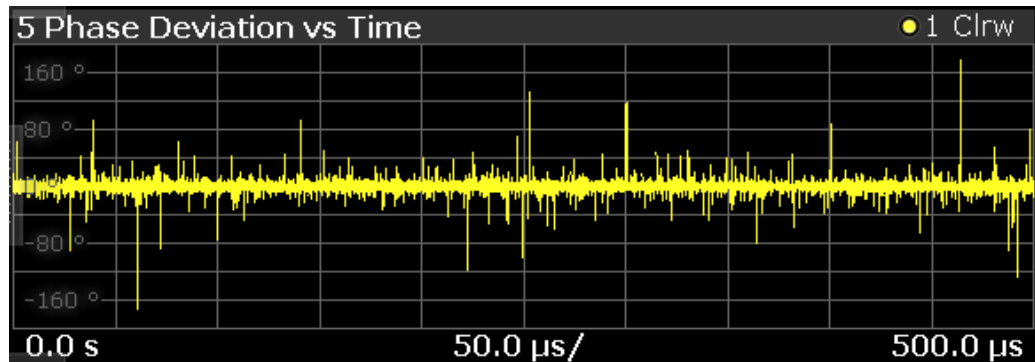
Phase Deviation vs Time

The "Phase Deviation vs Time" result display shows the (unwrapped) phase deviation of the measured signal compared to the reference signal over time.

The x-axis shows the time in seconds. The y-axis shows the phase deviation in degree.

The displayed results are based on the synchronized measurement data (represented by the green bar in the capture buffer).

Note that the result query and trace export only work for unencrypted reference signal waveform files.



Remote command:

Selection: LAY:ADD? '1', LEFT, PDVT

Result query: TRACe<n>[:DATA]? on page 345

Power vs Time

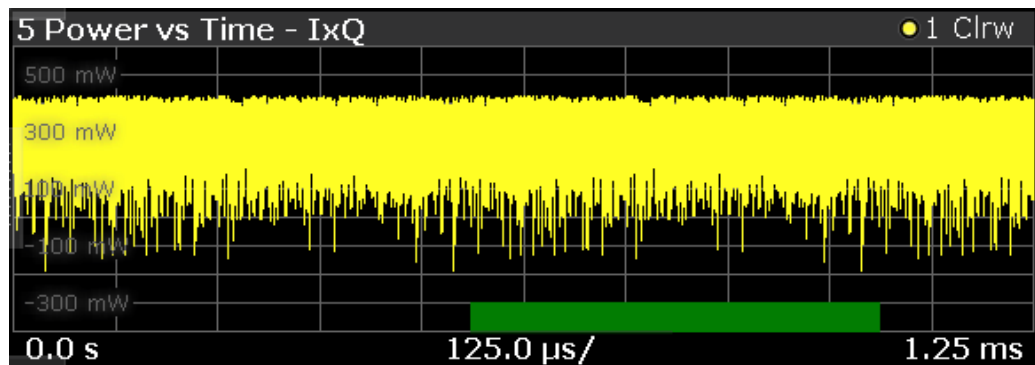
Note: This result display requires you to turn on the [baseband input](#).

The "Power vs Time" result display shows the supply power of the power amplifier against time.

The results are calculated by multiplying the supply voltage with the supply current which are recorded at the baseband inputs of the FSW.

The unit of the results is W.

For valid results, make sure that you have [configured the measurement](#) correctly regarding the equipment you are using.



Remote command:

Selection: LAY:ADD? '1', LEFT, PVT

Result query: TRACe<n>[:DATA]? on page 345

Raw EVM

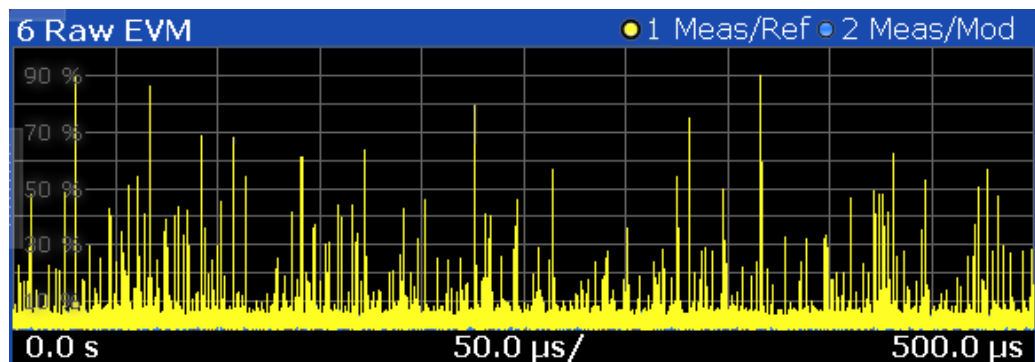
The "Raw EVM" result display shows the error vector magnitude of the signal over time.

The EVM is a measure of the modulation accuracy. It compares two signals and shows the distance of the measured constellation points and the ideal constellation points.

You can compare the measured signal against the reference signal and against the modeled signal.

- Measured signal against reference signal
Trace 1 compares the measured signal and the reference signal.
To get useful results, the calculated linear gain is compensated to match both signals.
Depending on the DUT, noise and nonlinear effects may have been added to the measurement signal. These effects are visualized by this trace.
- Measured signal against modeled signal
Trace 2 compares the measured signal and the modeled signal.
The EVM between the measured and modeled signal indicates the quality of the DUT modeling. If the model matches the DUT behavior, the modeling error is zero (or is merely influenced by noise).
This result display shows changes in the model and its parameters and thus allows you to optimize the modeling.
When system modeling has been turned off, this trace is not displayed.

Note that the raw EVM is calculated for each sample that has been recorded. Thus, the raw EVM can differ from EVM values that are calculated according to a specific mobile communication standard that apply special rules to calculate the EVM, for example LTE.



Remote command:

Selection: LAY:ADD? '1', LEFT, REVM

Result query: TRACe<n> [:DATA] ? on page 345

Numeric Result Summary

The "Result Summary" shows various measurement results in numerical form, combined in one table.

The table contains several areas.

- The modulation accuracy
- The power characteristics of the RF signal
- The power supply characteristics of the amplifier

2 Result Summary				
Modulation Accuracy	Min	Current	Max	Unit
Raw EVM	0.011	5.064	89.746	%
Raw Model EVM	0.009	3.127	15.763	%
Frequency Error	---	10.599	---	Hz
Power	Min	Current	Max	Unit
Power In	-46.00	0.00	10.02	dBm
Power Out	-30.27	14.44	21.59	dBm
Gain	---	14.43	---	dB
Crest Factor Out	---	7.16	---	dB
AM/AM Curve Width	---	0.026	---	Volt

For each result type, several values are displayed.

- **Current**
Value measured during the last sweep.
For measurements that evaluate each captured sample, this value represents the average value over all samples captured in the last sweep.
- **Min**
For measurements that evaluate each captured sample, this value represents the sample with lowest value captured in the last sweep.
- **Max**
For measurements that evaluate each captured sample, this value represents the sample with the highest value captured in the last sweep.
- **Unit**
Unit of the result.

Results that evaluate each captured sample

- "Raw EVM" and "Raw Model EVM"
- "Power In" and "Power Out"
- All baseband results, except the "Average PAE"

Note: When synchronization fails or is disabled, some results can be unavailable.

For details on the parameters, see [Chapter 2.2, "Amplifier parameters"](#), on page 33.

Remote command:

Selecting the result display: `LAY:ADD? '1', LEFT, RTAB`

Querying results: see [Chapter 5.8.2, "Retrieving numeric results"](#), on page 347

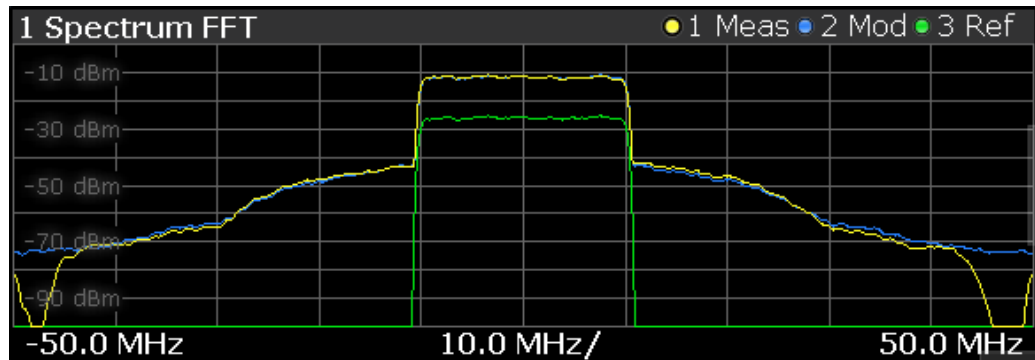
Spectrum FFT

The "Spectrum FFT" result display shows the frequency spectrum of the signal.

It is available for the data recorded on the RF input and both baseband inputs (I and Q channels). (Note that the spectrum FFT of the I and Q channel are only available when [parallel baseband capture](#) has been turned on.)

The spectrum FFT result shows the signal level in the spectrum around the center frequency. The unit is dBm.

You can display the spectrum of the measured signal and the reference signal. In the best case, the measured signal has the same shape as the reference signal.



Remote command:

Selection (RF): `LAY:ADD? '1', LEFT, RFS`

Selection (I): `LAY:ADD? '1', LEFT, ISP`

Selection (Q): `LAY:ADD? '1', LEFT, QSP`

Result query: `TRACe<n>[:DATA]? on page 345`

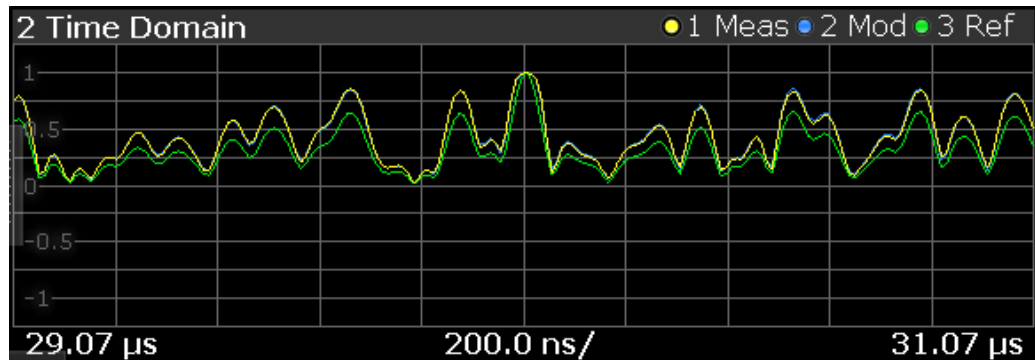
Time Domain

The "Time Domain" result display shows the signal characteristics over time.

It is similar to the "Power vs Time" and "Magnitude Capture" result displays in that it shows the signal characteristics over time. However, it deliberately shows only a very short period of the signal. You can thus use it to compare various aspects of the signal, especially the timing of the displayed signals, in a single result display.

- Measured signal
Trace 1 shows the characteristics of the measured signal over time. The data should be the same as the results shown in the "Magnitude Capture" RF result display.
In the best case, the measured signal is the same as the reference signal.
- Modeled signal
Trace 2 shows the characteristics of the modeled signal. When system modeling has been turned off, this trace is not displayed.
If the model matches the behavior of the DUT, the characteristics of the signal are the same as those of the measured signal (minus the noise).
- Reference signal
Trace 3 shows the characteristics of the reference signal. The reference signal present at the DUT input represents the ideal signal.
- Current measured at the I channel of the baseband input
Trace 4 shows the characteristics of the current that is drawn by the amplifier. It is measured at the I channel of the baseband input.
- Voltage measured at the Q channel of the baseband input
Trace 5 shows the characteristics of the power amplifier supply voltage. It is measured at the Q channel of the baseband input.
- Power measured at the baseband input
Trace 6 shows the power of the signal at the baseband input. The power is the product of the current and the voltage measured at the baseband channels.
Traces 4 to 6 are available when [parallel baseband capture](#) has been turned on.

For the baseband capture, all [multipliers and offsets](#) are already included in the results.



Remote command:

Selection: LAY:ADD? '1', LEFT, TDOM

Result query: TRACe<n> [:DATA] ? on page 345

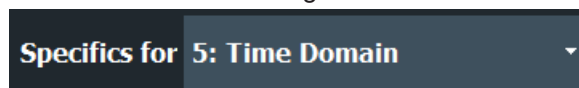
Scale of the x-axis (display settings for the time domain) ← Time Domain

The scale of the x-axis depends on your configuration in the "Display Settings" dialog box.

The logic is as follows:

- When you select automatic scaling (→ "Position: Auto") and synchronization has failed, the application searches for the peak level in the capture buffer and shows the signal around the peak for the "Duration" that has been defined.
- When you select automatic scaling (→ "Position: Auto") and synchronization is OK, the application searches for the peak level in the synchronized area of the capture buffer and shows the signal around the peak for the "Duration" that has been defined.
- When you select manual scaling (→ "Position: Manual") and synchronization has failed, the x-axis starts at an "Offset" relative to the first sample in the capture buffer. The end of the x-axis depends on the "Duration" you have defined.
- When you select manual scaling (→ "Position: Manual") and synchronization is OK, the x-axis starts at an "Offset" relative to the first sample in the synchronized area of the capture buffer. The end of the x-axis depends on the "Duration" you have defined.

Note: The "Display Settings" for the time domain are only available after you have selected the "Specifics for: Time Domain" item from the corresponding dropdown menu at the bottom of the dialog box.



Scale of the y-axis (display settings for the time domain) ← Time Domain

The scale of the y-axis also depends on your configuration.

The signal characteristics displayed in the time domain result display all have a different unit. Therefore, the application provides a feature that normalizes all results to 1 (see "Time domain result display" on page 150). Normalization makes it easier to compare the timing between the traces. By default, normalization is on. Note that you can normalize each "Time Domain" window individually.

Unnormalized results are displayed in their respective unit.

Statistics Table

The results for the statistics table are available only after the statistics mode has been activated using `[SENSe:]SWEep:STATistics[:STATe]` on page 258. If statistics mode is switched off, the statistics table stays empty.

All statistics are usually evaluated with the corresponding linear power unit before the unit conversion is done and the final unit is displayed. To illustrate, in the case of EVM, this means that the mean EVM is equal to the square root of the mean error power. The same principle applies accordingly to all other values.

Statistic	Raw EVM (%)	Raw Model EVM (%)	Frequency Error (Hz)	Power In (dBm)	Power Out (dBm)	Gain (dB)	Crest Factor Out (dB)
Selected	71.059	18.325	18.478	-4386.970	-104.930	-10.794	-10.825
Average	25.647	25.465	25.837	-3378.807	-41.393	-10.905	-10.962
Std. Dev.	24.250983	11.311995	11.987617	7154.384886	61.337266	0.158605	0.155308
Maximum	71.059	47.448	47.621	2575.087	50.115	-10.661	-10.825
Minimum	6.623	11.947	12.149	-22792.930	-112.493	-11.157	-11.221
Average	25.647	25.465	25.837	-3378.807	-41.393	-10.905	-10.962
Std. Dev.	24.250983	11.311995	11.987617	7154.384886	61.337266	0.158605	0.155308
Maximum	71.059	47.448	47.621	2575.087	50.115	-10.661	-10.825
Minimum	6.623	11.947	12.149	-22792.930	-112.493	-11.157	-11.221

Each value in the statistics table has different rows describing a single frame: Average, Std. Dev, Maximum and Minimum. This is similar to the [Numeric Result Summary](#).

The different color codes represent different result values:

- Blue**
 Result of the current result range. The selected values are updated when the user sweeps through the result range selection.
- Green**
 In I/Q averaging mode, the values in the green area are identical to the ones in the black background area.
 In trace statistics mode, the green area refers to all frames of the current capture buffer, whereas the black area refers to all measured frames (including previous capture buffers). Statistics is always done over sweep "Count" frames and then is being reset, unless the "Continuous Statistics" switch is activated. In this case, infinite statistics is executed.
- Black / No selection**
 Statistical results that can also be based on result ranges that were captured in previous measurement sweeps.

For details on the parameters, see [Chapter 2.2, "Amplifier parameters"](#), on page 33.

Remote command:

Adding statistics table: `LAY:ADD? '1',LEFT,STAB`

Querying results: [Chapter 5.8.2.4, "Retrieving results of the statistics table"](#), on page 371

Configuring statistics table: [Chapter 5.7.4, "Configuring the statistics table"](#), on page 332

Navigating through results ranges found in a capture: `CONFigure:RESult:RANGe[:SELEcted]` on page 259

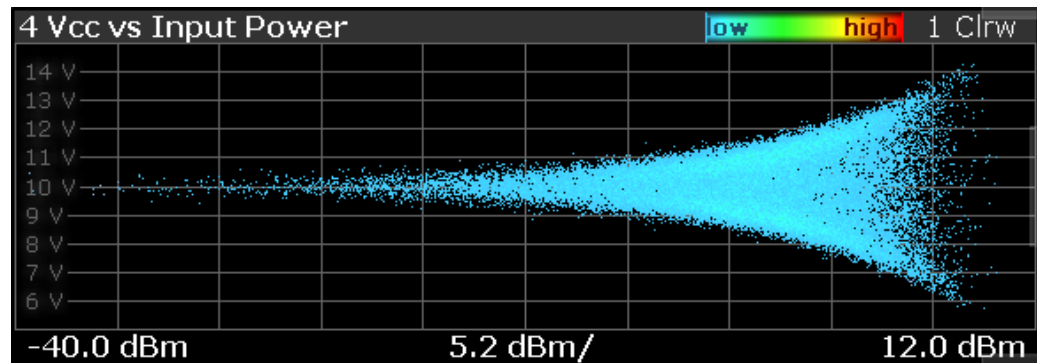
Vcc vs Power / Icc vs Power

Note: This result display requires you to turn on the [baseband input](#).

The "Vcc vs Power" / "Icc vs Power" result displays show the voltage (Vcc) or current (Icc) against the input or output power. It helps you to find the input or output levels at which the DUT works most efficiently.

The x-axis shows the levels of all samples of the reference signal (input power) or the measurement signal (output power) in dBm. You can select which signal characteristics you want to display in the [result settings](#).

The y-axis shows the voltage or current, depending on the result display.



Remote command:

Selection: LAY:ADD? '1', LEFT, PAEI

Result query: TRACe<n> [:DATA] ? on page 345

2.2 Amplifier parameters

The following parameters characterize the amplifier and are determined during an amplifier measurement.

- [Modulation accuracy parameters](#).....33
- [Power characteristics](#).....37
- [Power supply characteristics](#).....43

2.2.1 Modulation accuracy parameters

Amplitude Droop	34
Gain Imbalance	34
Frequency Error	34
I/Q Imbalance	34
I/Q Offset	35
Magnitude Error	35
Phase Error	35
Quadrature Error	36
Raw EVM	37
Raw Model EVM	37
Sample Rate Error	37

Amplitude Droop

Amplitude droop is a measure of the change in magnitude of the signal over the frame (reference signal) being measured in dB.

Note that amplitude droop is not available if the amplitude droop estimation is switched off. See also [Chapter 3.10, "Signal error estimation and compensation"](#), on page 105.

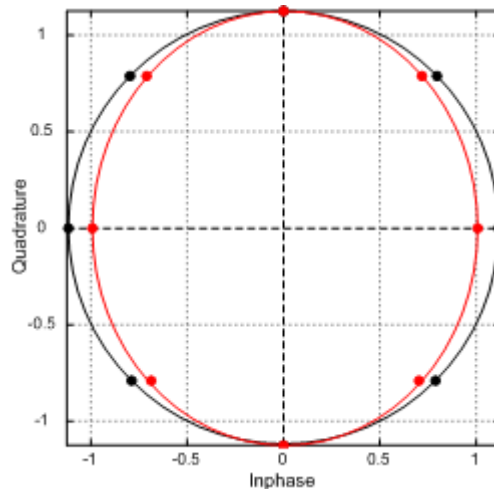
Remote command:

[FETCh:MACCuracy:ADRoop:CURRent\[:RESult\]?](#) on page 350

[FETCh:STABLE:ADRoop:STDeviatiOn?](#) on page 377

Gain Imbalance

Gain difference between the real (I) and imaginary (Q) part of the signal.



This effect is typically generated by two separate amplifiers with a different gain in the I and Q path of the analog baseband signal generation.

Note that gain imbalance is not available if the I/Q Imbalance estimation is switched off. See also [Chapter 3.10, "Signal error estimation and compensation"](#), on page 105.

Remote command:

[FETCh:MACCuracy:GIMBalance:CURRent\[:RESult\]?](#) on page 350

[FETCh:STABLE:GIMBalance:STDeviatiOn?](#) on page 384

Frequency Error

Difference of the RF frequency of the reference signal compared to the measured signal.

Note that a frequency error is not available if the frequency error estimation is switched off. See also [Chapter 3.10, "Signal error estimation and compensation"](#), on page 105.

Remote command:

[FETCh:MACCuracy:FERRor:CURRent\[:RESult\]?](#) on page 350

[FETCh:STABLE:FERRor:STDeviatiOn?](#) on page 383

I/Q Imbalance

Combination of Quadrature error and Gain imbalance.

The I/Q imbalance parameter is a representation of the combination of Quadrature error and gain imbalance.

Note that I/Q imbalance is not available if the I/Q imbalance estimation is switched off. See also [Chapter 3.10, "Signal error estimation and compensation"](#), on page 105.

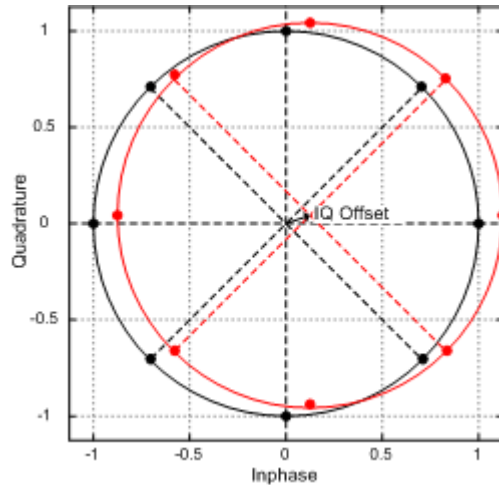
Remote command:

[FETCh:MACCuracy:IQIMbalance:CURRent\[:RESult\]?](#) on page 351

[FETCh:STABLE:IQIMbalance:STDeviatiOn?](#) on page 386

I/Q Offset

Shift of the measured signal compared to the ideal I/Q constellation in the I/Q plane.



Note that I/Q offset is not available if the I/Q Offset estimation is switched off. See also [Chapter 3.10, "Signal error estimation and compensation"](#), on page 105.

Remote command:

[FETCh:MACCuracy:IQOffset:CURRent\[:RESult\]?](#) on page 351

[FETCh:STABLE:IQOffset:STDeviatiOn?](#) on page 386

Magnitude Error

Difference in magnitude between the reference signal and the measured signal.

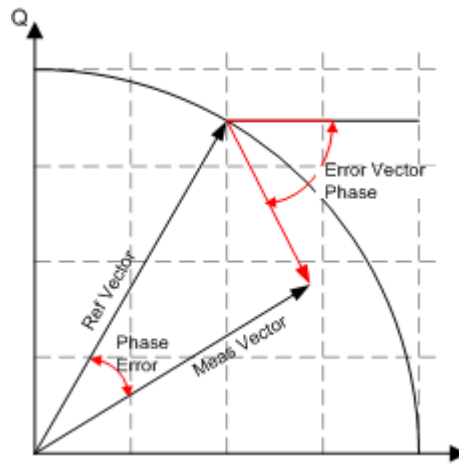
Remote command:

[FETCh:MACCuracy:MERRor:CURRent\[:RESult\]?](#) on page 351

[FETCh:STABLE:MERRor:STDeviatiOn?](#) on page 388

Phase Error

Phase difference between the reference and the (unwrapped) measured signal.



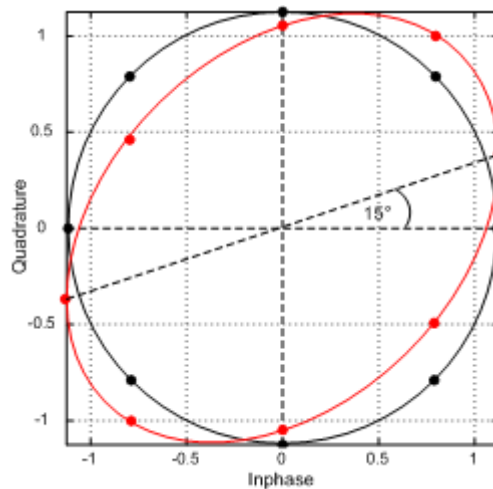
Remote command:

[FETCh:MACCuracy:PERror:CURRent\[:RESult\]?](#) on page 352

[FETCh:STABle:PERror:STDeviatiOn?](#) on page 392

Quadrature Error

Phase deviation of the 90° phase difference between the real (I) and imaginary (Q) part of the signal.



Within an ideal transmitter, the I and Q signal parts are mixed with an angle of 90° by the I/Q output mixer. Due to hardware imperfections, the signal delay of I and Q can be different and thus lead to an angle non-equal to 90° .

Note that quadrature rate error is not available if the I/Q Imbalance estimation is switched off. See also [Chapter 3.10, "Signal error estimation and compensation"](#), on page 105.

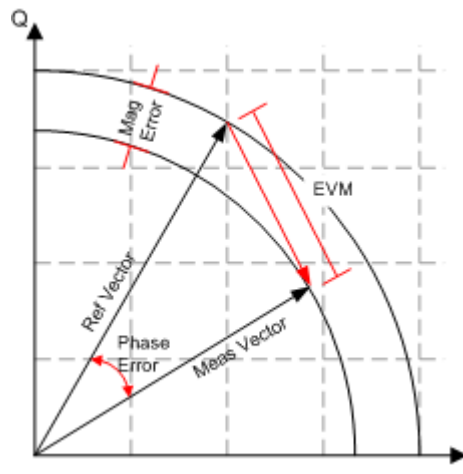
Remote command:

[FETCh:MACCuracy:QERRor:CURRent\[:RESult\]?](#) on page 353

[FETCh:STABle:QERRor:STDeviatiOn?](#) on page 396

Raw EVM

Error vector magnitude between synchronized reference and measured signal.



Remote command:

[FETCh:MACCuracy:REVM:CURRent\[:RESult\]?](#) on page 353

[FETCh:STABLE:REVM:AVG:STDeviation?](#) on page 398

[FETCh:STABLE:REVM:MAX:STDeviation?](#) on page 398

[FETCh:STABLE:REVM:MIN:STDeviation?](#) on page 399

[FETCh:PTABLE:EVM...](#), see [Chapter 5.8.2.3, "Retrieving results of the parameter sweep table"](#), on page 364.

Raw Model EVM

Error vector magnitude between synchronized measured and model signal.

Remote command:

[FETCh:MACCuracy:RMEV:CURRent\[:RESult\]?](#) on page 353

[FETCh:STABLE:RMEV:AVG:STDeviation?](#) on page 399

[FETCh:STABLE:RMEV:MAX:STDeviation?](#) on page 400

[FETCh:STABLE:RMEV:MIN:STDeviation?](#) on page 400

Sample Rate Error

Sample rate difference between reference and measured signal.

Note that a sample rate error is not available if the sample rate error estimation is switched off. See also [Chapter 3.10, "Signal error estimation and compensation"](#), on page 105.

Remote command:

[FETCh:MACCuracy:SRERror:CURRent\[:RESult\]?](#) on page 354

[FETCh:STABLE:SRERror:STDeviation?](#) on page 401

2.2.2 Power characteristics

ACLR Tx	38
ACLR Adj Upper	38
ACLR Adj Lower	38

Balanced ACLR Magnitude.....	38
AM/AM Curve Width.....	38
AM/AM Curve Width (Pk-Pk).....	39
AM/PM Curve Width.....	39
AM/PM Curve Width (Pk-Pk).....	40
Compression Point (1 dB / 2 dB / 3 dB).....	40
Crest Factor In.....	41
Crest Factor Out.....	41
Gain.....	41
Output Compression Point (1 dB / 2 dB / 3 dB).....	42
Occupied Bandwidth.....	42
Power In.....	42
Power Out.....	42
Power Out (Sensor).....	42
RMS Power.....	42

ACLR Tx

Power of the transmission channel.

Remote command:

FETCh:PTABle:ACP... , see [Chapter 5.8.2.3, "Retrieving results of the parameter sweep table"](#), on page 364.

ACLR Adj Upper

Power of the adjacent upper channels.

Remote command:

FETCh:PTABle:ACP:ACHannel<ch>:UPP... , see [Chapter 5.8.2.3, "Retrieving results of the parameter sweep table"](#), on page 364.

ACLR Adj Lower

Power of the lower adjacent channels.

Remote command:

FETCh:PTABle:ACP:ACHannel<ch>:LOW... , see [Chapter 5.8.2.3, "Retrieving results of the parameter sweep table"](#), on page 364.

Balanced ACLR Magnitude

Difference between the lower and upper adjacent channel power.

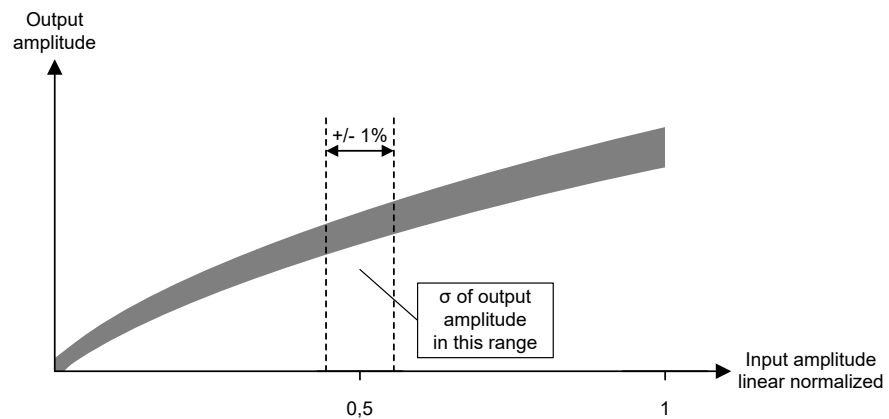
Remote command:

FETCh:PTABle:ACP:BALanced... , see [Chapter 5.8.2.3, "Retrieving results of the parameter sweep table"](#), on page 364.

AM/AM Curve Width

Vertical spread of the samples in the "AM/AM" result display.

The "AM/AM" curve width shows the standard deviation of the output voltage or the output phase deviation within a +/- 1% range around the mean amplitude in volt.



Remote command:

[FETCh:AMAM:CWIDth:CURRent\[:RESult\]?](#) on page 355

[FETCh:STABle:AMAM:CWIDth:STDeviatiOn?](#) on page 378

[FETCh:PTABle:AMAM:CWIDth...](#), see [Chapter 5.8.2.3, "Retrieving results of the parameter sweep table"](#), on page 364.

AM/AM Curve Width (Pk-Pk)

The "AM/AM" display shows the peak curve width around the specified reference value.

The values are Pk-Pk values, and represent $\max(\text{output power/dBm}) - \min(\text{output power/dBm})$.

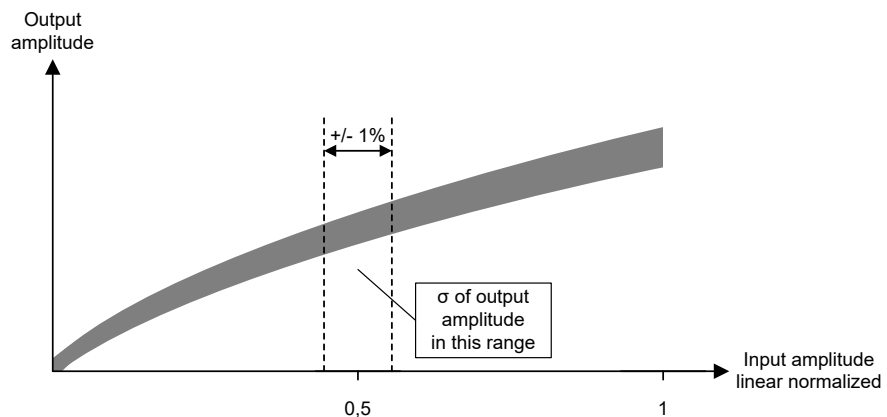
Remote command:

[FETCh:AMAM:PEAK:CWIDth:CURRent\[:RESult\]?](#) on page 357

AM/PM Curve Width

Vertical spread of the samples in the "Phase Deviation vs Input Power" ("AM/PM") result display.

The "Phase Deviation vs Input Power" curve width shows the standard deviation of the output voltage or the output phase deviation within a $\pm 1\%$ range around the mean amplitude in volt.



Remote command:

[FETCh:AMPm:CWIDth:CURRent\[:RESult\]? on page 356](#)

[FETCh:STABle:AMPm:CWIDth:STDeviatiOn? on page 378](#)

[FETCh:PTABle:AMPm:CWIDth...](#), see [Chapter 5.8.2.3, "Retrieving results of the parameter sweep table"](#), on page 364.

AM/PM Curve Width (Pk-Pk)

The "AM/PM Curve Width (Pk-Pk)" display shows the peak curve width around the specified reference value.

The values are Pk-Pk values, and represent $\max(\text{phase deviation}/^\circ) - \min(\text{phase deviation}/^\circ)$.

Remote command:

[FETCh:AMPm:PEAK:CWIDth:CURRent\[:RESult\]? on page 356](#)

Compression Point (1 dB / 2 dB / 3 dB)

Input power where the gain deviates by 1 dB, 2 dB or 3 dB from a reference gain (see ["Configuring compression point calculation"](#) on page 128).

In the graphical results, the compression points are indicated by horizontal red lines.

Remote command:

[FETCh:POWer:P1DB:CURRent\[:RESult\]? on page 360](#)

[FETCh:STABle:P1DB:IN:STDeviatiOn? on page 389](#)

[FETCh:PTABle:P1DB...](#), see [Chapter 5.8.2.3, "Retrieving results of the parameter sweep table"](#), on page 364.

[FETCh:POWer:P2DB:CURRent\[:RESult\]? on page 360](#)

[FETCh:STABle:P2DB:IN:STDeviatiOn? on page 390](#)

[FETCh:PTABle:P2DB...](#), see [Chapter 5.8.2.3, "Retrieving results of the parameter sweep table"](#), on page 364.

[FETCh:POWer:P3DB:CURRent\[:RESult\]? on page 360](#)

[FETCh:STABle:P3DB:IN:STDeviatiOn? on page 391](#)

[FETCh:PTABle:P3DB...](#), see [Chapter 5.8.2.3, "Retrieving results of the parameter sweep table"](#), on page 364.

Crest Factor In

Crest factor of the signal at the DUT input. The crest factor is the ratio of the RMS and peak power.

Remote command:

[FETCh:POWer:CFActor:IN:CURRent\[:RESult\]? on page 357](#)

[FETCh:STABle:CFACTOR:IN:STDeviatiOn? on page 382](#)

Crest Factor Out

Crest factor of the signal at the DUT output. The crest factor is the ratio of the RMS and peak power.

Remote command:

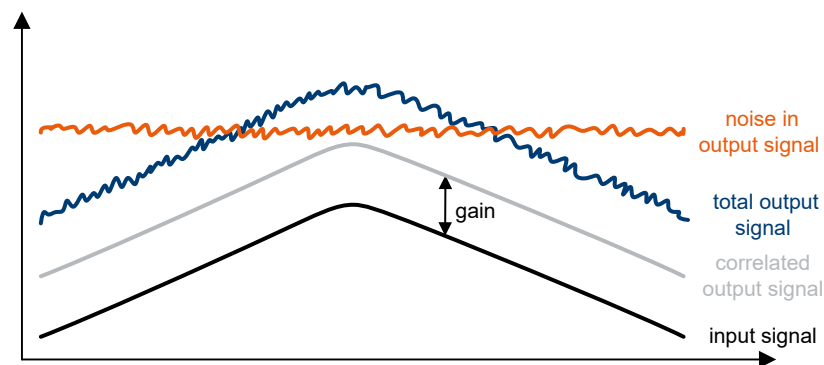
[FETCh:POWer:CFActor:OUT:CURRent\[:RESult\]? on page 358](#)

[FETCh:STABle:CFACTOR:OUT:STDeviatiOn? on page 382](#)

[FETCh:PTABle:CFACTOR...](#), see [Chapter 5.8.2.3, "Retrieving results of the parameter sweep table"](#), on page 364.

Gain

Average gain calculated over all samples of the "Gain Compression" trace.



Note that gain is not necessarily equal to the ratio "Power Out" / "Power In". Gain only describes the ratio of the correlated signal in "Power Out" to "Power In".

Gain is always referenced to the reference signal power, i.e. when DPD changes the generator level, the gain is still referenced to the input power of the reference signal - not the DPD signal.

Example: If the output signal contains the same amount of noise as the correlated signal (e.g. signal is 0 dBm and noise power is also 0 dBm), "Power Out" will show the sum (3 dBm). However, assuming an input signal power of -10 dBm, gain will only show 10 dB, not 13 dB.

Remote command:

[FETCh:POWer:GAIN:CURRent\[:RESult\]? on page 358](#)

[FETCh:STABle:GAIN:STDeviatiOn? on page 383](#)

[FETCh:PTABle:GAIN...](#), see [Chapter 5.8.2.3, "Retrieving results of the parameter sweep table"](#), on page 364.

Output Compression Point (1 dB / 2 dB / 3 dB)

Output power where the gain deviates by 1 dB, 2 dB or 3 dB from a reference gain.

Uses identical operating points as "Compression Point (1 dB / 2 dB / 3 dB)", but is identified by output power at compression point rather than input power.

Remote command:

`FETCh:POWer:P1DB:OUT:CURRent[:RESult]?` on page 360

`FETCh:STABle:P1DB:OUT:STDeviatiOn?` on page 389

`FETCh:POWer:P2DB:OUT:CURRent[:RESult]?` on page 360

`FETCh:STABle:P2DB:OUT:STDeviatiOn?` on page 390

`FETCh:POWer:P3DB:OUT:CURRent[:RESult]?` on page 360

`FETCh:STABle:P3DB:OUT:STDeviatiOn?` on page 391

Occupied Bandwidth

Occupied bandwidth calculated for the defined evaluation range.

Remote command:

`FETCh:POWer:OBW:CURRent[:RESult]?` on page 359

Power In

Signal power at the DUT input when reference signal is active. The signal generator level may change during direct DPD, but this result summary value will always refer to the reference signal – not the DPD signal.

Remote command:

`FETCh:POWer:INPut:CURRent[:RESult]?` on page 358

`FETCh:STABle:POWer:INPut:AVG:STDeviatiOn?` on page 393

`FETCh:STABle:POWer:INPut:MAX:STDeviatiOn?` on page 393

`FETCh:STABle:POWer:INPut:MIN:STDeviatiOn?` on page 394

Power Out

Signal power at the DUT output.

It is the RMS power of:

- The currently selected frame, if FSW-K18 has successfully synchronized.
- The current capture buffer, if FSW-K18 has not synchronized.

Remote command:

`FETCh:POWer:OUTPut:CURRent[:RESult]?` on page 359

`FETCh:STABle:POWer:OUTPut:AVG:STDeviatiOn?` on page 394

`FETCh:STABle:POWer:OUTPut:MAX:STDeviatiOn?` on page 395

`FETCh:STABle:POWer:OUTPut:MIN:STDeviatiOn?` on page 395

`FETCh:PTABle:POUT...`, see [Chapter 5.8.2.3, "Retrieving results of the parameter sweep table"](#), on page 364.

Power Out (Sensor)

Signal power at the output power sensor.

Remote command:

`FETCh:POWer:SENSor:OUT:CURRent[:RESult]?` on page 361

RMS Power

RMS signal power at the DUT output.

Remote command:

FETCh:PTABle:RMS . . . , see [Chapter 5.8.2.3, "Retrieving results of the parameter sweep table"](#), on page 364.

2.2.3 Power supply characteristics

These results are available when you enable baseband input.

For valid results, make sure that you have configured the measurement correctly regarding the equipment you are using (see ["Configuring PAE measurements \(Power Added Efficiency\)"](#) on page 126).

Baseband Input Voltage I.....	43
Baseband Input Voltage Q.....	43
Voltage.....	43
Current.....	44
Power.....	44
Average PAE.....	44

Baseband Input Voltage I

Voltage measured at the I channel of the analyzer baseband input.

Remote command:

FETCh:IVOLtage:PURE:CURRent[:RESult]? on page 363

FETCh:STABle:IVOLtage:AVG:STDeviatiOn? on page 387

FETCh:STABle:IVOLtage:MAX:STDeviatiOn? on page 387

FETCh:STABle:IVOLtage:MIN:STDeviatiOn? on page 388

Baseband Input Voltage Q

Voltage measured at the Q channel of the analyzer baseband input.

Remote command:

FETCh:QVOLtage:PURE:CURRent[:RESult]? on page 363

FETCh:STABle:QVOLtage:AVG:STDeviatiOn? on page 396

FETCh:STABle:QVOLtage:MAX:STDeviatiOn? on page 397

FETCh:STABle:QVOLtage:MIN:STDeviatiOn? on page 397

Voltage

Voltage measured at the Q channel of the analyzer baseband input.

This value represents the supply voltage of the power amplifier.

The result is the same as the "Baseband Input Voltage Q" when the multiplier = 1 and the offset = 0 (see ["Configuring PAE measurements \(Power Added Efficiency\)"](#) on page 126)

Remote command:

FETCh:VCC:CURRent[:RESult]? on page 364

FETCh:STABle:VCC:AVG:STDeviatiOn? on page 401

FETCh:STABle:VCC:MAX:STDeviatiOn? on page 402

FETCh:STABle:VCC:MIN:STDeviatiOn? on page 402

FETCh:PTABle:VCC . . . , see [Chapter 5.8.2.3, "Retrieving results of the parameter sweep table"](#), on page 364.

Current

Current measured at the I channel of the baseband input. This corresponds to the current drawn by the amplifier.

Remote command:

[FETCh:ICC:CURRent\[:RESult\]?](#) on page 363

[FETCh:STABLE:ICC:AVG:STDeviation?](#) on page 384

[FETCh:STABLE:ICC:MAX:STDeviation?](#) on page 385

[FETCh:STABLE:ICC:MIN:STDeviation?](#) on page 385

[FETCh:PTABLE:ICC...](#), see [Chapter 5.8.2.3, "Retrieving results of the parameter sweep table"](#), on page 364.

Power

DC power measured at the baseband input. The DC power is the product of the measured voltage and current.

Remote command:

[FETCh:BBPower:CURRent\[:RESult\]?](#) on page 362

[FETCh:STABLE:BBPower:AVG:STDeviation?](#) on page 380

[FETCh:STABLE:BBPower:MAX:STDeviation?](#) on page 381

[FETCh:STABLE:BBPower:MIN:STDeviation?](#) on page 381

Average PAE

The average Power Added Efficiency (PAE) indicates the efficiency of the amplifier.

The PAE is the ratio of the difference between RF output and input power and the DC power:

$$\text{PAE} = (\text{Output Power} - \text{Input Power}) / \text{DC power}$$

Remote command:

[FETCh:APAE:CURRent\[:RESult\]?](#) on page 362

[FETCh:STABLE:APAE:AVG:STDeviation?](#) on page 379

[FETCh:STABLE:APAE:MAX:STDeviation?](#) on page 379

[FETCh:STABLE:APAE:MIN:STDeviation?](#) on page 380

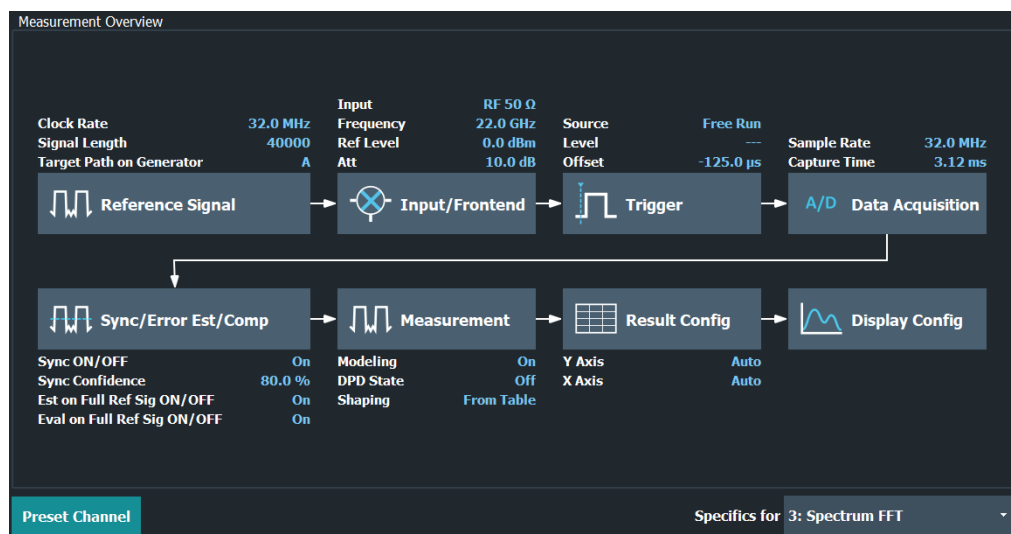
[FETCh:PTABLE:PAE...](#), see [Chapter 5.8.2.3, "Retrieving results of the parameter sweep table"](#), on page 364.

3 Configuration

• Configuration overview.....	45
• Performing measurements.....	47
• Reference signals.....	48
• Inputs and outputs.....	60
• Triggering.....	95
• Data acquisition.....	95
• Sweep configuration.....	99
• Synchronization.....	100
• Evaluation range.....	104
• Signal error estimation and compensation.....	105
• Equalizer.....	107
• System models.....	108
• Digital predistortion.....	111
• Detailed MSE.....	124
• Envelope measurements.....	126
• Power measurements.....	127
• Adjacent channel leakage error (ACLR) measurements.....	128
• Parameter sweeps.....	131
• Power servoing.....	134
• Frequency domain.....	136

3.1 Configuration overview

Throughout the measurement channel configuration, an overview of the most important currently defined settings is provided in the "Overview". The "Overview" is displayed when you select the "Overview" icon, which is available at the bottom of all softkey menus.



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

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

1. Reference Signal
See [Chapter 3.3, "Reference signals"](#), on page 48.
2. Input and output
See [Chapter 3.4, "Inputs and outputs"](#), on page 60.
3. Trigger
See [Chapter 3.5, "Triggering"](#), on page 95.
4. Data Acquisition
See [Chapter 3.6, "Data acquisition"](#), on page 95.
5. Synchronization, error estimation and compensation
See [Chapter 3.8, "Synchronization"](#), on page 100.
See [Chapter 3.10, "Signal error estimation and compensation"](#), on page 105.
6. Measurement
Modeling: see [Chapter 3.12, "System models"](#), on page 108.
DPD: see [Chapter 3.13, "Digital predistortion"](#), on page 111.
Envelope: see [Chapter 3.15, "Envelope measurements"](#), on page 126.
7. Result configuration
See [Chapter 4, "Analysis"](#), on page 138.
8. Display configuration
See [Chapter 2, "Measurements and result displays"](#), on page 12.

To configure settings

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

Preset Channel

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

Note: Do not confuse "Preset Channel" with the [Preset] key, which restores the entire instrument to its default values and thus closes *all channels* on the FSW (except for the default channel)!

Remote command:

`SYSTem:PRESet:CHANnel[:EXEC]` on page 166

Specific Settings for

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

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

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

3.2 Performing measurements

Access: [SWEEP]

The following features control the measurement. They are available in the "Sweep" menu.

The remote commands required to control the measurement are described in [Chapter 5.5.1, "Performing measurements"](#), on page 174.

Continuous Sweep / Run Cont	47
Single Sweep / Run Single	47
Continue Single Sweep	48

Continuous Sweep / Run Cont

After triggering, starts the measurement and repeats it continuously until stopped. This is the default setting.

While the measurement is running, "Continuous Sweep" and [RUN CONT] are highlighted. The running measurement can be aborted by selecting the highlighted softkey or key again. The results are not deleted until a new measurement is started.

Note: Sequencer. If the Sequencer is active, "Continuous Sweep" only controls the sweep mode for the currently selected channel. However, the sweep mode only takes effect the next time the Sequencer activates that channel, and only for a channel-defined sequence. In this case, a channel in continuous sweep mode is swept repeatedly.

Furthermore, [RUN CONT] controls the Sequencer, not individual sweeps. [RUN CONT] starts the Sequencer in continuous mode.

For details on the Sequencer, see the FSW User Manual.

Remote command:

`INITiate<n>:CONTinuous` on page 175

Single Sweep / Run Single

After triggering, starts the number of sweeps set in "Sweep Count". The measurement stops after the defined number of sweeps has been performed.

While the measurement is running, "Single Sweep" and [RUN SINGLE] are highlighted. The running measurement can be aborted by selecting the highlighted softkey or key again.

Note: Sequencer. If the Sequencer is active, "Single Sweep" only controls the sweep mode for the currently selected channel. However, the sweep mode only takes effect the next time the Sequencer activates that channel, and only for a channel-defined sequence. In this case, the Sequencer sweeps a channel in single sweep mode only once.

Furthermore, [RUN SINGLE] controls the Sequencer, not individual sweeps. [RUN SINGLE] starts the Sequencer in single mode.

If the Sequencer is off, only the evaluation for the currently displayed channel is updated.

For details on the Sequencer, see the FSW User Manual.

Remote command:

[INITiate<n>\[:IMMEDIATE\]](#) on page 175

Continue Single Sweep

While the measurement is running, "Continue Single Sweep" and [RUN SINGLE] are highlighted. The running measurement can be aborted by selecting the highlighted softkey or key again.

Remote command:

[INITiate<n>:CONMeas](#) on page 175

3.3 Reference signals

Many of the results available in the application require a reference signal that describes the characteristics of the signal you feed into the amplifier.

The reference signal describes the characteristics of the signal that you feed into the amplifier and whose amplified version is measured by the application. You can define any signal you want as a reference signal.

The application provides several methods to design a reference signal:

- Designing the signal on a generator
(Requires a Rohde & Schwarz generator.)
- Designing the signal in a waveform file
- Designing the signal in the amplifier application
(Requires a Rohde & Schwarz generator.)
- Designing the signal with a Crest Factor Reduction (Generator Option K548)

For a list of supported signal generators, refer to the datasheet of the amplifier application.

The remote commands required to configure the reference signal are described in [Chapter 5.6.1, "Designing a reference signal"](#), on page 178.

- [Reference signal information](#)..... 49
- [Using multi-segment waveform files](#)..... 50
- [Transferring the reference signal](#)..... 50
- [Current Generator Waveform](#).....51

- [Custom Waveform File](#).....52
- [Generate Own Signal](#).....54
- [CFR \(Crest Factor Reduction\)](#)..... 57

3.3.1 Reference signal information

Reference signal information

Each tab of the "Reference Signal" dialog box contains some basic information about the reference signal currently in use.

The information is only displayed when a reference signal has been successfully loaded. When you load a different waveform, the reference signal information is updated accordingly.

Currently Active Reference Signal			
Waveform File:	C:\Simulation\ES-MAIN_20.1.1 \user\Demo\LTE-DL_FDD.iq.tar		
Sample Rate:	15.36 MHz	Number of Samples:	307500
Crest Factor (File):	10.48 dB	Bandwidth (OBW):	3.82 MHz

- **Waveform file**
Name and path of the waveform file currently in use.
- **Sample rate**
The sample rate in the header of the currently used reference signal waveform file in Hz.
- **Number of samples**
Length of the currently used reference signal waveform file in samples.
- **Crest Factor (File)**
Crest factor of the whole file currently in use. The crest factor of waveform files is read from their header. The crest factor of iq.tar files is calculated.
- **Bandwidth (OBW)**
The occupied bandwidth of the reference signal currently in use. A calculated bandwidth that contains 99% of signal power is displayed.

Remote command:

File path: [CONFigure:REFSignal:SINFo:FPATH?](#) on page 187

Sample rate: [CONFigure:REFSignal:SINFo:SRATe?](#) on page 187

Sample length: [CONFigure:REFSignal:SINFo:SLENgth?](#) on page 187

Crest Factor: [CONFigure:REFSignal:SINFo:CFACTOR?](#) on page 188

OBW: [CONFigure:REFSignal:SINFo:OBW?](#) on page 188

reference trace I/Q data: [TRACe:IQ:REF\[:DATA\]?](#) on page 403

3.3.2 Using multi-segment waveform files

Using multi-segment waveform files

Modern chip technologies implement several communication standards within one chip and thus increase the requirements in spatial design and test systems. To fulfill the requirements in the test systems, and to enable a rapid change between different waveforms containing different test signals, the R&S SMW provides the functionality to generate multi-segment waveform files. Multi-segment waveform files are files that contain several different waveforms.

(For more information about creating and using multi-segment waveform files (including examples) refer to the documentation of the R&S SMW.)

When you are testing amplifiers with the amplifier measurement application, you can use a multi-segment waveform file to create the reference signal. If you use one of these files, you have to select the segment that you want to use as a reference signal in the corresponding input field.

Note that the content of the segment you are using for the reference signal must match the content of the segment used by the ARB of the signal generator. You can select the segment for the used by the generator in the [generator setup](#).

Remote command:

[CONFigure:REFSignal:SEGment](#) on page 186

3.3.3 Transferring the reference signal

Transferring the reference signal

Both the signal generator and analyzer used in the test setup need to know the characteristics of the reference signal.

- The signal generator needs that information to generate the signal.
- The analyzer needs that information for the evaluation of the results.

This is why you have to transfer the signal information to both instruments. The transmission is done through a LAN connection that you have to establish when setting up the measurement. For more information on that see [Chapter 3.4.7, "Controlling a signal generator"](#), on page 79.

- When you design the reference signal on the signal generator, transfer the signal information from the generator to the analyzer with the →"Read and Load Current Signal from R&S SMW" button.
You can either design a reference signal with one of the available firmware options (for example an LTE signal with the R&S SMW-K55) or design a signal in a custom waveform file. Note that the R&S FSW-K18 does not support all firmware options of the signal generator.
- When you load the reference signal from a waveform file or design the signal within the R&S FSW-K18, transfer the signal information from the analyzer to the generator. Depending on the signal source, you can do this either with the "Load and Export Selected Waveform File to Generator" or the "Generate and Load Signal and Export it to Generator" buttons.

When you send the signal information to the generator, the application automatically configures the generator accordingly.

Transmission state

The LED displayed with the transmission button shows the state of the reference signal transmission.

The LED is either gray, green or red:

- Grey LED
Transmission state unknown (for example when you have not yet started the transmission).
- Green LED
Transmission has been successful.
- Red LED
Transmission has not been successful.
Make sure that the [generator control state](#) is on.
Check if the generator IP address / computer name are correct and if the connection has been established.

3.3.4 Current Generator Waveform

Access (source: generator): "Overview" > "Reference Signal" > "Current Generator Waveform"

Designing a reference signal on a signal generator

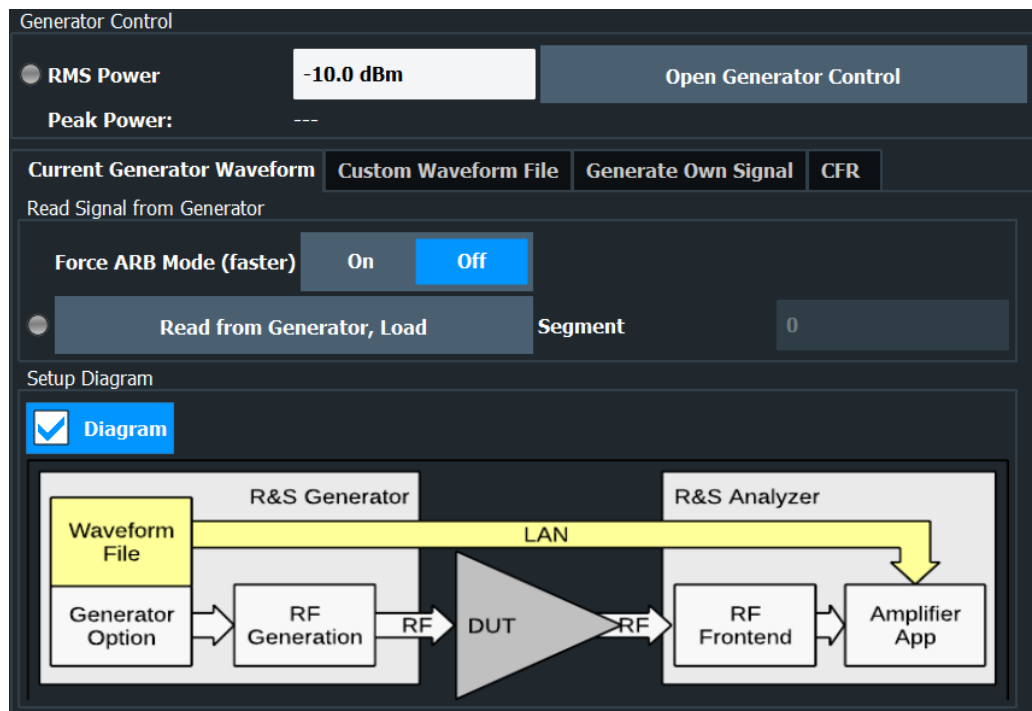
One way to design a reference signal is to design the signal on the signal generator itself.

You can design any signal you like, as long as it is storable as an arbitrary waveform (ARB) file. When you are done, you have to transfer the signal information from the signal generator to the signal analyzer with the "Read from Generator, Load" button.

The "Force ARB Mode" switch forces the signal generator to use its ARB mode (arbitrary waveform) rather than its real-time mode, whenever possible. As a result, switching between DPD on and off state is significantly faster. When the "Force ARB Mode" function is used, the peak power of the generator is read out and used within the process but as a result of this function the RMS power of the generator is modified. Also the waveform header of the file is recalculated to make sure that the peak input level stays constant or lower than the gain expansion during DPD calculation.

The parameters of the currently active reference signal are described in ["Reference signal information"](#) on page 49.

The "Open Generator Control" button provides functionality to change the generator settings as described in [Chapter 3.4.7, "Controlling a signal generator"](#), on page 79.



Most of the options available for the connected generator are supported by the automatic signal import functionality of the R&S FSW-K18. If the signal import was not successful (indicated by a red LED), you have to transfer the reference signal in another way (for example with a memory stick).

For a comprehensive description of all features available on the signal generator and information on how to generate signals, refer to the documentation of the signal generator.

Remote command:

See signal generator documentation.

[CONFigure:REFSignal:CGW:AMODE\[:STATe\]](#) on page 179

[CONFigure:REFSignal:CGW:READ](#) on page 180

[CONFigure:REFSignal:CGW:LEDState?](#) on page 179

3.3.5 Custom Waveform File

Access (source: waveform file): "Overview" > "Reference Signal" > "Custom Waveform File"

Designing a reference signal in a waveform file

One way to design a reference signal is to define its characteristics in a waveform file (*.wv or *.iq.tar).

You can create a waveform file, for example:

- With the R&S®WinIQSIM2 software package
- By exporting a signal designed on the signal generator

Basically, this file contains the characteristics of the reference signal. The generator then generates the reference signal based on the information in the file.

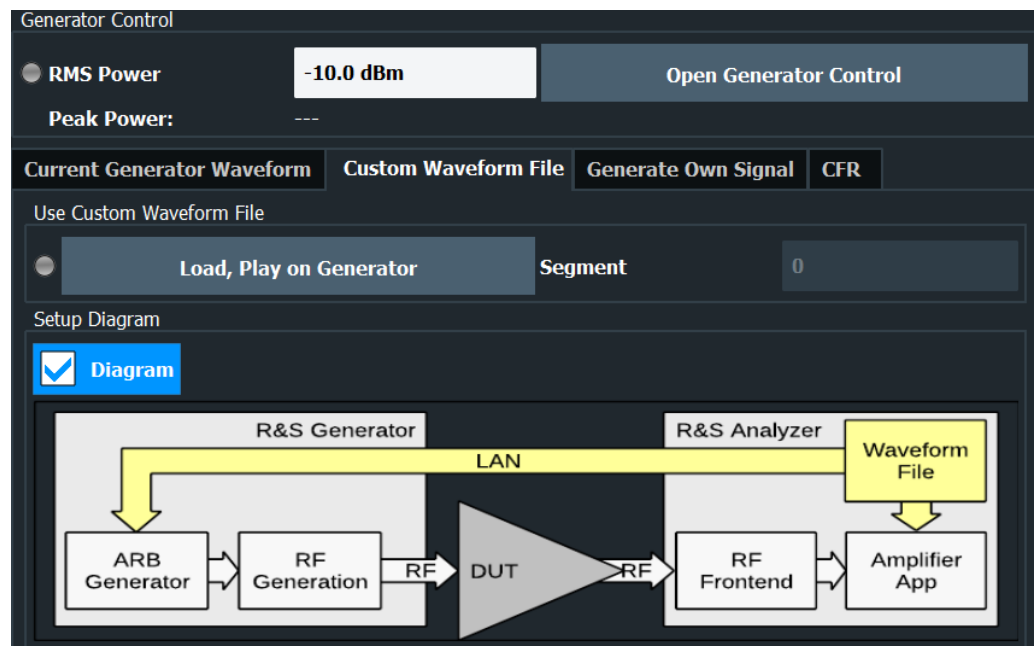
There are two ways to generate the reference signal through a custom waveform file.

- The generator is connected to the FSW in a LAN, and can be recognized by the R&S FSW-K18 (Rohde & Schwarz generators only, for example the R&S SMW)
In that case, you can simply transfer the reference signal information to the generator with the features integrated into the R&S FSW-K18. The generator then generates the corresponding signal with the appropriate signal level, and the R&S FSW-K18 is able to compare the measured signal to the ideal reference signal.
- The generator is not connected to the FSW
In that case, you have to load the reference signal information onto the generator manually and turn off the "Export to Generator" function. Because no exchange of information is possible between generator and analyzer, it is required to specify the input level of the signal in the "DUT Peak Input Power" input field.

The parameters of the currently active reference signal are described in ["Reference signal information"](#) on page 49.

The "Open Generator Control" button provides functionality to change the generator settings as described in [Chapter 3.4.7, "Controlling a signal generator"](#), on page 79.

For a comprehensive description of all features available on the signal generator and information on how to generate and export signals to a file, refer to the documentation of the signal generator.



To transfer a waveform file from the analyzer to the generator and process it with the ARB generator of the R&S SMW, for example, proceed as follows:

- ▶ In the "Custom Waveform" tab, select a file via "Load, Play on Generator".
- ▶ Transfer the file to the generator with the "Select" button.

If a waveform is only used as a reference without transferring it to the signal generator, make sure that the generator control state "Off" is selected in the [generator setup](#) dialog.

Remote command:

Select file: [CONFigure:REFSignal:CWF:FPATH](#) on page 181

Transfer file: [CONFigure:REFSignal:CWF:WRITE](#) on page 182

Transmission state: [CONFigure:REFSignal:CWF:LEDState?](#) on page 181

Export file: [CONFigure:REFSignal:CWF:ETGenerator\[:STATE\]](#) on page 180

DUT input power: [CONFigure:REFSignal:CWF:DPIPower](#) on page 180

3.3.6 Generate Own Signal

Access (source: Amplifier application): "Overview" > "Reference Signal" > "Generate Own Signal"

Designing a reference signal within the R&S FSW-K18

One way to design a reference signal is to design the signal within the R&S FSW-K18.

The application provides functionality to design a basic reference signal and saves the signal characteristics in a waveform file which you have to transfer to the signal generator with the "Generate and Load Signal and Export it to Generator" button.

When the data has been transferred, the signal generator (for example the R&S SMW) generates the corresponding signal.

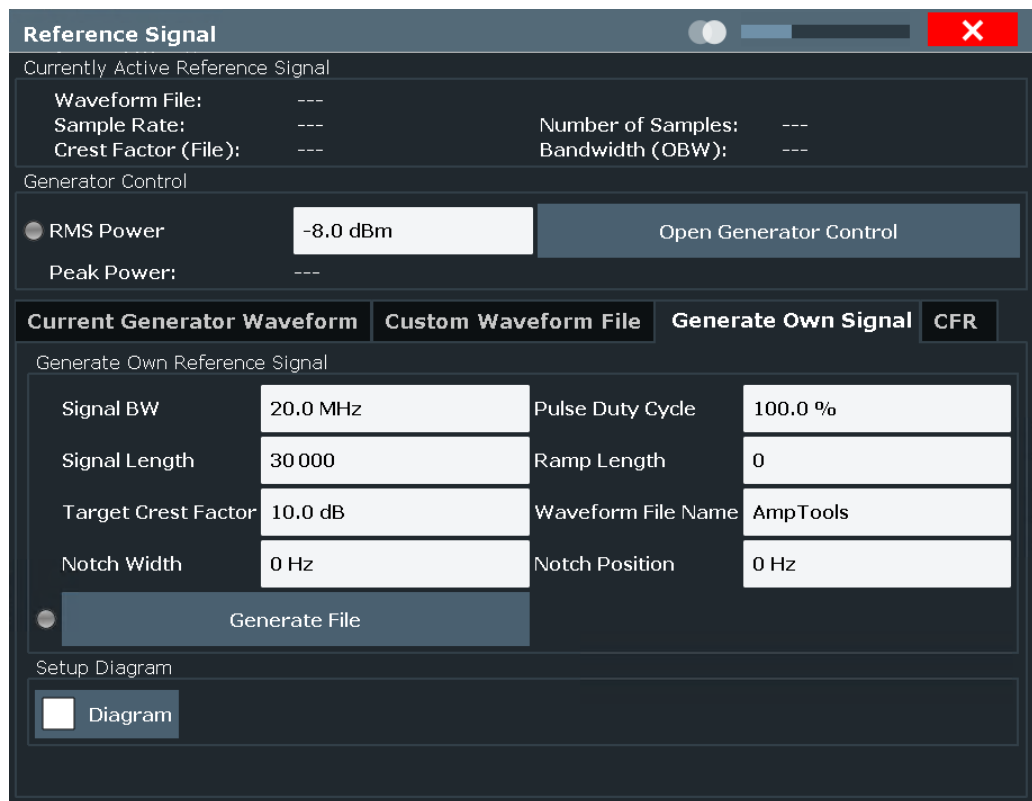
The generated signal is a pseudo-noise signal, whose basic properties, like crest factor and bandwidth, you can specify as required.

The parameters of the currently active reference signal are described in ["Reference signal information"](#) on page 49.

The "Open Generator Control" button provides functionality to change the generator settings as described in [Chapter 3.4.7, "Controlling a signal generator"](#), on page 79.

Table 3-1: Parameter dependencies

Parameter	Min Value	Max Value
Target Crest Factor	2	13
Signal Length	$((N+2*\text{RampLength})*100)/\text{Pulse-DutyCycle}$ N=1000 for Target Crest Factor < 12.5 dB N=25000 for Target Crest Factor ≥ 12.5 dB	
Notch Width	Signal Bandwidth/100	Signal Bandwidth
Ramp Length		0 if Pulse Duty Cycle is 100 % Otherwise $(\text{Signal Length}*\text{Pulse-DutyCycle}/100-N)/2$



To generate a reference signal within the application, proceed as follows:

- ▶ In the "Generate Own Signal" tab, design the reference signal as required.

The application stores the current signal properties as an ARB signal in a waveform file.

- ▶ Upload the data to the generator with the "Generate, Play on Generator" button.

You can define the following signal characteristics.

- "Signal Bandwidth" on page 55
- "Pulse Duty Cycle" on page 56
- "Signal Length" on page 56
- "Ramp Length" on page 56
- "Target Crest Factor" on page 56
- "Waveform File Name" on page 56
- "Notch Width" on page 56
- "Notch Position" on page 57

Remote command:

[CONFigure:REFSignal:GOS:WRITE](#) on page 186

[CONFigure:REFSignal:GOS:LEDState?](#) on page 183

Signal Bandwidth ← Designing a reference signal within the R&S FSW-K18

Defines the bandwidth of the reference signal.

The bandwidth should not be larger than maximum I/Q bandwidth supported by your signal analyzer (which depends on the analyzer configuration).

Remote command:

[CONFigure:REFSignal:GOS:BWIDth](#) on page 182

Pulse Duty Cycle ← Designing a reference signal within the R&S FSW-K18

Defines the duty cycle of a pulsed reference signal.

The duty cycle of a pulse is the ratio of the pulse duration and the actual length of the pulse. A duty cycle of 100 % corresponds to a continuous signal.

Example:

The pulse duration is 2 μ s. The actual length of the pulse is 1 μ s. The duty cycle is $1 \mu\text{s} : 2 \mu\text{s} = 0.5$ or 50 %.

Remote command:

[CONFigure:REFSignal:GOS:DCYCLe](#) on page 183

Signal Length ← Designing a reference signal within the R&S FSW-K18

Defines the number of samples that the reference signal consists of.

A number that is a power of 2 speeds up the internal signal processing. Thus, such a number should be specified if no other requirements limit the choice of the sample count.

For more information, see "[Pulse Duty Cycle](#)" on page 56.

Remote command:

[CONFigure:REFSignal:GOS:SLENgth](#) on page 185

Ramp Length ← Designing a reference signal within the R&S FSW-K18

Defines the number of samples used to ramp up the pulse to its full power and vice versa.

Remote command:

[CONFigure:REFSignal:GOS:RLENgth](#) on page 185

Target Crest Factor ← Designing a reference signal within the R&S FSW-K18

Defines the crest factor of the reference signal.

The crest factor shows the RMS power in relation to the peak power.

The crest factor is defined for a signal with 100 % pulse duty cycle and 0 Hz notch. Changes to the pulse duty cycle and notch parameters will change the crest factor.

Remote command:

[CONFigure:REFSignal:GOS:CRESt](#) on page 183

Waveform File Name ← Designing a reference signal within the R&S FSW-K18

Defines the name of the waveform file that the reference ARB signal configuration is stored in.

Remote command:

[CONFigure:REFSignal:GOS:WNAME](#) on page 186

Notch Width ← Designing a reference signal within the R&S FSW-K18

Defines the width of a notch that you can add to the reference signal.

Within the notch, all carriers of the reference signal have zero amplitude. You can use the noise notch to, for example, determine the noise power ratio (NPR) before and after the DPD.

Remote command:

`CONFigure:REFSignal:GOS:NWIDth` on page 184

Notch Position ← Designing a reference signal within the R&S FSW-K18

Defines an offset for the noise notch relative to the center frequency.

The offset moves the notch to a position outside the center of the signal. You can use the offset to, for example, generate a one-sided noise signal or to examine asymmetric distortion effects.

Remote command:

`CONFigure:REFSignal:GOS:NPOSition` on page 184

3.3.7 CFR (Crest Factor Reduction)

Access (source: K548 control): "Overview" > "Reference Signal" > "CFR"

Crest Factor Reduction (Generator Option K548)

The Crest Factor Reduction dialog provides functionality to control the main parameters of a Rohde & Schwarz signal generator equipped with option K548.

- CFR decreases the peak-to-average power ratio (PAPR) of the reference file, consequently leading to an increase in the EVM when compared to the reference signal.
- CFR often yields significantly improved DPD results due to reduced compression of the amplifier caused by less intense driving.
- As a result, the CFR provides a way to trade EVM for ACLR, balancing the two factors.

Note: During DPD, the CRF file needs to be selected as the reference.

For more detailed information, refer to the "Advanced Digital Pre-Distortion" video, which is part of the R&S amplifier masterclass playlist on the R&S youtube channel ([Chapter 1, "Welcome to the amplifier measurement application"](#), on page 9).

Reference Signal ⏻ 🔴 X

Currently Active Reference Signal

Waveform File:	C:\R_S\Instr\user\ET\Files\2FA-LTE5M_60MSP_ra_dec.wv		
Sample Rate:	121.548 MHz	Number of Samples:	1215484
Crest Factor (File):	5.6 dB	Bandwidth (OBW):	64.95 MHz

Generator Control

RMS Power: Open Generator Control

Peak Power: ---

Current Generator Waveform | Custom Waveform File | Generate Own Signal | **CFR**

Crest Factor Reduction (K548 Control)

Crest Factor Reduction State	<input checked="" type="radio"/> On <input type="radio"/> Off	EVM Ref Signal	<input type="text" value="Original"/> <input type="text" value="CFR"/>
Crest Factor Delta	<input type="text" value="-3.0 dB"/>	Current Crest Factor	5.6 dB
Max Iterations	<input type="text" value="5"/>		
Filter Mode	<input type="radio"/> Simple <input checked="" type="radio"/> Enhanced		
Signal Bandwidth	<input checked="" type="radio"/> Auto <input type="radio"/> Manual	97.2387 MHz	
Channel Spacing	<input checked="" type="radio"/> Auto <input type="radio"/> Manual	121.548 MHz	
	<input type="radio"/> Read CFR from Generator, Load		

Reference Signal ⏻ 🔴 X

Currently Active Reference Signal

Waveform File:	C:\R_S\Instr\user\ET\Files\2FA-LTE5M_60MSP_ra_dec.wv		
Sample Rate:	121.548 MHz	Number of Samples:	1215484
Crest Factor (File):	5.6 dB	Bandwidth (OBW):	64.95 MHz

Generator Control

RMS Power: Open Generator Control

Peak Power: ---

Current Generator Waveform | Custom Waveform File | Generate Own Signal | **CFR**

Crest Factor Reduction (K548 Control)

Crest Factor Reduction State	<input checked="" type="radio"/> On <input type="radio"/> Off	EVM Ref Signal	<input type="text" value="Original"/> <input type="text" value="CFR"/>
Crest Factor Delta	<input type="text" value="-3.0 dB"/>	Current Crest Factor	5.6 dB
Max Iterations	<input type="text" value="5"/>		
Filter Mode	<input type="radio"/> Simple <input checked="" type="radio"/> Enhanced		
Passband Frequency	<input type="text" value="48.61936 MHz"/>	Stopband Frequency	<input type="text" value="60.7742 MHz"/>
Maximum Filter Order	<input type="text" value="101"/>		
	<input type="radio"/> Read CFR from Generator, Load		

Crest Factor Reduction State ← **Crest Factor Reduction (Generator Option K548)**
Enables the crest factor reduction calculation.

If "On" is selected and all input fields are editable, crest factor reduction is active on the generator but the FSW-K18 application has no CFR reference yet.

If "On" is selected and "Read CFR from Generator, Load" is selected, all input fields are grayed out. The CFR reference can now be used by the FSW-K18 application.

If the state is changed to "Off", a potentially active DPD is also turned off. The DPD results will be invalid and new measurements will be needed.

Remote command:

[CONFigure:CFReduction\[:STATe\]](#) on page 188

[CONFigure:CFReduction\[:STATe\]:LEDState?](#) on page 188

EVM Ref. Signal ← Crest Factor Reduction (Generator Option K548)

Loads a new ARB file as reference if "CFR" is selected. The original ARB file is stored.

Remote command:

[CONFigure:CFReduction:RSORignal](#) on page 189

Crest Factor Delta ← Crest Factor Reduction (Generator Option K548)

Sets the value difference by which you want to change your crest factor.

Remote command:

[CONFigure:CFReduction:CFDelta](#) on page 191

[CONFigure:CFReduction:CFDelta:LEDState?](#) on page 191

Current Crest Factor ← Crest Factor Reduction (Generator Option K548)

Displays the current crest factor of the waveform after the calculation of the resulting crest factor is completed.

Remote command:

[CONFigure:CFReduction:CCFactor?](#) on page 191

Max Iterations ← Crest Factor Reduction (Generator Option K548)

Sets the number of iterations that are used for calculating the resulting crest factor. The iteration process is stopped when the desired crest factor delta is achieved by 0.1 dB.

Remote command:

[CONFigure:CFReduction:ITERations](#) on page 189

[CONFigure:CFReduction:ITERations:LEDState?](#) on page 190

Filter Mode ← Crest Factor Reduction (Generator Option K548)

Selects which filter mode is used for the filtering. In "Simple" mode, you can specify the RF bandwidth and channel spacing of the signal. The lowpass filter is designed to pass through frequency components inside the signal bandwidth and suppress components in the adjacent channel. In "Enhanced" mode, you can specify the passband and stop-band frequencies of the lowpass filter.

Remote command:

[CONFigure:CFReduction:FILTer](#) on page 190

[CONFigure:CFReduction:FILTer:LEDState?](#) on page 190

Signal Bandwidth ← Crest Factor Reduction (Generator Option K548)

Sets the signal bandwidth. The value of the "Signal Bandwidth" should not be higher than the "Channel Spacing".

When in automatic mode, "Signal Bandwidth" shall be set to the OBW value of the reference file (shown in reference signal overview).

"Channel Spacing" shall be set to 1.15 times this value.

Remote command:

[CONFigure:CFReduction:SBANdwidth](#) on page 188

[CONFigure:CFReduction:SBANdwidth:AUTO](#) on page 189

[CONFigure:CFReduction:SBANdwidth:LEDState?](#) on page 189

Channel Spacing ← Crest Factor Reduction (Generator Option K548)

Sets the channel spacing.

Remote command:

[CONFigure:CFReduction:CSPacing](#) on page 190

[CONFigure:CFReduction:CSPacing:AUTO](#) on page 190

[CONFigure:CFReduction:CSPacing:LEDState?](#) on page 191

Read CFR from Generator, Load ← Crest Factor Reduction (Generator Option K548)

Applies crest factor reduction on the connected signal generator.

Remote command:

[CONFigure:CFReduction:READ](#) on page 192

[CONFigure:CFReduction:READ:LEDState?](#) on page 192

Passband Frequency ← Crest Factor Reduction (Generator Option K548)

Sets the passband frequency. Only available for "Enhanced" [filter mode](#).

Remote command:

[CONFigure:CFReduction:PFrequency](#) on page 193

[CONFigure:CFReduction:PFrequency:LEDState?](#) on page 193

Stopband Frequency ← Crest Factor Reduction (Generator Option K548)

Sets the stopband frequency. Only available for "Enhanced" [filter mode](#).

Remote command:

[CONFigure:CFReduction:SFrequency](#) on page 193

[CONFigure:CFReduction:SFrequency:LEDState?](#) on page 194

Maximum Filter Order ← Crest Factor Reduction (Generator Option K548)

Sets the maximum filter order. Only available for "Enhanced" [filter mode](#).

Remote command:

[CONFigure:CFReduction:MFOOrder](#) on page 192

[CONFigure:CFReduction:MFOOrder:LEDState?](#) on page 193

3.4 Inputs and outputs

- [Selecting and configuring the input source](#)..... 61
- [Configuring the frequency](#)..... 67
- [Defining level characteristics](#)..... 68

• Power sensors	74
• Using probes	79
• Configuring outputs	79
• Controlling a signal generator	79
• Configuring the 2 GHz or 5 GHz bandwidth extension	84
• Reference: I/Q file input	85

3.4.1 Selecting and configuring the input source

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

The R&S FSW-K18 supports the RF input, the optional analog baseband input and optional input from external mixers.



Simultaneous use of the RF input and the Analog Baseband input

Compared to other applications available for the FSW, the FSW-K18 allows you to use both the RF input and the optional analog baseband input simultaneously.

This allows for various specific measurements which require a simultaneous capture of the RF signal, of the supply voltage and of the current drawn by an amplifier. Such a test setup is, for example, required to calculate the instantaneous PAE (Power Added Efficiency), which in turn is of interest for measurements on amplifiers that use envelope tracking.

For more information about input from external mixers, refer to the FSW user manual.

• Configuring the RF input	61
• External mixer	64
• Configuring the analog baseband input	64
• I/Q file	66

3.4.1.1 Configuring the RF input

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

The RF input captures the RF signal that you are measuring. It is always on.

The RF input source settings are similar to those available in the spectrum application. For a comprehensive description of these settings, refer to the FSW user manual.

Input Source	Frequency	Amplitude	Output	Probes	Generator Setup	B5000
RF Input	On	Off				
External Mixer	Input Coupling	AC	DC			
	Impedance	50Ω	75Ω			
BB Input Analog	Direct Path	Auto	Off			
I/Q File	High Pass Filter 1 to 3 GHz	On	Off			
	YIG-Preselector	On	Off			
	Input Connector	RF	Baseband I			

The remote commands required to configure the RF input are described in [Chapter 5.6.2, "Selecting and configuring the input source"](#), on page 194.

Input Coupling	62
Impedance	62
Direct Path	63
High Pass Filter 1 to 3 GHz	63
YIG-Preselector	63
Input Connector	64

Input Coupling

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

For an active external frontend, input coupling is always DC.

Not available for input from the optional "Analog Baseband" interface.

Not available for input from the optional "Digital Baseband" interface.

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

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

Remote command:

`INPut:COUPling` on page 195

Impedance

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

For an active external frontend, impedance is always 50 Ω.

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

Not available for input from the optional "Digital Baseband" interface.

Not available for input from the optional "Analog Baseband" interface. For analog baseband input, an impedance of 50 Ω is always used.

Remote command:

[INPut:IMPedance](#) on page 197

Direct Path

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

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

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

For an active external frontend, the direct path is always used automatically for frequencies close to zero.

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

"Off" The analog mixer path is always used.

Remote command:

[INPut:DPATH](#) on page 195

High Pass Filter 1 to 3 GHz

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

This function requires an additional hardware option.

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

Remote command:

[INPut:FILTer:HPASs\[:STATe\]](#) on page 196

YIG-Preselector

Enables or disables the YIG-preselector.

This setting requires an additional option on the FSW.

An internal YIG-preselector at the input of the FSW ensures that image frequencies are rejected. However, image rejection is only possible for a restricted bandwidth. To use the maximum bandwidth for signal analysis you can disable the YIG-preselector at the input of the FSW, which can lead to image-frequency display.

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

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

Remote command:

[INPut:FILTer:YIG\[:STATe\]](#) on page 197

Input Connector

Determines which connector the input data for the measurement is taken from.

For more information on the optional "Analog Baseband" interface, see the FSW I/Q Analyzer and I/Q Input user manual.

"RF"	(Default:) The "RF Input" connector
"RF Probe"	The "RF Input" connector with an adapter for a modular probe This setting is only available if a probe is connected to the "RF Input" connector. It is not available for an active external frontend.
"Baseband Input I"	The optional "Baseband Input I" connector This setting is only available if the optional "Analog Baseband" interface is installed and active for input. It is not available for the FSW67. For FSW85 models with two input connectors, this setting is only available for "Input 1". This feature is available when you turn off Enable Parallel BB Capture .

Remote command:

[INPut:CONNector](#) on page 194

3.4.1.2 External mixer

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

Controlling external generators is available with the optional external generator control. The functionality is the same as in the spectrum application.

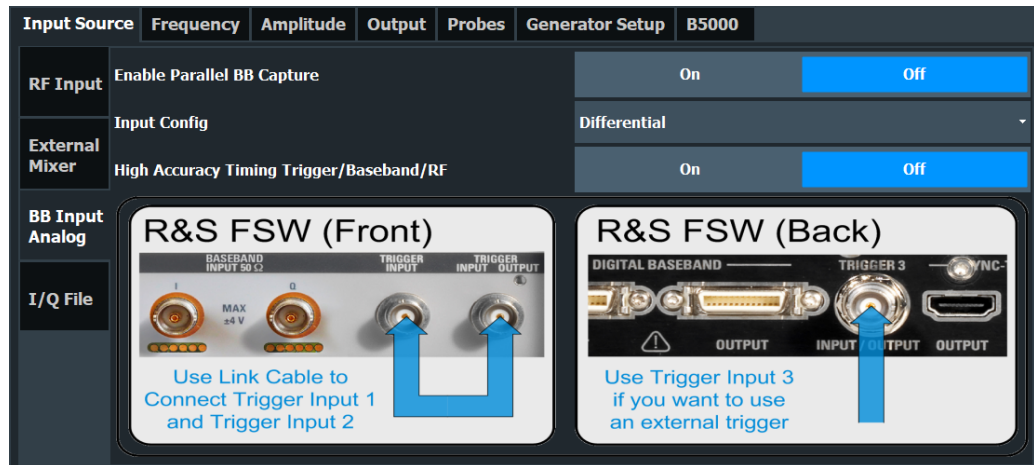
For more information about using external generators, refer to the FSW user manual.

3.4.1.3 Configuring the analog baseband input

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

The analog baseband input is available as a hardware option.

Measurements that also consider the supply voltage and the current drawn by the PA, require the analog baseband inputs to measure the voltage (baseband input Q) and the current (baseband input I). Typically, you need to connect some power probes to the baseband inputs for this purpose.



The remote commands required to configure the RF input are described in [Chapter 5.6.2, "Selecting and configuring the input source"](#), on page 194.

[Enable Parallel BB Capture](#)..... 65
[Input Configuration](#)..... 65
[High Accuracy Timing Trigger - Baseband - RF](#)..... 65

Enable Parallel BB Capture

Turns simultaneous data capture on the RF input and the analog baseband input on and off.

Simultaneous data capture is necessary when you measure the supply voltage and the current drawn by the PA.

Remote command:

`INPut:SELEct:BBANalog[:STATe]` on page 198

Input Configuration

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

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

- "Single-ended" I, Q data only
- "Differential" I, Q and inverse I,Q data
(Not available for FSW85)

Remote command:

`INPut:IQ:BALanced[:STATe]` on page 197

High Accuracy Timing Trigger - Baseband - RF

Activates a mode with enhanced timing accuracy between analog baseband, RF and external trigger signals.

Note: Prerequisites for previous models of FSW.

For FSW models with a serial number lower than 103000, special prerequisites and restrictions apply for high accuracy timing:

- To obtain this high timing precision, trigger port 1 and port 2 must be connected via the Cable for High Accuracy Timing (order number 1325.3777.00).
- As trigger port 1 and port 2 are connected via the cable, only trigger port 3 can be used to trigger a measurement.
- Trigger port 2 is configured as output if the high accuracy timing option is active. Make sure not to activate this option if you use trigger port 2 in your measurement setup.
- When you first enable this setting, you are prompted to connect the cable for high accuracy timing to trigger ports 1 and 2. If you cancel this prompt, the setting remains disabled. As soon as you confirm this prompt, the cable must be in place - the firmware does not check the connection. (In remote operation, the setting is activated without a prompt.)

For more information, see the FSW I/Q Analyzer and I/Q Input User Manual.

Remote command:

[CALibration:AIQ:HATiming\[:STATe\]](#) on page 194

3.4.1.4 I/Q file

Access: "Overview" > "Input / Frontend" > "Input Source" > "I/Q File"

Available for I/Q based measurements.

As an alternative to capturing the measurement (I/Q) data live, you can also load previously recorded I/Q data stored in an `iq.tar` file. The file is then used as the input source for the application. Files containing multi-channel measurement data are supported.

However, only the RF capture buffer is filled with I/Q data from the file. Envelope / supply power measurements based on data from the "Analog Baseband" interface (FSW-B71) are not supported in I/Q file mode.

For details on the "I/Q File" input, see the user manual of the I/Q analyzer.

I/Q Input File State	66
Select I/Q data file	67
File Repetitions	67
Selected Channel	67

I/Q Input File State

Enables input from the selected I/Q input file.

If enabled, the application performs measurements on the data from this file. Thus, most measurement settings related to data acquisition (attenuation, center frequency, measurement bandwidth, sample rate) cannot be changed. The measurement time can only be decreased to perform measurements on an extract of the available data only.

Note: Even when the file input is disabled, the input file remains selected and can be enabled again quickly by changing the state.

Remote command:

[INPut:SElect](#) on page 198

Select I/Q data file

Opens a file selection dialog box to select an input file that contains I/Q data.

The I/Q data must have a specific format (.iq.tar) as described in FSW I/Q Analyzer and I/Q Input user manual.

The default storage location for I/Q data files is C:\R_S\INSTR\USER.

Remote command:

[INPut:FILE:PATH](#) on page 196

File Repetitions

Determines how often the data stream is repeatedly copied in the I/Q data memory to create a longer record. If the available memory is not sufficient for the specified number of repetitions, the largest possible number of complete data streams is used.

Remote command:

[TRACe:IQ:FILE:REPetition:COUNT](#) on page 200

Selected Channel

Only available for files that contain more than one data stream from multiple channels: selects the data stream to be used as input for the currently selected channel.

In "Auto" mode (default), the first data stream in the file is used as input for the channel. Applications that support multiple data streams use the first data stream in the file for the first input stream, the second for the second stream etc.

Remote command:

[MMEMory:LOAD:IQ:STReam](#) on page 199

[MMEMory:LOAD:IQ:STReam:AUTO](#) on page 199

[MMEMory:LOAD:IQ:STReam:LIST?](#) on page 200

3.4.2 Configuring the frequency

Access: "Overview" > "Input / Output" > "Frequency"

The "Frequency" tab of the "Input / Output" dialog box contains settings to configure frequency characteristics.

The frequency settings are similar to those available in the spectrum application. For a comprehensive description of these settings, refer to the FSW user manual.

Input Source	Frequency	Amplitude	Output	Probes	Generator Setup	B5000
Frequency						
Center	13.25 GHz					
Center Frequency Stepsize						
Stepsize	Manual	Value	1.0 MHz			
Frequency Offset						
Value	0.0 Hz					

The remote commands required to configure the frequency are described in [Chapter 5.6.4, "Configuring the frequency"](#), on page 234.

Center Frequency	68
Center Frequency Stepsize	68
Frequency Offset	68

Center Frequency

Defines the frequency of the measured signal.

The possible value range depends on the FSW model you have. See the specifications document for more information about the supported frequency range.

Remote command:

[\[SENSe:\] FREQuency:CENTer](#) on page 234

Center Frequency Stepsize

Defines the step size by which the center frequency is increased or decreased when the arrow keys are pressed.

When you use the rotary knob the center frequency changes in steps of only 1/10 of the "Center Frequency Stepsize".

"= Center" Sets the step size to the value of the center frequency and removes the coupling of the step size to span or resolution bandwidth. The used value is indicated in the "Value" field.

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

Remote command:

[\[SENSe:\] FREQuency:CENTer:STEP](#) on page 234

Frequency Offset

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

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

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

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

Remote command:

[\[SENSe:\] FREQuency:OFFSet](#) on page 235

3.4.3 Defining level characteristics

Access: "Overview" > "Input / Output" > "Amplitude"

The "Amplitude" tab of the "Input / Output" dialog box contains settings to configure the signal level characteristics.

The level settings are the same as those available in the spectrum application. For a comprehensive description of these settings, refer to the FSW user manual.

Input Source	Frequency	Amplitude	Output	Probes	Generator Setup	B5000
Reference Level		Input Settings				
Value	0.0 dBm	Preamplifier	On	Off		
Offset	0.0 dB	Input Coupling	AC	DC		
Attenuation		Impedance	50Ω	75Ω		
Mode	Auto	Manual	Electronic Attenuation			
Value	10.0 dB	State	On	Off		
Optimization	Low Distortion	Mode	Auto	Manual		
		Value	0 dB			

The remote commands required to configure the amplitude are described in [Chapter 5.6.5, "Defining level characteristics"](#), on page 235.

Functions available in the "Amplitude" dialog box described elsewhere:

- "Input Coupling" on page 62
- "Impedance" on page 62

Reference Level.....	69
└ Shifting the Display (Offset).....	70
Full Scale Level.....	70
Preamplifier.....	70
Ext. PA Correction.....	71
Input Coupling.....	71
Impedance.....	72
Attenuation Mode / Value.....	72
Optimization.....	72
Signal Path.....	73
Using Electronic Attenuation.....	73

Reference Level

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

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

For an active external frontend, the reference level refers to the RF input at the external frontend, not the levels at the RF input of the FSW. The hardware is adjusted to the defined reference level optimally for input signals with a crest factor of 10 dB. Thus, the required reference level for an optimal measurement can differ depending on the crest factor of the input signal.

Remote command:

```
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALE]:RLEVEL
```

on page 235

Shifting the Display (Offset) ← Reference Level

Defines an arithmetic level offset. This offset is added to the measured level. In some result displays, the scaling of the y-axis is changed accordingly.

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

The reference level offset takes level offsets into account that occur after the signal has passed through the DUT (usually an amplifier). For level offsets occurring before the DUT, you can define a [level offset](#) on the signal generator from within the R&S FSW-K18 user interface.

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

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

Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet` on page 236

Full Scale Level

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

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

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

Available for parallel capture on the baseband and RF inputs.

Remote command:

`INPut:IQ:FULLScale[:LEVel]` on page 240

Preamplifier

If the (optional) internal preamplifier hardware is installed on the FSW, a preamplifier can be activated for the RF input signal.

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

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

For an active external frontend, a preamplifier is not available.

This function is not available for input from the (optional) "Digital Baseband" interface.

For all FSW models except for FSW85, the following settings are available:

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

"30 dB" The RF input signal is amplified by about 30 dB.

For FSW85 models, the input signal is amplified by 30 dB if the preamplifier is activated.

Remote command:

[INPut:GAIN:STATe](#) on page 241

[INPut:GAIN\[:VALue\]](#) on page 241

Ext. PA Correction

This function is only available if an external preamplifier is connected to the FSW, and only for frequencies above 1 GHz. For details on connection, see the preamplifier's documentation.

Using an external preamplifier, you can measure signals from devices under test with low output power, using measurement devices which feature a low sensitivity and do not have a built-in RF preamplifier.

When you connect the external preamplifier, the FSW reads out the touchdown (.S2P) file from the EEPROM of the preamplifier. This file contains the s-parameters of the preamplifier. As soon as you connect the preamplifier to the FSW, the preamplifier is permanently on and ready to use. However, you must enable data correction based on the stored data explicitly on the FSW using this setting.

When enabled, the FSW automatically compensates the magnitude and phase characteristics of the external preamplifier in the measurement results. Any internal preamplifier, if available, is disabled.

For FSW85 models with two RF inputs, you can enable correction from the external preamplifier for each input individually, but not for both at the same time.

When disabled, no compensation is performed even if an external preamplifier remains connected.

Remote command:

[INPut:EGAIN\[:STATe\]](#) on page 239

Input Coupling

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

For an active external frontend, input coupling is always DC.

Not available for input from the optional "Analog Baseband" interface.

Not available for input from the optional "Digital Baseband" interface.

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

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

Remote command:

[INPut:COUPling](#) on page 195

Impedance

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

For an active external frontend, impedance is always 50 Ω .

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

Not available for input from the optional "Digital Baseband" interface.

Not available for input from the optional "Analog Baseband" interface. For analog baseband input, an impedance of 50 Ω is always used.

Remote command:

[INPut:IMPedance](#) on page 197

Attenuation Mode / Value

Defines the attenuation applied to the RF input of the FSW.

This function is not available for input from the optional "Digital Baseband" interface.

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

Note: Using an external frontend. If an external frontend is active, you can configure the attenuation for the external frontend and the analyzer separately. When using an external frontend, only mechanical attenuation is available.

For more information, see the FSW User Manual.

By default and when no (optional) [electronic attenuation](#) is available, mechanical attenuation is applied.

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

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

Remote command:

[INPut:ATTenuation](#) on page 236

[INPut:ATTenuation:AUTO](#) on page 237

Defining attenuation for the analyzer when using an external frontend:

[INPut:SANalyzer:ATTenuation:AUTO](#) on page 237

[INPut:SANalyzer:ATTenuation](#) on page 237

Optimization

Selects the priority for signal processing *after* the RF attenuation has been applied.

This function is only available under the following conditions:

- One of the following options that provide a separate wideband processing path in the FSW is installed:
 - Bandwidth extension R&S FSW-B160/-B320 Extension Board 1, Revision 2 or higher
 - Bandwidth extension R&S FSW-B512, B1200, B2001, B4001, B6001, or B8001
 - Real-time option R&S FSW-B160R
(Currently not supported for K161R, B512R and B800R/K800RE)
- An I/Q bandwidth that requires the wideband path is used.
- The optional "Digital Baseband" interface is not active.

"Low distortion"

(Default:) Optimized for low distortion by avoiding intermodulation

"Low noise"

Optimized for high sensitivity and low noise levels

If this setting is selected, "Low noise" is indicated in the channel information bar.

Remote command:

[INPut:ATTenuation:AUTO:MODE](#) on page 238

Signal Path

Selects the signal path for signal processing.

"Narrowband" (Default:) The narrowband signal path is used.

"Wideband" The wideband signal path is used. With this setting, the dynamic range for EVM measurements is increased.

This function is only available under the following conditions:

- Instrument models FSW50/67/85
- One of the following bandwidth extension options is installed:
 - R&S FSW-B1200
 - R&S FSW-B2001
 - R&S FSW-B800R
- An I/Q bandwidth between 80 MHz and 512 MHz is used.
- The center frequency is higher than 43.5 GHz.
- The optional "Digital Baseband" interface is not active.

Remote command:

[\[SENSe:\] IQ:WBANd](#) on page 242

Using Electronic Attenuation

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

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

For an active external frontend, electronic attenuation is not available.

Note: Electronic attenuation is not available for stop frequencies (or center frequencies in zero span) above 15 GHz.

In "Auto" mode, RF attenuation is provided by the electronic attenuator as much as possible to reduce the amount of mechanical switching required. Mechanical attenuation can provide a better signal-to-noise ratio, however.

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

The electronic attenuation can be varied in 1 dB steps. If the electronic attenuation is on, the mechanical attenuation can be varied in 5 dB steps. Other entries are rounded to the next lower integer value.

For the FSW85, the mechanical attenuation can be varied only in 10 dB steps.

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

Remote command:

[INPut:EATT:STATE](#) on page 239

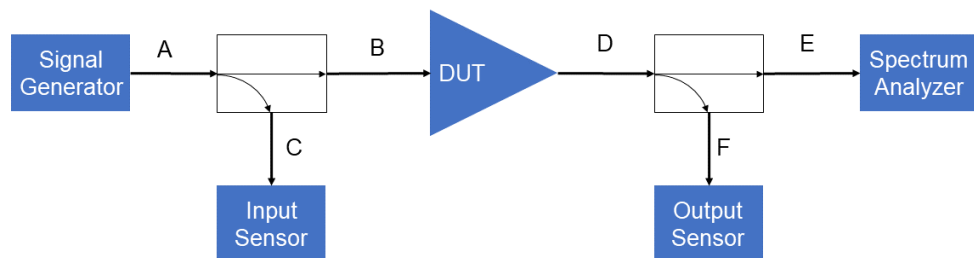
[INPut:EATT:AUTO](#) on page 239

[INPut:EATT](#) on page 238

3.4.4 Power sensors

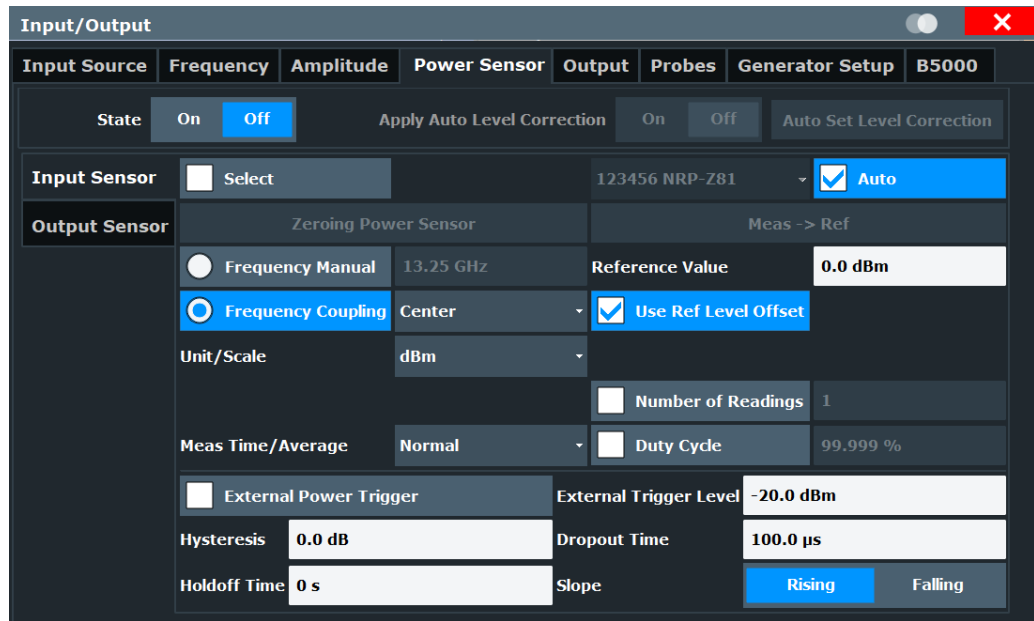
Access: "Overview" > "Input" > "Power Sensor" tab

A typical measurement using power sensors in the FSW-K18 application is set up as shown below:



For details on working with power sensors, see the FSW User Manual.

Input and output sensors are configured individually on a separate tab.



State.....75

Apply Auto Level Correction.....75

Select.....76

Zeroing Power Sensor.....76

Frequency Manual.....76

Frequency Coupling.....76

Unit/Scale.....77

Meas Time/Average.....77

Setting the Reference Level from the Measurement Meas -> Ref.....77

Reference Value.....77

Use Ref Level Offset.....77

Sensor Level Offset.....77

Average Count (Number of Readings).....78

Duty Cycle.....78

Using the power sensor as an external trigger.....78

- L External Trigger Level.....78
- L Hysteresis.....78
- L Trigger Holdoff.....78
- L Drop-Out Time.....79
- L Slope.....79

State

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

Apply Auto Level Correction

This function can be activated after "Auto Set Level Correction" has been used.

If the input sensor is selected, the input power used to calculate the measurement results is corrected so that it corresponds to the value measured by the input power sensor.

If the output sensor is selected, the power measured on the analyzer is corrected so that it corresponds to the value measured by the output power sensor.

Remote command:

[CALCulate:PMETer:LEVel:CORRection](#) on page 230

[\[SENSe:\]PMETer:LEVel:CORRection:APPLy](#) on page 230

Select

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

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

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

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

Remote command:

[\[SENSe:\]PMETer<p>\[:STATe\]](#) on page 229

[SYSTem:COMMUnicate:RDEvice:PMETer<p>:DEFine](#) on page 224

[SYSTem:COMMUnicate:RDEvice:PMETer<p>:CONFIgure:AUTO\[:STATe\]](#) on page 223

[SYSTem:COMMUnicate:RDEvice:PMETer<p>:COUNT?](#) on page 223

Zeroing Power Sensor

Starts zeroing of the power sensor.

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

Remote command:

[CALibration:PMETer<p>:ZERO:AUTO ONCE](#) on page 224

Frequency Manual

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

Remote command:

[\[SENSe:\]PMETer<p>:FREQuency](#) on page 227

Frequency Coupling

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

Remote command:

[\[SENSe:\]PMETer<p>:FREQuency:LINK](#) on page 227

Unit/Scale

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

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

Remote command:

`UNIT<n>:PMETer<p>:POWer` on page 231

`UNIT<n>:PMETer<p>:POWer:RATio` on page 231

Meas Time/Average

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

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

Remote command:

`[SENSe:] PMETer<p>:MTIME` on page 228

`[SENSe:] PMETer<p>:MTIME:AVERage [:STATe]` on page 228

Setting the Reference Level from the Measurement Meas -> Ref

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

Remote command:

`CALCulate<n>:PMETer<p>:RELative[:MAGNitude]:AUTO ONCE` on page 225

Reference Value

Defines the reference value in dBm used for relative power meter measurements.

Remote command:

`CALCulate<n>:PMETer<p>:RELative[:MAGNitude]` on page 225

Use Ref Level Offset

If deactivated, takes the [Sensor Level Offset](#) into account.

Remote command:

`[SENSe:] PMETer<p>:ROFFset[:STATe]` on page 229

Sensor Level Offset

Takes the specified offset into account for the measured power. Only available if [Use Ref Level Offset](#) is disabled.

Remote command:

`[SENSe:] PMETer<p>:SOFFset` on page 229

Average Count (Number of Readings)

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

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

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

Remote command:

[\[SENSe:\] PMETer<p>:MTIME:AVERage:COUNT](#) on page 228

Duty Cycle

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

Remote command:

[\[SENSe:\] PMETer<p>:DCYCLE\[:STATe\]](#) on page 226

[\[SENSe:\] PMETer<p>:DCYCLE:VALue](#) on page 226

Using the power sensor as an external trigger

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

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

Remote command:

[\[SENSe:\] PMETer<p>:TRIGger\[:STATe\]](#) on page 234

TRIG:SOUR PSE, see [TRIGger\[:SEquence\]:SOURce](#) on page 230

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

Defines the trigger level for the power sensor trigger.

For details on supported trigger levels, see the specifications document.

Remote command:

[\[SENSe:\] PMETer<p>:TRIGger:LEVel](#) on page 233

Hysteresis ← Using the power sensor as an external trigger

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

Remote command:

[\[SENSe:\] PMETer<p>:TRIGger:HYSTeresis](#) on page 232

Trigger Holdoff ← Using the power sensor as an external trigger

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

Remote command:

[SENSe:] PMETer<p>:TRIGger:HOLDoff on page 232

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

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

Slope ← Using the power sensor as an external trigger

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

Remote command:

[SENSe:] PMETer<p>:TRIGger:SLOPe on page 233

3.4.5 Using probes

Access: "Overview" > "Input / Output" > "Probes"

The "Probes" tab of the "Input / Output" dialog box contains settings to configure probes.

Probes are a mandatory part of the test setup if you want to measure the supply voltage and the current drawn by the PA.

The probes settings are the same as those available in the spectrum application. For a comprehensive description of these settings, refer to the FSW user manual.

3.4.6 Configuring outputs

Access: "Overview" > "Input / Output" > "Output"

The "Output" tab of the "Input / Output" dialog box contains settings to configure the various signal outputs available on the FSW.

The functionality is the same as in the spectrum application. For more information about the output functions, refer to the FSW user manual.

3.4.7 Controlling a signal generator

Access: "Overview" > "Input / Output" > "Generator Setup"

The "Generator Setup" tab of the "Input / Output" dialog box contains settings to control the signal generator from within the R&S FSW-K18. A remote control connection between the FSW and the signal generator has to be established to be able to do so.

Because a signal generator is (mostly) mandatory in the test setup, these features make measurement configuration as easy as possible. This way, you can control both analyzer and generator from within the application without having to operate the two instruments to configure the measurement.



While generator control is active, you cannot change the connection information.

When you switch on generator control while it is still active in another channel, the control is disabled in the other channel. Only one channel can control a generator at any time.

Exception: The SCPI Recorder maintains control of the generator even if you switch channels.

Input Source	Frequency	Amplitude	Output	Probes	Generator Setup
Generator Configuration					
Generator Control		<input checked="" type="checkbox"/> On	<input type="checkbox"/> Off	IP Address	<input type="text"/> <input type="button" value="Configure..."/>
Level(RMS)	<input type="checkbox"/>	<input type="text" value="-10.0 dBm"/>		Path RF	<input type="text" value="A"/>
Level Offset	<input type="checkbox"/>	<input type="text" value="0.0 dB"/>		Path BB	<input type="text" value="A"/>
Max DUT Input Level	<input type="checkbox"/>	<input type="text" value="30.0 dBm"/>		Segment	<input type="text" value="0"/>
Attach to Analyzer Freq.	<input checked="" type="checkbox"/> On	<input type="checkbox"/> Off		Digital Attenuation	<input type="text" value="0.0 dB"/>
Center Frequency	<input type="checkbox"/>	<input type="text" value="22.0 GHz"/>		RF Output	<input checked="" type="checkbox"/> On <input type="checkbox"/> Off
Reference Frequency	<input type="checkbox"/>	<input type="text" value="Internal"/>			
<input type="button" value="Query all Settings from Generator"/>			<input type="button" value="Upload all Settings to Generator"/>		
Generator Details			DUT Specific Settings		
Name			Settling Delay <input type="text" value="0.0 s"/>		
Serial Number					
Firmware Version					

The remote commands required to configure the generator are described in [Chapter 5.6.6, "Controlling a signal generator"](#), on page 242.

State of operation

Most settings have an LED that shows the state of the corresponding setting on the signal generator.

The LED is either gray, green or red:

- Grey LED
Configuration state unknown (for example when you have not yet started the transmission).
- Green LED
Configuration has been successful. Generator has been configured correctly.
- Red LED
Configuration has not been successful.
Check if the connection between analyzer and generator has been established or if the IP address has been stated correctly.

Generator details

The "Generator Details" contain information about the connected signal generator, like the software version or the serial number of the generator.

Updating generator settings

When you change the generator level or frequency in this dialog, the application automatically updates those settings on the generator.

When you use the "Upload All Settings To Generator" button, you can force an update of all generator settings available in this dialog box. Useful when you change the level or frequency on the generator itself. In that case, those settings remain the same in the R&S FSW-K18. To restore the original settings defined within the R&S FSW-K18, use that button to restore the generator settings.

Remote command:

[CONFigure:GENerator:SETTings:UPDate](#) on page 250

Querying generator settings

Similarly, you can transfer the current generator configuration into the amplifier application with the "Query All Settings From Generator" button.

Note that the center frequency is not updated when you [attach the generator frequency](#) to that of the FSW.

Remote command:

[CONFigure:SETTings](#) on page 251

Generator Control State	81
IP Address	81
RMS Level	82
Maximum DUT Input Level	82
Attach to Analyzer Frequency	83
Center Frequency	83
Reference Frequency	83
Path RF / BB	83
Segment	83
Digital Attenuation	83
RF Output	84
Settling Delay	84

Generator Control State

Turns the communication with a connected signal generator on and off.

When you turn off the generator control, the connection between FSW and generator is closed. All settings related to the generator connection (level, frequency, IP address etc.) become unavailable.

When a new measurement channel or save set is opened, the generator control is automatically set to "Off".

Remote command:

[CONFigure:GENerator:CONTrol\[:STATe\]](#) on page 243

IP Address

Opens a dialog box to configure the network properties of the signal generator.

You can connect to the generator either by entering its IP address ("123" button), or its computer name ("ABC" button).

If you are not sure about the IP address or computer name of your generator, check its user interface or kindly ask your IT administrator to provide them.

After you have entered IP address or computer name, use "Connect" to establish the connection. The FSW shows if the connection state, and, if the connection was successful, the connected generator type.

Remote command:

[CONFigure:GENerator:IPConnection:ADDResS](#) on page 246

[CONFigure:GENerator:CONNection:CSTate?](#) on page 246

RMS Level

Defines the RMS level of the signal that is generated.

When you define the RMS level here, the signal generator is automatically configured to that level.

In addition, you can define a level offset (for example to take external attenuation into account). Note that the level offset is a purely mathematical value and does not change the actual level of the signal at the RF output.

The level offset takes level offsets into account that occur before the signal has passed through the DUT (usually an amplifier). For level offsets occurring after the DUT, define a [level offset](#) in the "Amplitude" menu of the signal analyzer.

You can also define a [Digital Attenuation](#) that you can use for fast output level changes.

NOTICE! Risk of damage to the DUT.

RMS levels that are too high can damage or destroy the DUT.

Make sure to keep an eye on the RMS level, especially when defining a level offset. A level offset changes the displayed value of the RMS level, but not the real RMS level.

Displayed RMS level = real RMS level + level offset

Thus, the actual RMS level can be higher than the displayed level.

Note: Always change the generator level from within the R&S FSW-K18 user interface and thus synchronize the levels of both instruments.

If you change the generator level on the signal generator, the R&S FSW-K18 does not synchronize the levels and measurement results are going to be invalid.

Remote command:

RMS level: [CONFigure:GENerator:POWer:LEVel](#) on page 246

[CONFigure:GENerator:POWer:LEVel:LEDState?](#) on page 248

Level offset: [CONFigure:GENerator:POWer:LEVel:OFFSet](#) on page 248

[CONFigure:GENerator:POWer:LEVel:OFFSet:LEDState?](#) on page 248

Maximum DUT Input Level

Defines the maximum level that the generated signal can have. Selecting a higher level is not possible.

Defining a maximum output level is useful if you are measuring sensitive DUTs.

Remote command:

[CONFigure:GENerator:DUT:INPut:MAXimum:POWer](#) on page 243

[CONFigure:GENerator:DUT:INPut:MAXimum:POWer:LEDState?](#) on page 244

Attach to Analyzer Frequency

Turns synchronization of the analyzer and generator frequency on and off.

When you turn on this feature, changing the frequency on the analyzer automatically adjusts the frequency on the generator.

Remote command:

[CONFigure:GENerator:FREQuency:CENTer:SYNC\[:STATE\]](#) on page 245

Center Frequency

Defines the frequency of the signal that the generator transmits.

When you turn on [Attach to Analyzer Frequency](#), any changes you make to the generator frequency are also adjusted on the analyzer.

Remote command:

[CONFigure:GENerator:FREQuency:CENTer](#) on page 245

[CONFigure:GENerator:FREQuency:CENTer:LEDState?](#) on page 245

Reference Frequency

Selects the source of the generator reference frequency.

The internal reference is that of the signal generator itself. When you select an external reference, you can use another frequency reference, for example that of the FSW.

Remote command:

[CONFigure:GENerator:EXTernal:ROSCillator](#) on page 244

[CONFigure:GENerator:EXTernal:ROSCillator:LEDState?](#) on page 244

Path RF / BB

Selects the RF signal path of the generator that is used for signal generation.

Remote command:

RF path: [CONFigure:GENerator:TARGET:PATH:RF](#) on page 251

BB path: [CONFigure:GENerator:TARGET:PATH:BB?](#) on page 250

Segment

If you are using a waveform file that contains several different waveforms, you have to select the segment to transfer to the signal generator.

Note that the segment that you have selected in the "Generator Setup" has to match the segment selected for the reference signal, regarding the signal characteristics.

Remote command:

[CONFigure:GENerator:SEGment](#) on page 249

[CONFigure:GENerator:SEGment:LEDState?](#) on page 250

Digital Attenuation

Attenuates or amplifies the internal, digitally modulated I/Q signal on the signal generator. The level of the RF signal is thus adjusted accordingly.

Digital attenuation allows very fast level changes of the internal I/Q signals.

Note that digital attenuation only has an effect on the RF output level if the internal I/Q modulator of the generator is active.

Remote command:

[CONFigure:GENerator:POWer:LEVel:ATTenuation](#) on page 247

RF Output

Turns the RF output on the connected signal generator on and off.

When you turn off the RF output, the generator does not feed a signal into the connected DUT.

Remote command:

[CONFigure:GENerator:RFOutput\[:STATe\]](#) on page 249

[CONFigure:GENerator:RFOutput:LEDState?](#) on page 249

Settling Delay

The "Settling Delay" defines a time period between the time a parameter changes on the generator and the start of the next measurement. The FSW automatically waits for the defined time period whenever one of the relevant generator settings has been changed.

Defining a delay time is especially useful for measurements that automatically change generator settings (for example the parameter sweep). The delay time considers the settling time of the generator's hardware components between individual measurements.

Remote command:

[CONFigure:DUT:STIME](#) on page 243

3.4.8 Configuring the 2 GHz or 5 GHz bandwidth extension

Access: "Overview" > "Input / Frontend" > "B2000"

Access: "Overview" > "Input / Frontend" > "B5000"

The optional 2 GHz and 5 GHz bandwidth extensions allow you to capture signals with a bandwidth of up to 2 GHz and 5 GHz respectively.

Processing the data with this bandwidth requires a Rohde & Schwarz oscilloscope in the measurement setup (for example an R&S RTO). The FSW provides the signal to the oscilloscope at a (fixed) IF via an additional connector. The oscilloscope samples the signal at a rate of 10 or 20 Gigasamples, using an external frequency reference. The A/D converted data is then sent to the FSW, where it is equalized and resampled to the sample rate required by the FSW measurement application. The entire measurement and both instruments are controlled by the FSW.

For a comprehensive description on how to use the bandwidth extension, refer to the I/Q analyzer manual available for the FSW.

3.4.9 Reference: I/Q file input

- [Basics on input from I/Q data files](#)..... 85
- [I/Q data file format \(iq-tar\)](#)..... 86

3.4.9.1 Basics on input from I/Q data files

The I/Q data to be evaluated in a particular FSW application cannot only be captured by the application itself, it can also be loaded from a file, provided it has the correct format. The file is then used as the input source for the application.

For example, you can capture I/Q data using the I/Q Analyzer application, store it to a file, and then analyze the signal parameters for that data later using the AM/FM/PM Modulation Analysis application.

The I/Q data file must be in one of the following supported formats:

- .iq.tar
- .iqw
- .csv
- .mat
- .wv
- .aid



An application note on converting Rohde & Schwarz I/Q data files is available from the Rohde & Schwarz website:

[1EF85: Converting R&S I/Q data files](#)

When importing data from an I/Q data file using the import functions provided by some FSW applications, the data is only stored temporarily in the capture buffer. It overwrites the current measurement data and is in turn overwritten by a new measurement. If you use an I/Q data file as input, the stored I/Q data remains available for any number of subsequent measurements. Furthermore, the (temporary) data import requires the current measurement settings in the current application to match the settings that were applied when the measurement results were stored (possibly in a different application). When the data is used as an input source, however, the data acquisition settings in the current application (attenuation, center frequency, measurement bandwidth, sample rate) can be ignored. As a result, these settings cannot be changed in the current application. Only the measurement time can be decreased, to perform measurements on an extract of the available data (from the beginning of the file) only.

For input files that contain multiple data streams from different channels, you can define which data stream to be used for the currently selected channel in the input settings. You can define whether the data stream is used only once, or repeatedly, to create a larger amount of input data.

When using input from an I/Q data file, the [RUN SINGLE] function starts a single measurement (i.e. analysis) of the stored I/Q data, while the [RUN CONT] function repeatedly analyzes the same data from the file.



Sample iq.tar files

If you have the optional FSW VSA application (R&S FSW-K70), some sample `iq.tar` files are provided in the `C:\R_S\INSTR\USER\vsa\DemoSignals` directory on the FSW.

Pre-trigger and post-trigger samples

In applications that use pre-triggers or post-triggers, if no pre-trigger or post-trigger samples are specified in the I/Q data file, or too few trigger samples are provided to satisfy the requirements of the application, the missing pre- or post-trigger values are filled up with zeros. Superfluous samples in the file are dropped, if necessary. For pre-trigger samples, values are filled up or omitted at the beginning of the capture buffer. For post-trigger samples, values are filled up or omitted at the end of the capture buffer.

3.4.9.2 I/Q data file format (iq-tar)

I/Q data is packed in a file with the extension `.iq.tar`. An `iq-tar` file contains I/Q data in binary format together with meta information that describes the nature and the source of data, e.g. the sample rate. The objective of the `iq-tar` file format is to separate I/Q data from the meta information while still having both inside one file. In addition, the file format allows you to include user-specific data and to preview the I/Q data in a web browser (not supported by all web browsers).

The `iq-tar` container packs several files into a single `.tar` archive file. Files in `.tar` format can be unpacked using standard archive tools (see http://en.wikipedia.org/wiki/Comparison_of_file_archivers) available for most operating systems. The advantage of `.tar` files is that the archived files inside the `.tar` file are not changed (not compressed) and thus it is possible to read the I/Q data directly within the archive without the need to unpack (untar) the `.tar` file first.



Sample iq-tar files

Some sample `iq-tar` files are provided in the `C:\R_S\INSTR\USER\Demo\` directory on the FSW.



An application note on converting Rohde & Schwarz I/Q data files is available from the Rohde & Schwarz website:

[1EF85: Converting R&S I/Q data files](#)

Contained files

An `iq-tar` file must contain the following files:

- **I/Q parameter XML file**, e.g. `xyz.xml`
Contains meta information about the I/Q data (e.g. sample rate). The filename can be defined freely, but there must be only one single I/Q parameter XML file inside an `iq-tar` file.
- **I/Q data binary file**, e.g. `xyz.complex.float32`

Contains the binary I/Q data of all channels. There must be only one single I/Q data binary file inside an `iq-tar` file.

Optionally, an `iq-tar` file can contain the following file:

- **I/Q preview XSLT file**, e.g. `open_IqTar_xml_file_in_web_browser.xslt`
Contains a stylesheet to display the I/Q parameter XML file and a preview of the I/Q data in a web browser (not supported by all web browsers).
A sample stylesheet is available at http://www.rohde-schwarz.com/file/open_IqTar_xml_file_in_web_browser.xslt.
- **I/Q parameter XML file specification**..... 87
- **I/Q data binary file**..... 92

I/Q parameter XML file specification



The content of the I/Q parameter XML file must comply with the XML schema `RsIqTar.xsd` available at: <http://www.rohde-schwarz.com/file/RsIqTar.xsd>.

In particular, the order of the XML elements must be respected, i.e. `iq-tar` uses an "ordered XML schema". For your own implementation of the `iq-tar` file format make sure to validate your XML file against the given schema.

The following example shows an I/Q parameter XML file. The XML elements and attributes are explained in the following sections.

Sample I/Q parameter XML file: `xyz.xml`

```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl"
href="open_IqTar_xml_file_in_web_browser.xslt"?>
<RS_IQ_TAR_FileFormat fileFormatVersion="1"
xsi:noNamespaceSchemaLocation="RsIqTar.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <Name>FSW</Name>
  <Comment>Here is a comment</Comment>
  <DateTime>2011-01-24T14:02:49</DateTime>
  <Samples>68751</Samples>
  <Clock unit="Hz">6.5e+006</Clock>
  <Format>complex</Format>
  <DataType>float32</DataType>
  <ScalingFactor unit="V">1</ScalingFactor>
  <NumberOfChannels>1</NumberOfChannels>
  <DataFilename>xyz.complex.float32</DataFilename>
  <UserData>
    <UserDefinedElement>Example</UserDefinedElement>
  </UserData>
  <PreviewData>...</PreviewData>
</RS_IQ_TAR_FileFormat>
```

Minimum data elements

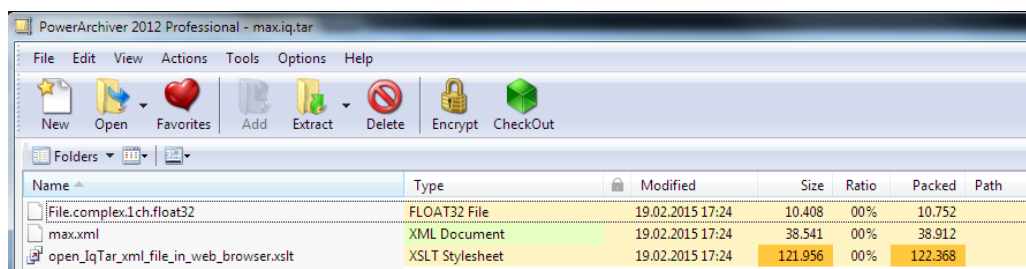
The following data elements are the minimum required for a valid `iq-tar` file. They are always provided by an `iq-tar` file export from a Rohde & Schwarz product. If not specified otherwise, it must be available in all `iq-tar` files used to import data to a Rohde & Schwarz product.

Element	Possible Values	Description
<RS_IQ_TAR_FileFormat>	-	The root element of the XML file. It must contain the attribute <code>fileFormatVersion</code> that contains the number of the file format definition.
<Name>	string	Optional: describes the device or application that created the file.
<Comment>	string	Optional: contains text that further describes the contents of the file.
<DateTime>	yyyy-mm-ddThh:mm:ss	Contains the date and time of the creation of the file. Its type is <code>xs:dateTime</code> (see <code>RsIqTar.xsd</code>).
<Samples>	integer	Contains the number of samples of the I/Q data. For multi-channel signals all channels have the same number of samples. One sample can be: <ul style="list-style-type: none"> • A complex number represented as a pair of I and Q values • A complex number represented as a pair of magnitude and phase values • A real number represented as a single real value See also <Format> element.
<Clock>	double	Contains the clock frequency in Hz, i.e. the sample rate of the I/Q data. A signal generator typically outputs the I/Q data at a rate that equals the clock frequency. If the I/Q data was captured with a signal analyzer, the signal analyzer used the clock frequency as the sample rate. The attribute <code>unit</code> must be set to "Hz".
<Format>	complex real polar	Specifies how the binary data is saved in the I/Q data binary file (see <DataFilename> element). Every sample must be in the same format. The format can be one of the following: <ul style="list-style-type: none"> • <code>complex</code>: Complex number in cartesian format, i.e. I and Q values interleaved. I and Q are unitless • <code>real</code>: Real number (unitless) • <code>polar</code>: Complex number in polar format, i.e. magnitude (unitless) and phase (rad) values interleaved. Requires <code>DataType = float32 or float64</code>
<DataType>	int8 int16 int32 float32 float64	Specifies the binary format used for samples in the I/Q data binary file (see <DataFilename> element and " I/Q data binary file " on page 92). The following data types are allowed: <ul style="list-style-type: none"> • <code>int8</code>: 8 bit signed integer data • <code>int16</code>: 16 bit signed integer data • <code>int32</code>: 32 bit signed integer data • <code>float32</code>: 32 bit floating point data (IEEE 754) • <code>float64</code>: 64 bit floating point data (IEEE 754)

Element	Possible Values	Description
<ScalingFactor>	double	Optional: describes how the binary data can be transformed into values in the unit Volt. The binary I/Q data itself has no unit. To get an I/Q sample in the unit Volt the saved samples have to be multiplied by the value of the <ScalingFactor>. For polar data only the magnitude value has to be multiplied. For multi-channel signals the <ScalingFactor> must be applied to all channels. The attribute <code>unit</code> must be set to "v". The <ScalingFactor> must be > 0. If the <ScalingFactor> element is not defined, a value of 1 V is assumed.
<NumberOfChannels>	integer	Optional: specifies the number of channels, e.g. of a MIMO signal, contained in the I/Q data binary file. For multi-channels, the I/Q samples of the channels are expected to be interleaved within the I/Q data file (see "I/Q data binary file" on page 92). If the <NumberOfChannels> element is not defined, one channel is assumed.
<DataFilename>		Contains the filename of the I/Q data binary file that is part of the <code>iq-tar</code> file. It is recommended that the filename uses the following convention: <code><xyz>.<Format>.<Channels>ch.<Type></code> <ul style="list-style-type: none"> • <xyz> = a valid Windows file name • <Format> = complex, polar or real (see <code>Format</code> element) • <Channels> = Number of channels (see <code>NumberOfChannels</code> element) • <Type> = float32, float64, int8, int16, int32 or int64 (see <code>DataType</code> element) Examples: <ul style="list-style-type: none"> • xyz.complex.1ch.float32 • xyz.polar.1ch.float64 • xyz.real.1ch.int16 • xyz.complex.16ch.int8
<UserData>	xml	Optional: contains user, application or device-specific XML data which is not part of the <code>iq-tar</code> specification. This element can be used to store additional information, e.g. the hardware configuration. User data must be valid XML content.
<PreviewData>	xml	Optional: contains further XML elements that provide a preview of the I/Q data. The preview data is determined by the routine that saves an <code>iq-tar</code> file (e.g. FSW). For the definition of this element refer to the <code>RsIqTar.xsd</code> schema. Note that the preview can be only displayed by current web browsers that have JavaScript enabled and if the XSLT stylesheet <code>open_IqTar_xml_file_in_web_browser.xslt</code> is available.

Example

The following example demonstrates the XML description inside the `iq-tar` file. Note that this preview is not supported by all web browsers.



Open the xml file in a web browser. If the stylesheet `open_IqTar_xml_file_in_web_browser.xslt` is in the same directory, the web browser displays the xml file in a readable format.

← → C:\temp\max.xml 🔍 ↻ max.xml

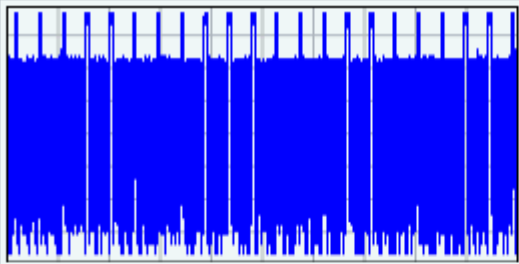
max.xml (of .iq.tar file)

Description	
Saved by	VSE_1.10
Date & Time	2014-11-24 14:34:06
Sample rate	32 MHz
Number of samples	3200300
Duration of signal	100.009 ms
Data format	complex, float32
Data filename	File.complex.1ch.float32
Scaling factor	1 V

IQ Analyzer

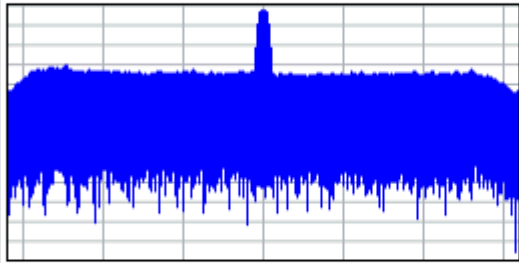
Power vs time

y-axis: 10 dB /div
x-axis: 10 ms /div

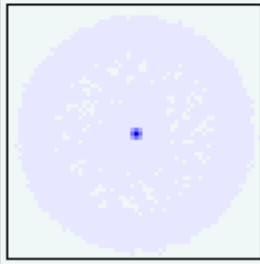


Spectrum

y-axis: 10 dB /div
x-axis: 5 MHz /div



I/Q



```

<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl" href="open_IqTar_xml_file_in_web_browser.xslt"?>
<RS_IQ_TAR_FileFormat fileFormatVersion="1" xsi:noNamespaceSchemaLocation=
"http://www.rohde-schwarz.com/file/RsIqTar.xsd" xmlns:xsi=
"http://www.w3.org/2001/XMLSchema-instance">
  <Name>VSE_1.10a 29 Beta</Name>
  <Comment></Comment>
  <DateTime>2015-02-19T15:24:58</DateTime>
  <Samples>1301</Samples>
  <Clock unit="Hz">32000000</Clock>
  <Format>complex</Format>
  <DataType>float32</DataType>
  <ScalingFactor unit="V">1</ScalingFactor>
  <NumberOfChannels>1</NumberOfChannels>
  <DataFilename>File.complex.1ch.float32</DataFilename>

  <UserData>
    <RohdeSchwarz>
      <DataImportExport_MandatoryData>
        <ChannelNames>
          <ChannelName>IQ Analyzer</ChannelName>
        </ChannelNames>
        <CenterFrequency unit="Hz">0</CenterFrequency>
      </DataImportExport_MandatoryData>
      <DataImportExport_OptionalData>
        <Key name="Ch1_NumberOfPostSamples">150</Key>
        <Key name="Ch1_NumberOfPreSamples">150</Key>
      </DataImportExport_OptionalData>
    </RohdeSchwarz>
  </UserData>

</RS_IQ_TAR_FileFormat>

```

Example: ScalingFactor

Data stored as int16 and a desired full scale voltage of 1 V

ScalingFactor = 1 V / maximum int16 value = 1 V / 2¹⁵ = 3.0517578125e-5 V

Scaling Factor	Numerical value	Numerical value x ScalingFactor
Minimum (negative) int16 value	- 2 ¹⁵ = - 32768	-1 V
Maximum (positive) int16 value	2 ¹⁵ -1= 32767	0.999969482421875 V

I/Q data binary file

The I/Q data is saved in binary format according to the format and data type specified in the XML file (see <Format> element and <DataType> element). To allow reading and writing of streamed I/Q data, all data is interleaved, i.e. complex values are interleaved pairs of I and Q values and multi-channel signals contain interleaved (complex)

samples for channel 0, channel 1, channel 2 etc. If the <NumberOfChannels> element is not defined, one channel is presumed.

Example: Element order for real data (1 channel)

```
I[0],           // Real sample 0
I[1],           // Real sample 1
I[2],           // Real sample 2
...
```

Example: Element order for complex cartesian data (1 channel)

```
I[0], Q[0],     // Real and imaginary part of complex sample 0
I[1], Q[1],     // Real and imaginary part of complex sample 1
I[2], Q[2],     // Real and imaginary part of complex sample 2
...
```

Example: Element order for complex polar data (1 channel)

```
Mag[0], Phi[0], // Magnitude and phase part of complex sample 0
Mag[1], Phi[1], // Magnitude and phase part of complex sample 1
Mag[2], Phi[2], // Magnitude and phase part of complex sample 2
...
```

Example: Element order for complex cartesian data (3 channels)

Complex data: I[channel no][time index], Q[channel no][time index]

```
I[0][0], Q[0][0], // Channel 0, Complex sample 0
I[1][0], Q[1][0], // Channel 1, Complex sample 0
I[2][0], Q[2][0], // Channel 2, Complex sample 0

I[0][1], Q[0][1], // Channel 0, Complex sample 1
I[1][1], Q[1][1], // Channel 1, Complex sample 1
I[2][1], Q[2][1], // Channel 2, Complex sample 1

I[0][2], Q[0][2], // Channel 0, Complex sample 2
I[1][2], Q[1][2], // Channel 1, Complex sample 2
I[2][2], Q[2][2], // Channel 2, Complex sample 2
...
```

Example: Element order for complex cartesian data (1 channel)

This example demonstrates how to store complex cartesian data in float32 format using MATLAB®.

```
% Save vector of complex cartesian I/Q data, i.e. iqiqli...
N = 100
iq = randn(1,N)+1j*randn(1,N)
fid = fopen('xyz.complex.float32','w');
for k=1:length(iq)
    fwrite(fid,single(real(iq(k))), 'float32');
```

```

    fwrite(fid, single(imag(iq(k))), 'float32');
end
fclose(fid)

```

Example: PreviewData in XML

```

<PreviewData>
  <ArrayOfChannel length="1">
    <Channel>
      <PowerVsTime>
        <Min>
          <ArrayOfFloat length="256">
            <float>-134</float>
            <float>-142</float>
            ...
            <float>-140</float>
          </ArrayOfFloat>
        </Min>
        <Max>
          <ArrayOfFloat length="256">
            <float>-70</float>
            <float>-71</float>
            ...
            <float>-69</float>
          </ArrayOfFloat>
        </Max>
      </PowerVsTime>
      <Spectrum>
        <Min>
          <ArrayOfFloat length="256">
            <float>-133</float>
            <float>-111</float>
            ...
            <float>-111</float>
          </ArrayOfFloat>
        </Min>
        <Max>
          <ArrayOfFloat length="256">
            <float>-67</float>
            <float>-69</float>
            ...
            <float>-70</float>
            <float>-69</float>
          </ArrayOfFloat>
        </Max>
      </Spectrum>
      <IQ>
        <Histogram width="64" height="64">0123456789...0</Histogram>
      </IQ>
    </Channel>
  </ArrayOfChannel>
</PreviewData>

```

```
</ArrayOfChannel>  
</PreviewData>
```

3.5 Triggering

Access: "Overview" > "Trigger"

The R&S FSW-K18 provides functionality to trigger measurements.

The "Trigger" dialog box contains settings to configure triggered measurements.

The following trigger sources are supported:

- Free Run
- External
- I/Q Power
- IF Power
- RF Power

The trigger settings are similar to those in the spectrum application. For a comprehensive description of the trigger functionality, refer to the FSW user manual.

Note that in [parallel baseband](#) mode, you can only use trigger connector 3, the others are used to capture baseband data. When you are using an external [bandwidth extension](#), you can only use "External Ch3" on the oscilloscope as the trigger source.


Correct TPIS

If enabled, the trigger event is set to the actual trigger point within the sample (TPIS). See also [TRACe: IQ: TPISample?](#) on page 295.

This setting is available for all trigger sources except "Free Run".

TPIS correction is not supported if user frequency response correction (R&S FSW-K544) is active. If you activate frequency response correction, TPIS correction is automatically deactivated in all channels.

For details see frequency response correction in the FSW user manual.

Note that when you enable this setting, the displayed trace no longer matches the instrument settings. Thus, the  yellow star icon is displayed on the tab label. Start a new measurement for the correction to take effect and to update the display.

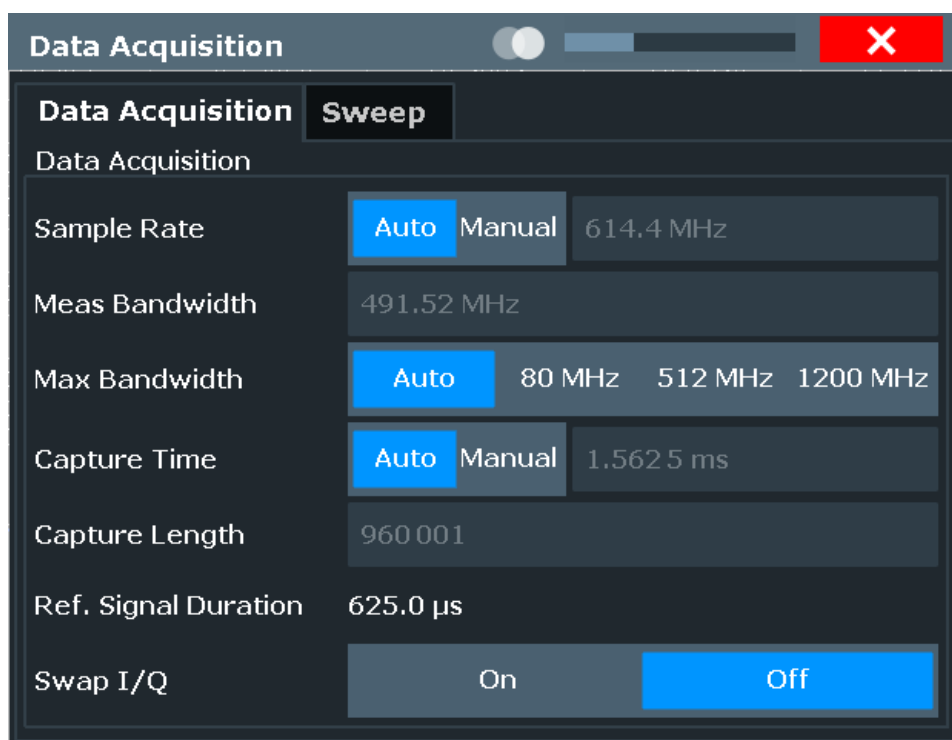
Remote command:

[TRIGger\[:SEquence\]:CTPis](#) on page 294

3.6 Data acquisition

Access: "Overview" > "Data Acquisition"

The "Data Acquisition" dialog box contains settings to configure the process of how the application records the signal.



The remote commands required to configure the data capture are described in [Chapter 5.6.7, "Configuring the data capture"](#), on page 252.

Configuring the measurement bandwidth.....	96
L Automatic adjustment.....	96
L Manual definition.....	97
L Maximum bandwidth.....	97
Configuring the measurement time.....	97
L Automatic adjustment.....	97
L Manual definition.....	98
Inverting the I/Q branches.....	98
Defining the resolution bandwidth for spectrum measurements.....	98

Configuring the measurement bandwidth

The sample rate defined for data acquisition is the sample rate with which the analyzer samples the amplified signal.

The measurement bandwidth defines the flat, usable bandwidth of the final I/Q data.

The application allows you to adjust both values automatically or manually.

Automatic adjustment ← Configuring the measurement bandwidth

When you select automatic adjustment of sample rate and measurement bandwidth, the application selects a bandwidth that is appropriate for the characteristics of the reference signal and adjusts the sample rate accordingly.

For more information about the reference signal, see [Chapter 3.3, "Reference signals"](#), on page 48.

Remote command:

Mode: `TRACe:IQ:SRATe:AUTO` on page 255

Manual definition ← Configuring the measurement bandwidth

When you define the sample rate and measurement bandwidth manually, you can select values that you are comfortable with. Because the bandwidth is a function of the sample rate (and vice versa), the application adjusts the values when you change either setting.

The following dependencies apply:

- When you change the sample rate, the application updates the bandwidth accordingly (and vice versa). It also adjusts the capture length to the new values. The capture time remains the same.
- When you change the capture time or capture length, the sample rate and bandwidth remain the same.

Note that when you upload a new input file, the Amplifier measurement application maintains the manual sample rate definition.

Remote command:

Sample Rate: `TRACe:IQ:SRATe` on page 255

Bandwidth: `TRACe:IQ:BWIDth` on page 254

Maximum bandwidth ← Configuring the measurement bandwidth

The maximum bandwidth you can use depends on your hardware configuration.

For an overview of available bandwidth extensions, refer to the datasheet.

By default, the application automatically determines the maximum bandwidth. When you select a maximum bandwidth other than "Auto", the bandwidth is restricted to that value. When you select the maximum bandwidth manually, make sure that this bandwidth is suited for the signal you are testing. Otherwise, the signal can be distorted and results are no longer valid.

When you are using the baseband input FSW-B71, the maximum bandwidth is always limited to 80 MHz.

If you have no bandwidth extension this setting is not available.

For more information about the maximum bandwidth, refer to the user manual of the FSW I/Q Analyzer.

Remote command:

`TRACe:IQ:WBANd[:STATe]` on page 256

`TRACe:IQ:WBANd:MBWidth` on page 256

Configuring the measurement time

The measurement time (or capture time) defines the duration of a measurement in which the required number of samples is collected.

The capture length is the number of samples that are captured during the selected measurement time. The capture length is a function of the sample rate and the capture time.

Automatic adjustment ← Configuring the measurement time

When you select automatic adjustment of capture time, the application selects a capture time that is appropriate for the characteristics of the reference signal.

As orientation, the application shows the length of the reference signal in the corresponding field in the dialog box (→ "Ref Signal Duration").

For more information about the reference signal, see [Chapter 3.3, "Reference signals"](#), on page 48.

Remote command:

Mode: [\[SENSe:\]SWEep:TIME:AUTO](#) on page 254

Reference signal: [\[SENSe:\]REFSig:TIME?](#) on page 253

Manual definition ← Configuring the measurement time

When you define the capture length and time manually, you can select values that you are comfortable with.

However, make sure to define a capture time that is greater than the length of the reference signal - otherwise the application is not able to analyze the signal correctly.

The following dependencies apply:

- When you change the capture time, the application updates the capture length accordingly (and vice versa). Sample rate and bandwidth remain the same.
- When you change the sample rate or bandwidth, the application updates the capture length accordingly. The capture time remains the same.

Note that the maximum capture time depends on the current measurement bandwidth.

When you upload a new input file, the Amplifier measurement application maintains the manual capture time definition.

Remote command:

Time: [\[SENSe:\]SWEep:TIME](#) on page 254

Capture length: [\[SENSe:\]SWEep:LENGth](#) on page 253

Inverting the I/Q branches

The application allows you to swap the I and Q branches of the signal.

Swapping the branches is useful, for example, when the DUT inverts the real (I) and imaginary (Q) parts of the signal and transfers the signal that way.

Note that the sideband is also inverted when you turn on this feature.

Remote command:

[\[SENSe:\]SWAPiq](#) on page 253

Defining the resolution bandwidth for spectrum measurements

The resolution bandwidth (RBW) defines the bandwidth of the resolution filter applied to spectrum measurements (like the "Spectrum FFT" result).

The "RBW Mode" selects whether the application automatically selects a suitable resolution bandwidth based on the signal you are measuring, or if you define the resolution bandwidth manually. When you select manual definition of the RBW (for example when you want to do a measurement according to a certain telecommunications standard), you can enter the bandwidth in the "RBW" field.

The amplifier measurement application supports any bandwidth between 1 Hz and 10 MHz.

Remote command:

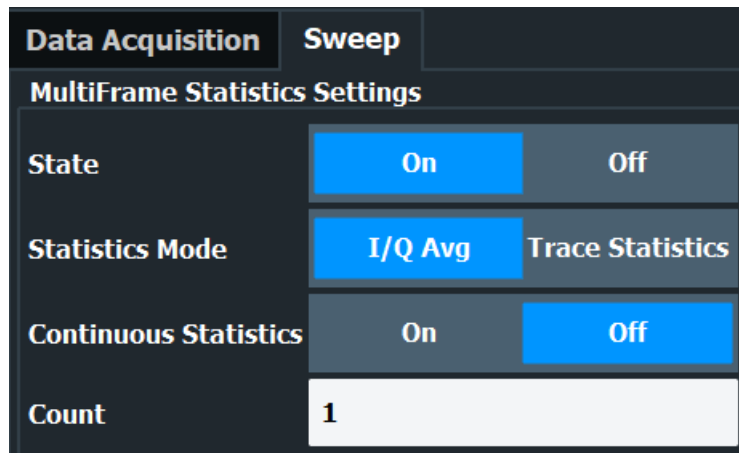
[SENSe:]BANDwidth[:RESolution]:AUTO on page 252

[SENSe:]BANDwidth[:RESolution] on page 252

3.7 Sweep configuration

Access: "Overview" > "Data Acquisition" > "Sweep"

The "Sweep" dialog box contains settings to configure the characteristics of a single data recording (a sweep).



The remote commands required to configure the sweep are described in [Chapter 5.6.8, "Sweep configuration"](#), on page 257.

Statistics State.....	99
Statistics Mode.....	99
Continuous Statistics.....	100
Statistics Count.....	100
Select Result Rng.....	100

Statistics State

Turns the sweep statistics calculation on and off.

Remote command:

[SENSe:]SWEep:STATistics[:STATe] on page 258

Statistics Mode

Sets the statistics mode.

If I/Q averaging is selected, the IQ data is averaged over several data captures after synchronization to the reference file. This leads to a significant noise reduction. Be aware that I/Q averaging is only possible for synchronized parts of the captured signal, because it only makes sense if the same samples in the I/Q data stream are averaged. Therefore, make sure that the measurement is synchronized. Otherwise, the results would be invalid.

If trace statistics is selected, multiple frames are measured to create a graphical or scalar statistics result.

Remote command:

[\[SENSe:\] SWEEp:STATistics:MODE](#) on page 259

Continuous Statistics

If continuous statistics is enabled, it does not reset the results when the average count is through. Instead, it continues to average the data. The continuous statistics setting only has an effect in continuous sweep mode.

If continuous statistics is turned off, averaging starts again from "0" after the defined [statistics count](#) is reached.

Remote command:

[\[SENSe:\] SWEEp:STATistics:CONTInuous\[:STATe\]](#) on page 258

Statistics Count

Defines the number of single data captures the application uses to average the data.

Remote command:

[\[SENSe:\] SWEEp:STATistics:COUNT](#) on page 258

Select Result Rng

Sets the result range.

Remote command:

[CONFigure:RESult:RANGe\[:SElected\]](#) on page 259

3.8 Synchronization

Access: "Overview" > "Sync / Error Est / Comp" > "Sync and Eval Range" > "Synchronization"

The application allows you to synchronize the measured signal with the reference signal and provides various features to control synchronization.

Synchronization consists of signal estimation and compensation. After the application has detected the position of the reference signal in the capture buffer, it estimates possible errors in the measured signal (for example the sample error rate or the amplitude droop) by comparing it to the reference signal. The estimated errors can optionally be compensated for.

The screenshot shows the 'Synchronization/Error Est/Comp' configuration window. The 'Sync and Eval Range' tab is selected, displaying a power spectrum plot with a yellow highlighted region. The plot shows power levels from 0 dBm to -90 dBm over a time range from 0 s to 1.25 ms. The 'Synchronization' section is expanded, showing the following settings:

Setting	Value
Signal Synchronization	On
Stop on Synchronization Fail	On
Synchronization Mode	I/Q Phase Difference
Synchronization Confidence	65.0 %
2nd Stage Synchronization	Off
Use Full Ref Signal	On
Estimation Start (rel. to Ref Signal Start)	0 s
Estimation Stop (rel. to Ref Signal Start)	1.25 ms

The remote commands required to configure signal synchronization are described in [Chapter 5.6.9, "Synchronizing measurement data"](#), on page 259.

Turning synchronization of reference and measured signal on and off.....	101
Selecting the synchronization method.....	102
Defining a synchronization confidence level.....	102
2nd Stage Synchronization.....	103
Defining the estimation range.....	103

Turning synchronization of reference and measured signal on and off

During measurements, the application tries to synchronize the measured signal with the reference signal. When no significant correlation between the measured and reference signal can be found, synchronization fails.

However, you can turn off synchronization if you would like to run unsynchronized measurements. Note however, that the calculation of some results in the result summary requires synchronization. These results cannot be calculated when you turn off synchronization.

When you turn off synchronization, the results are always calculated over the complete capture buffer. When synchronization is on, the results are always calculated over the synchronized data range of the capture buffer. Therefore, the result values can be different for unsynchronized measurements, even if you measure the same signal (the result is still valid and correct, though).

Failed synchronization

When you turn on "Stop on Sync Failed", the application automatically aborts the measurement, in case synchronization fails.

Remote command:

[CONFigure:SYNC:STAT](#) on page 262

[CONFigure:SYNC:SOFail](#) on page 262

Selecting the synchronization method

The application allows you to select the method with which the application synchronizes the signals with the "Synchronization Mode" parameter. The following methods are available.

- **I/Q Direct**
The I/Q data for the reference signal is directly correlated with the reference and measured signal. The performance of this method degrades in the presence of a frequency offset between the measured and reference signals.
- **I/Q Phase Difference**
Correlation on the phase differentiated I/Q data. This method retains phase change information and can handle a frequency offset, but is more sensitive to noise than the "I/Q Direct" method.
- **I/Q Magnitude**
Correlation on the magnitude of the I/Q data with no regard for phase information. This method can handle a frequency offset and is less sensitive to noise than the "I/Q Phase Difference" method, but is only useful with amplitude modulated signals.
- **Trigger**
It is assumed that the capture is triggered at the start of the reference waveform. Only minimal correlation is performed to account for trigger jitter. This method is the fastest synchronization method.

Remote command:

[CONFigure:SYNC:DOMain](#) on page 261

Defining a synchronization confidence level

The synchronization confidence level ("Sync Confidence") is a percentage that describes how similar (or correlated) reference and measured signal need to be in order for synchronization to be successful.

A value of 0 % means that synchronization is always successful even if the signals are not correlated at all. However, results that rely on a good synchronization (like the EVM) do contain reasonable values in that case. A value of 100 % means that the signals are identical (in that they are linearly dependent).

The cross-correlation is calculated over all samples in the capture buffer (or the estimation range, if you have defined one).

When the cross-correlation coefficient falls below the confidence level you have defined, synchronization is no longer successful.

Remote command:

`CONFigure:SYNC:CONFidence` on page 261

2nd Stage Synchronization

The second stage synchronization activates an additional synchronization algorithm (operating in frequency domain).

The activation is recommended especially for e.g. two carrier signals with a large spacing between the carriers, when the standard synchronization delivers unstable results.

As it is an additional synchronization step, it increases the measurement time.

Remote command:

`CONFigure:SYNC:SECond:STAT` on page 261

Defining the estimation range

The estimation range has several effects on the synchronization process.

- It defines which part of the reference signal is used for cross-correlation within the capture buffer in order to align the reference and measured signals.
- It defines which part of the reference signal is used for error estimation.

By default, the application estimates over the complete reference signal. However, you can also estimate over a given range in the capture buffer only. In that case, turn off the "Use Full Ref Signal" feature. When you are not using the full reference signal, the "Eval Start" and "Eval Stop" fields become available. The allowed values are offsets relative to the beginning of the capture buffer (0 s). The highest offset possible depends on the size of the capture buffer.

Defining an estimation range is useful in the following cases.

- If you want to limit the estimation to a specific part of the signal, for example if the signal contains a preamble or midamble.
- If you want to limit the estimation to the ON part of a TDD signal.
- If you want to increase the measurement speed for relatively long signals, for example an LTE signal.

On the downside, limiting the estimation range leads to a higher empirical variance of the results.

In the preview pane displayed in the dialog box, the currently defined estimation range is represented by two red vertical lines.

Tip: You can also use the touchscreen to move the lines to a new position in the preview pane. However, this way is not as accurate as entering a number into the input field.

Remote command:

`CONFigure:ESTimation:FULL` on page 259

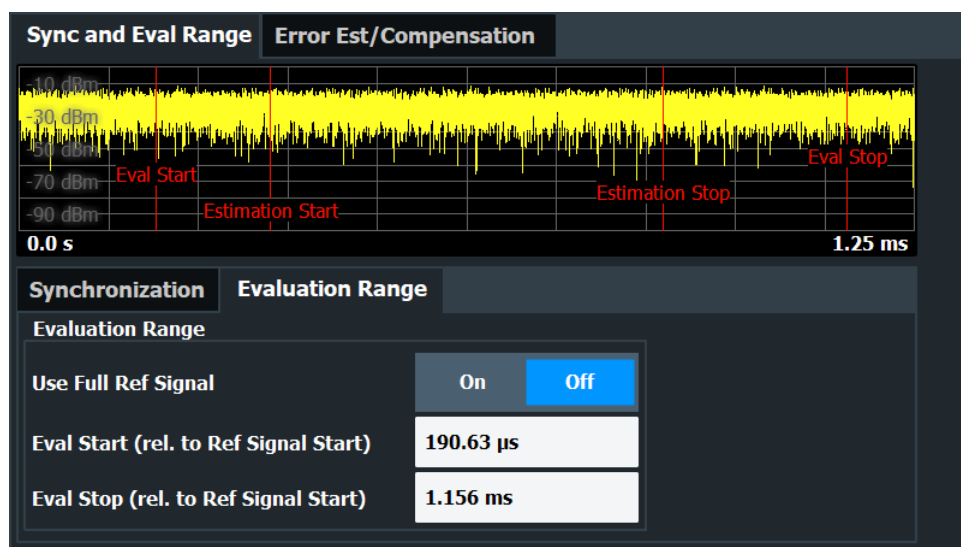
`CONFigure:ESTimation:START` on page 260

`CONFigure:ESTimation:STOP` on page 260

3.9 Evaluation range

Access: "Overview" > "Sync / Error Est / Comp" > "Sync and Eval Range" > "Eval Range"

The application allows you to define the time frame in the reference signal used to evaluate and calculate the measurement results.



The remote commands required to configure signal evaluation are described in [Chapter 5.6.10, "Defining the evaluation range"](#), on page 263.

[Defining the evaluation range](#)..... 104

Defining the evaluation range

The evaluation range defines the data range in the capture buffer over which the application calculates the measurement results.

By default, the application calculates the results over the complete capture buffer. If synchronization has been successful, the application calculates the results over the capture buffer range in which the reference signal has been found. If you have turned off synchronization or if it has not been successful, the complete capture buffer is used to calculate the remaining results.

Example:

The capture buffer is 30 ms long, the reference signal starts at 9 ms and is 10 ms long. When synchronization is successful, the evaluation range starts at 9 ms and ends at 19 ms. If synchronization has been turned off, the evaluation range is the full capture buffer.

However, you can also select a particular data range within the reference signal. In that case, turn off the "Use Full Ref Signal" feature. When it is off, the "Eval Start" and "Eval Stop" fields become available. The allowed values are offsets relative to the beginning of the reference signal (0 s). The highest offset possible depends on the length of the reference signal.

Example:

The situation is as described above (30 ms capture buffer, 10 ms reference signal). Let's say you want to evaluate milliseconds 2 to 6 of the reference signal. In that case, you would have to define a start offset of 11 ms (the reference signal starts at 9 ms, plus the first 2 ms you are not interested in = 11 ms) and a stop offset of 15 ms (9 ms + 6 ms).

In the preview pane displayed in the dialog box, the currently defined evaluation range is represented by two blue vertical lines.

Tip: You can also use the touchscreen to move the lines to a new position in the preview pane. However, this way is not as accurate as entering a number into the input field.

Remote command:

[CONFigure:EVALuation:FULL](#) on page 263

[CONFigure:EVALuation:RANGe](#) on page 264

[CONFigure:EVALuation:STARt](#) on page 264

[CONFigure:EVALuation:STOP](#) on page 264

3.10 Signal error estimation and compensation

Access: "Overview" > "Sync / Error Est / Comp" > "Error Est / Compensation"

The application allows you to estimate possible undesired effects in the signal, and, if there are any, also compensate these effects.

Sync and Eval Range	Error Est/Compensation		Equalizer	
Signal Error Estimation/Compensation				
	Estimation		Compensation	
I/Q Imbalance	On	Off	On	Off
I/Q Offset	On	Off	On	Off
Frequency Error	On	Off	On	Off
Sample Rate Error	On	Off	On	Off
Amplitude Droop	On	Off	On	Off

The remote commands required to configure error compensation and equalization are described in [Chapter 5.6.11, "Estimating and compensating signal errors"](#), on page 265.

Estimation and compensation

When you turn on error estimation only, the results are not compensated for the corresponding errors.

When you turn on error compensation, the displayed results are also corrected by the estimated errors. Note that in that case, the signal might look better than it actually is.

Compensation without estimation is not possible.

Generally, it is recommended to switch off the estimation of a certain parameter if it is not existent. E.g., if generator and analyzer are frequency locked, it is recommended to switch off the frequency error estimation. Furthermore sample rate error estimation can be switched off if the frequency locked generator is a vector signal generator, i.e. includes the DAC.

You can estimate and compensate the following effects:

I/Q Imbalance	106
I/Q Offset	106
Frequency Error	106
Sample Error Rate	106
Amplitude Droop	106

I/Q Imbalance

Combined effect of amplitude and phase error.

Remote command:

[CONFigure:SIGNal:ERRor:ESTimation:IQIMbalance\[:STATe\]](#) on page 267

[CONFigure:SIGNal:ERRor:COMPensation:IQIMbalance\[:STATe\]](#)

on page 266

I/Q Offset

Shift of the constellation points in a particular direction.

Remote command:

[CONFigure:SIGNal:ERRor:ESTimation:IQOffset\[:STATe\]](#) on page 267

[CONFigure:SIGNal:ERRor:COMPensation:IQOffset\[:STATe\]](#) on page 266

Frequency Error

Difference between measured and reference center frequency.

Remote command:

[CONFigure:SIGNal:ERRor:ESTimation:FERRor\[:STATe\]](#) on page 267

[CONFigure:SIGNal:ERRor:COMPensation:FERRor\[:STATe\]](#) on page 265

Sample Error Rate

Difference between the sample rate of the reference signal and the measured signal.

Remote command:

[CONFigure:SIGNal:ERRor:ESTimation:SRATE\[:STATe\]](#) on page 268

[CONFigure:SIGNal:ERRor:COMPensation:SRATE\[:STATe\]](#) on page 266

Amplitude Droop

Decrease of the signal power over time in the transmitter.

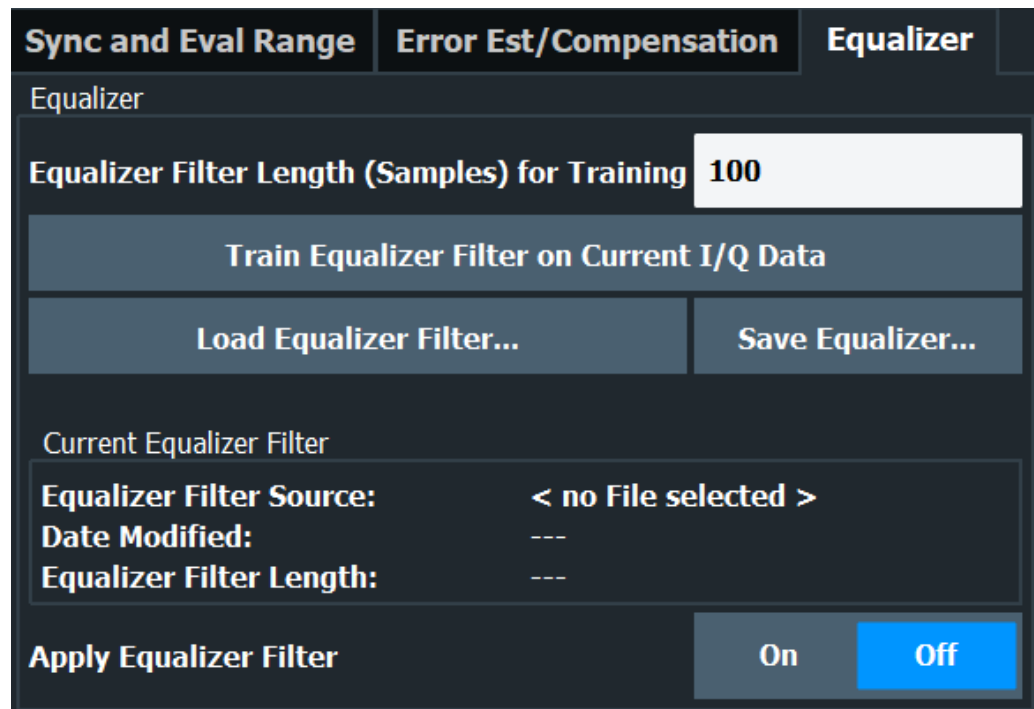
Remote command:

[CONFigure:SIGNal:ERRor:ESTimation:ADRoop\[:STATe\]](#) on page 267

[CONFigure:SIGNal:ERRor:COMPensation:ADRoop\[:STATe\]](#) on page 265

3.11 Equalizer

In addition, the amplifier application provides equalizer functionality. The equalizer corrects distortions in the frequency characteristics during the transmission of the signal. It can thus help to faithfully reproduce the input signal at the amplifier output.



Using the equalizer

Using the equalizer requires a description of the equalizer filter. You can either train (and save) such a filter automatically with the FSW, or use one that you already have.

Training (or creating) the equalizer filter is a process in which the FSW compares the frequency response of the input and output signal and equalizes potential distortion. The goal is to match the frequency response of the output signal and the input signal. The FSW is able to train the filter based on all samples in the evaluation range.

The "Equalizer Filter Length For Training" property defines the number of FIR filter coefficients to be calculated. A larger number of samples generally yields better results, but takes longer to calculate. After you have defined the filter length (coefficients), you can start the training sequence with the "Train Equalizer Filter on Current I/Q Data" feature. To apply the filter, turn on the equalizer with the "Equalizer State" toggle.

Note that the reference and measured signal need to be synchronized for a successful filter training. Make sure to turn on [signal synchronization](#) before you train a filter.

When the filter training is done, you can save the filter in a `csv` or a `fres` file (→ "Save Equalizer").

For more information about the `fres` file format, refer to the FSW user manual.

If you want to use an equalizer filter that you already have from a previous measurement, you can restore that filter (→ "Load Equalizer Filter") and apply it without a training sequence.

The dialog box also shows the information about the filter file that is currently in use. This information includes the file name, the date it was modified last and the length of the filter (in samples).

Note: Any equalizer filter is only valid for the sample rate it has been trained for. If you change the sample rate when an equalizer filter is active, the FSW automatically turns off the equalizer filter. If you still want to use an equalizer filter with the new sample rate, you have to train and apply the equalizer filter again.

Note: An I/Q data export always exports the unequalized (raw) data. If you want to export the equalized data, you can do so with the following SCPI command.

[TRACe:IQ:EQUalized?](#) on page 403

Remote command:

Filter length: [CONFigure:EQUalizer:FILTer:LENGTh](#) on page 268

Start training: [CONFigure:EQUalizer:TRAIIn](#) on page 270

Store filter: [MMEMory:STORe<n>:EQUalizer:FILTer:COEFFicient](#) on page 270

File format: [CONFigure:EQUalizer:FILTer:FILE:FORMat](#) on page 268

Restore filter: [MMEMory:LOAD:EQUalizer:FILTer:COEFFicient](#) on page 270

Equalizer state: [CONFigure:EQUalizer\[:STATe\]](#) on page 269

Manual filter definition: [CONFigure:EQUalizer:FPARAMeters](#) on page 269

3.12 System models

Access: "Overview" > "Measurement" > "Modeling"

A polynomial model describes the characteristics of the DUT based on the input signal and the output signal of the amplifier.

Modeling	DPD	PA Envelope/Supply	ACLR Settings	Power Settings	Parameter Sweep
Modeling	On		Off		
Modeling Sequence	AM/AM first		AM/PM first		
AM/AM Order (0 to 18)	1-7				
AM/PM Order (0 to 18)	0-7				
Modeling Level Range	50.0 dB				
No of Modeling Points	100				
Modeling Scale	Logarithmic		Linear		

The remote commands required to configure system models are described in [Chapter 5.6.12, "Applying a system model"](#), on page 271.

Turning system modeling on and off.....	109
Selecting the degree of the polynomial.....	109
Defining the modeling range.....	110
Selecting the modeling scale.....	110

Turning system modeling on and off

You can use the system modeling functionality to calculate a mathematical model that describes the properties of the DUT.

Using a model is useful to observe and estimate the behavior of the amplifier and, if necessary, adjust the DUT behavior. The application supports memory-free polynomial models to the 18th degree.

The following diagrams contain traces that show the model. These traces are calculated by using the model function on the reference signal.

- "AM/AM"
- "AM/PM"

Note that the model traces are also the basis for the DPD functionality available in the R&S FSW-K18.

When the characteristics of the modeled signal match those of the measured signal, the model describes the DUT behavior well. If not, you can try to get a better result by adjusting the model properties.

When you turn on modeling, the application shows an additional trace in the graphical result displays. This trace corresponds to the signal characteristics after the model has been applied to the reference signal.

Selecting the modeling sequence

The modeling sequence selects the sequence in which the models are calculated. The application then either calculates the "AM/AM" model before calculating the "AM/PM" model (default), or vice versa.

Remote command:

[CONFigure:MODEling\[:STATe\]](#) on page 273

[CONFigure:MODEling:SEQuence](#) on page 272

Selecting the degree of the polynomial

In addition to the type of curve, you can also select the order of the polynomial model.

The order of the model defines the degree, complexity and number of terms in the polynomial model. In general, a polynomial of the Nth degree looks like this:

$$y = a_0 + a_1x + a_2x^2 + \dots + a_Nx^N$$

The degree of the model is defined by N (as an index or exponent). The higher the order, the more complex the calculation and the longer it takes to calculate the model. Higher models do not necessarily lead to better fitting model curves.

Note that the nonlinear effects consume an additional bandwidth proportional to 2 times the number of odd factors in the polynomial, excluding the linear one.

Example:

If the signal bandwidth is 1 MHz and the highest degree is 5, the bandwidth of the resulting signal is increased by 2 times 2 (because there are the variables a_3 and a_5) times 1 MHz which are 4 MHz. This leads to a total signal bandwidth of 5 MHz (1 MHz + 4 MHz). The configured recording bandwidth must be at least 5 MHz to record all nonlinear effects generated by the DUT.

Tip: To select a specific subset of polynomial degrees you want to apply, you can either:

- Define a range of degrees (e.g. "0 - 5", in that case the application applies all degrees in that range).
- Define a set of individual degrees only (e.g. "1;3;5;7", in that case the application applies those degrees only). Note that the "." key on the front panel draws the ";" character.
- Define a combination of the methods mentioned above (e.g. "1;3;5-7")

Remote command:

"AM/AM": [CONFigure:MODEling:AMAM:ORDer](#) on page 271

"AM/PM": [CONFigure:MODEling:AMPM:ORDer](#) on page 271

Defining the modeling range

The modeling range defines the part of the signal that the model is applied to.

When you limit the level range that the model is applied to, only samples with levels between peak level and "peak level minus modeling level range value" are used during the model calculation. Note that the modeling range is also the range the DPD is applied to.

You can also define a smaller or larger modeling level range. Make sure, however, that the range is large enough not to distort the model.

In addition, you can define the number of points on the curve that the application uses to calculate the model. The selected points are spaced equidistant on a logarithmic scale (an equidistant spacing on a [linear scale](#) is also possible if you prefer that). Using fewer modeling points further speeds up measurement times (but can reduce the quality of the model if set too low).

Remote command:

Range: [CONFigure:MODEling:LRANge](#) on page 272

Points: [CONFigure:MODEling:NPOints](#) on page 272

Selecting the modeling scale

The input power range is split into several equally spaced subranges (= modeling points) for the calculation of the amplifier model.

With the "Modeling Scale", you can select whether the split is done on a logarithmic or linear basis.

Remote command:

[CONFigure:MODEling:SCALe](#) on page 272

3.13 Digital predistortion

Access: "Overview" > "Measurement" > "DPD"

Digital predistortion (DPD) is a method to improve the linearity of an RF power amplifier. Basically, DPD is a set of correction values that is added to the input signal to compensate the non-linearities that occur in the amplifier. The output signal measured by the FSW then shows the corrected amplifier characteristics.

You can compensate non-linearities with the functionality of the amplifier application. The application provides two compensation methods: polynomial DPD and direct DPD.

Note that you can only use one of the two DPD types at any time. When you turn on the polynomial DPD, the FSW automatically turns off the direct DPD and vice versa.

Using the DPD functionality requires a connection to a signal generator. For more information about configuring generators, see [Chapter 3.4.7, "Controlling a signal generator"](#), on page 79.

Note:

When you create a `.wv` waveform file using digital predistortion, it only applies to the specific generator level and generator attenuation that were set during creation. The values used during creation can be seen in the `.wv` file header comment, for example: "{COMMENT: Created by Rohde & Schwarz FS-K18 Amplifier Measurement application. Signal generated for SMx RMS level: -6.8 dBm and with SMx attenuation 0 dB.}". Create a new waveform file if you have changed the generator level or generator attenuation.

Remote command:

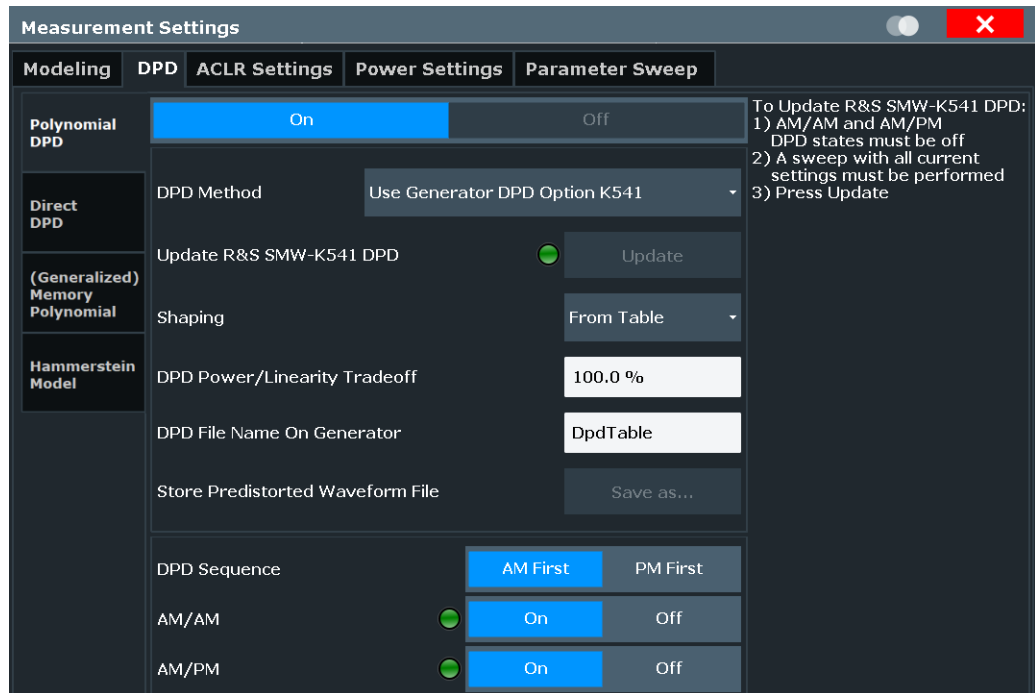
`CONFigure:DDPD[:STATe]` on page 284

- [Polynomial DPD](#)..... 111
- [Direct DPD \(FSW-K18D\)](#)..... 114
- [\(Generalized\) memory polynomial DPD \(FSW-K18M\)](#)..... 118
- [Hammerstein model \(FSW-K18M\)](#)..... 122

3.13.1 Polynomial DPD

For polynomial DPD, the application calculates the correction values based on a polynomial function, whose characteristics you can define with the settings available for the [system models](#). The polynomial DPD approach used by the FSW compensates for "AM/AM" (amplitude-to-amplitude) distortion and "AM/PM" (amplitude-to-phase) distortion.

When you apply the DPD, the correction values are applied to the input signal to improve the linearity of the amplifier.



The remote commands required to configure the polynomial DPD are described in [Chapter 5.6.13, "Applying digital predistortion"](#), on page 273.

Selecting the DPD method	112
Selecting the DPD shaping method	113
Polynomial DPD Power / Linearity Tradeoff	113
Selecting the order of model calculation	114

Selecting the DPD method

The amplifier application provides a couple of DPD calculation methods.

- "Use Generator DPD Option K541"
The signal generator corrects the input signal in real time.
This method requires a Rohde & Schwarz signal generator equipped with option R&S SMx-K541.
The source of the predistortion values is either a [table](#) or a [polynomial function](#).
After a successful measurement, you can apply the predistortion values that were calculated by the FSW with the "Update" button. (The button is only available when data has been captured on the FSW and synchronization was successful).
Note that you have to turn on the [DPD model](#) in order to make the DPD work.
As long as you use the same amplifier, the polynomial DPD calculated with this method is valid for all signals that use a similar bandwidth and frequency as the signal it was calculated for.
- "Generate Pre-Distorted Waveform File"
The FSW applies the correction values taken from the table or polynomial function to each measured sample and generates a waveform file that contains the corrected input signal. For TDD and FDD signals, we recommend that you use the [full reference signal](#) to generate the DPD.
You can start the DPD calculation and transfer the resulting waveform file to the connected generator with the "Generate and Load" button. Successful calculation

and transfer are indicated by a green LED. Note that you have to turn on the [DPD model](#) in order to make the DPD work.

Note:

When you use this method, the predistortion information only applies to the currently selected reference signal and generator level. When you change the reference signal or generator level, you have to create a file that applies to the new reference signal.

You can also save the predistorted waveform into a waveform file with the "Store Pre-Distorted Waveform File" feature for later reference.

Remote command:

[CONFigure:DPD:METhod](#) on page 276

Selecting the DPD shaping method

The application provides several ways for DPD calculation (or shaping).

- "From Table"

Shapes the DPD function based on a table that contains the correction values required to predistort the signal.

The calculation of the table is based on the "AM/AM" and "AM/PM" polynomial models.

For more information about the contents and usage of the shaping table, refer to the documentation of the R&S SMW-K541.

You can define a file name for the DPD table in the corresponding field.

- "From Polynomial"

Shapes the DPD function based on a correction polynomial that is calculated out of the model polynomial.

Compared to DPD based on a shaping table, this method does not transfer a list with correction values. Instead, the application transfers the polynomial coefficients of the correction polynomial.

For more information, see [Chapter 3.12, "System models"](#), on page 108.

You can update the DPD shaping on the signal generator comfortably with the "Update" button.

Remote command:

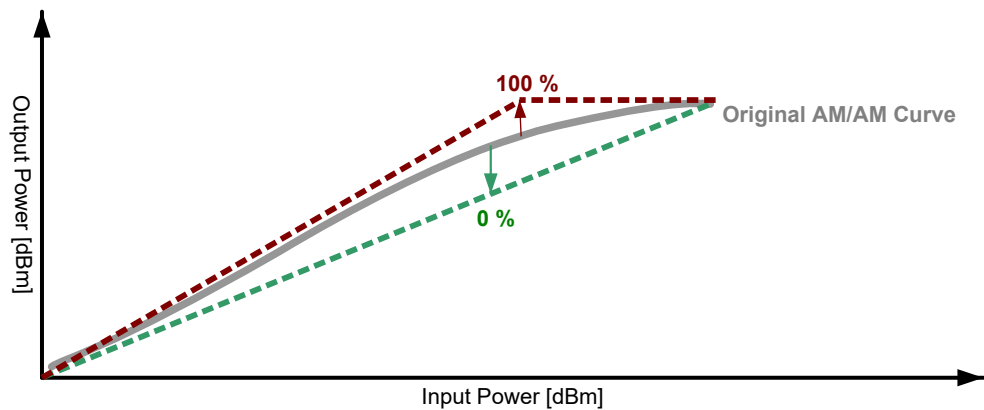
Mode: [CONFigure:DPD:SHAPing:MODE](#) on page 278

Table name: [CONFigure:DPD:FNAME](#) on page 276

Polynomial DPD Power / Linearity Tradeoff

The "DPD Power / Linearity Tradeoff" describes the effects of the DPD on the amplifier characteristics.

When you define a tradeoff of 0 %, the DPD aims for the best linearity (green line in the illustration below). When you increase the tradeoff value, the DPD aims for an optimization of the output power at the expense of linearity. In the ideal case (red line), the DPD affects the amplifier characteristics in a way that the best output power is achieved.



Remote command:

[CONFigure:DPD:TRADeoff](#) on page 278

Selecting the order of model calculation

The application allows you to compensate for "AM/AM" distortion, "AM/PM" distortion or both simultaneously. You can turn correction of the distortion models on and off in the corresponding fields.

If you want to predistort both the "AM/AM" distortion and the "AM/PM" distortion simultaneously, you can select the order in which the curves are calculated and applied to the I/Q signal on the R&S SMW.

- "AM/AM" First
Calculates the "AM/AM" first, then calculates the "AM/PM" based on the signal that has already been corrected by its "AM/AM" distortions.
- "AM/PM" First
Calculates the "AM/PM" first, then calculates the "AM/AM" based on the signal that has already been corrected by its "AM/PM" distortions.

Note: the DPD sequence is displayed by the diagram that is part of the dialog box.

Remote command:

"AM/AM" state: [CONFigure:DPD:AMAM\[:STATE\]](#) on page 274

"AM/PM" state: [CONFigure:DPD:AMPM\[:STATE\]](#) on page 275

Both: [CONFigure:DPD:AMXM\[:STATE\]](#) on page 275

Calculation order: [CONFigure:DPD:SEquence](#) on page 277

3.13.2 Direct DPD (FSW-K18D)

The direct DPD is an iterative process in which the correction values are determined for each sample of the input signal. Compared to the polynomial DPD, the direct DPD is not based on a model. It rather calculates the correction values for each sample directly.

Determining the DPD directly is based on a sequence of individual measurements (iterations). When one iteration is done, the FSW applies the correction values, measures the improved input signal again, applies the correction values etc. This process goes

on until the number of iterations that you have defined is done. Usually, the predistortion gets better with an increasing number of iterations. On the other hand, increasing the number of iterations also increases the measurement time.

Note that if synchronization is not possible during direct DPD, FSW-K18 continues with a new measurement (including capture) until synchronization was successful. Reducing the [synchronization confidence level](#) can help in that case.

The result of the direct DPD is an I/Q file that contains a predistorted waveform. When you save the I/Q file, you can later play it back on a signal generator.

For TDD and FDD signals, we recommend that you use the [full reference signal](#) to generate the DPD.



Further improvement of predistortion

In addition to increasing the number of iterations, it is recommended to apply signal averaging during each iteration. Averaging helps to remove noise from the signal, which in turn improves the quality of the predistortion values.

Without averaging, each iteration consists of a single measurement. When you apply averaging, the number of measurements during each iteration increases, depending on the number of averages you have defined.

The advantage of the direct DPD compared to the polynomial DPD is that it takes memory effects into account. This, and the fact that it is not based on a model, but corrects each sample individually, makes the direct DPD the superior method to predistort the input signal and determine the ideal DPD effect for your DUT. Note however, that the correction values that have been determined are only applicable to the signal and amplifier you have used. If the signal characteristics change in any way, you have to predistort the signal again.

The direct DPD is especially useful for the following test cases:

- Determining the best performance of a DUT.
- Removing external effects from the measurement results, for example a preamplifier that should not be considered in the final measurement results.



Continuous statistics during direct DPD calculation

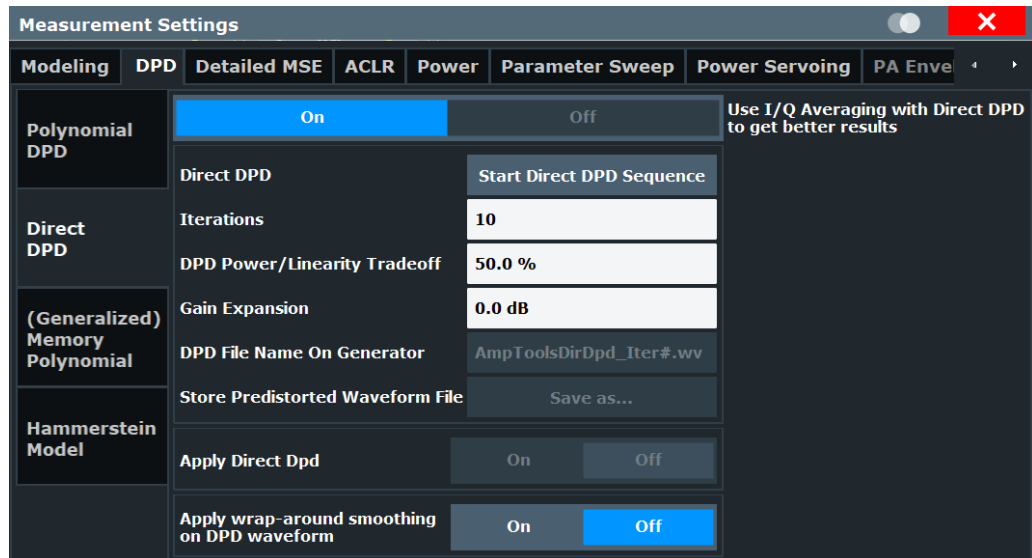
Continuous statistics is automatically disabled during the direct DPD calculation.



Generator control during direct DPD calculation

When direct DPD is activated, the generator is prevented from changing its attenuator setting automatically, i.e. it is being set into mode "Fixed" if it was in "Auto" mode so far. The attenuator mode is switched back to "Auto" when direct DPD is turned off. If the generator was in "Fixed" or "Manual" mode, the mode is not changed.

Also, the I/Q modulator of the signal generator is set to high quality table mode.



The remote commands required to configure the direct DPD are described in [Chapter 5.6.13, "Applying digital predistortion"](#), on page 273.

Automated direct DPD sequence	116
Manual direct DPD sequence	117
Direct DPD Power / Linearity Tradeoff	118

Automated direct DPD sequence

The direct DPD method requires one or more measurements (or iterations) to determine the correction values.

When you select the "Start Direct DPD Sequence" button, the FSW initiates a sequence of measurements during which the DPD is calculated. The number of measurements performed during the sequence depends on the number of "Iterations" you have defined. It is also recommended to average each iteration for further improvement of the quality of the input signal. The "Gain Expansion" defines the increase of input power relative to the peak power value of the reference signal.

You can follow the process of the DPD sequence in the channel bar. The "DPD Count" label shows the current iteration and the complete number of iterations of the DPD sequence. If you are using averaging, the "Count" label shows the process of the current iteration. The first number is the current measurement, the second number the total number of measurements.

When the DPD sequence is done, the FSW stores the predistorted I/Q signal in a waveform file and transfers it to the signal generator. You can change the name of the waveform file in the "DPD File Name on Generator" property. The "#" in the file name will be replaced by the iteration number. The waveform file is transferred automatically to the generator. It is loaded into the ARB when you turn on the "Apply Direct DPD" property. (Note that when you turn off the direct DPD again, the generator restores the waveform file that was previously used.)

"Apply wrap-around smoothing on DPD waveform" smoothes start- and tail-samples down to "0" in order to avoid phase discontinuities when the file is cyclically played from a signal source.

You can also save the waveform file, for example if you want to use it again later, with the "Store Predistorted Waveform File" property.

Note that you can stop a DPD sequence anytime through the dialog box shown while the DPD sequence is running.

- "Finish": Stops the DPD sequence and keeps the predistorted I/Q data that have already been calculated.
- "Abort": Stops the DPD sequence and discards the predistorted I/Q data that have already been calculated.

Remote command:

Iterations: `CONFigure:DDPD:COUNT` on page 282

Start sequence: `CONFigure:DDPD:START` on page 284

Gain expansion: `CONFigure:DDPD:GEXPansion` on page 284

File name: `CONFigure:DDPD:FNAME` on page 283

Save DPD: `MMEMory:STORe<n>:DDPD` on page 286

Apply DPD: `CONFigure:DDPD:APPLY[:STATe]` on page 281

Wrap-around smoothing: `CONFigure:DDPD:APPLY:WRAP[:STATe]` on page 282

Query I/Q values: `TRACe:IQ:DDPD[:DATA]?` on page 316

Manual direct DPD sequence

The direct DPD method requires one or more measurements (or iterations) to determine the correction values. The manual direct DPD sequence described here can be used, for example, to perform measurements on RF simulations and Digital2RF devices like fully integrated frontends containing an amplifier. When generator control is off, manual direct DPD mode is activated automatically.

When you select the "Start Direct DPD Sequence" button, the FSW runs the first iteration to calculate DPD.

The number of measurements performed during the sequence depends on the number of "Iterations" you have defined. It is also recommended to average each iteration for further improvement of the quality of the input signal. The "Gain Expansion" defines the increase of input power relative to the peak power value of the reference signal.

While the calculation is running, you can "Abort" the calculation. This stops the DPD sequence and discards the predistorted I/Q data that have already been calculated.

When the calculation is finished, a path to a `.wv` file with the calculated DPD values for the current iteration is displayed. Upload this file to the signal source and set the level on the source to the value saved in the `RMSLevel.txt` in the same location.

After you have uploaded the waveform file and set the level on the signal source, press "Continue" to run another iteration based on the new waveform file. A new `.wv` file is created with each iteration and another level value is added to the `RMSLevel.txt` document.

The process ends automatically when you have reached the defined number of iterations. If you want to end the process earlier, select "Finish" to end the DPD sequence.

You can also follow the process of the DPD sequence in the channel bar. The "DPD Count" label shows the current iteration and the complete number of iterations of the DPD sequence. If you are using averaging, the "Count" label shows the process of the current iteration. The first number is the current measurement, the second number the total number of measurements.

"Apply wrap-around smoothing on DPD waveform" smoothes start- and tail-samples down to "0" in order to avoid phase discontinuities when the file is cyclically played from a signal source.

Remote command:

Iterations: [CONFigure:DDPD:COUNT](#) on page 282

Query finished iterations: [CONFigure:DDPD:COUNT:CURRENT?](#) on page 283

Start sequence: [CONFigure:DDPD:START](#) on page 284

Gain expansion: [CONFigure:DDPD:GEXPansion](#) on page 284

Wrap-around smoothing: [CONFigure:DDPD:APPLY:WRAP\[:STATE\]](#) on page 282

Continue direct DPD: [CONFigure:DDPD:CONTINUE](#) on page 282

Query RMS power: [CONFigure:MDPD:RMS\[:CURRENT\]?](#) on page 290

Query RMS power (online mode): [CONFigure:DDPD:RMS\[:CURRENT\]?](#) on page 284

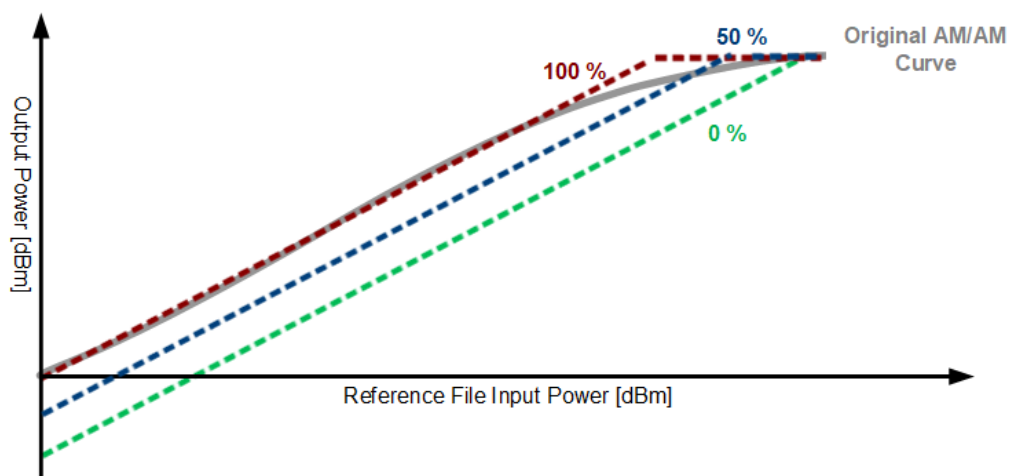
Query I/Q values: [TRACe:IQ:DDPD\[:DATA\]?](#) on page 316

Query file name and path: [FETCh:DDPD:WAVEform:PATH?](#) on page 286

Direct DPD Power / Linearity Tradeoff

The "DPD Power / Linearity Tradeoff" describes the effects of the DPD on the amplifier characteristics.

When you define a tradeoff of 0 %, the DPD aims for the best linearity (green line in the illustration below). When you increase the tradeoff value, the DPD aims for an optimization of the output power at the expense of linearity. In the 100 % case, output power is maximized, whereas linearity is reduced compared to all other cases. The blue line shows the default tradeoff value of 50 %.



Remote command:

[CONFigure:DDPD:TRADeoff](#) on page 285

3.13.3 (Generalized) memory polynomial DPD (FSW-K18M)

The FSW-K18M application is an extension to the FSW-K18D [Direct DPD](#) application. It is only available after a valid automated or manual direct DPD sequence is run. In FSW-K18M the application derives a (generalized) memory polynomial equation that

transfers the reference signal (ideal waveform) into the pre-distorted waveform (K18D waveform).

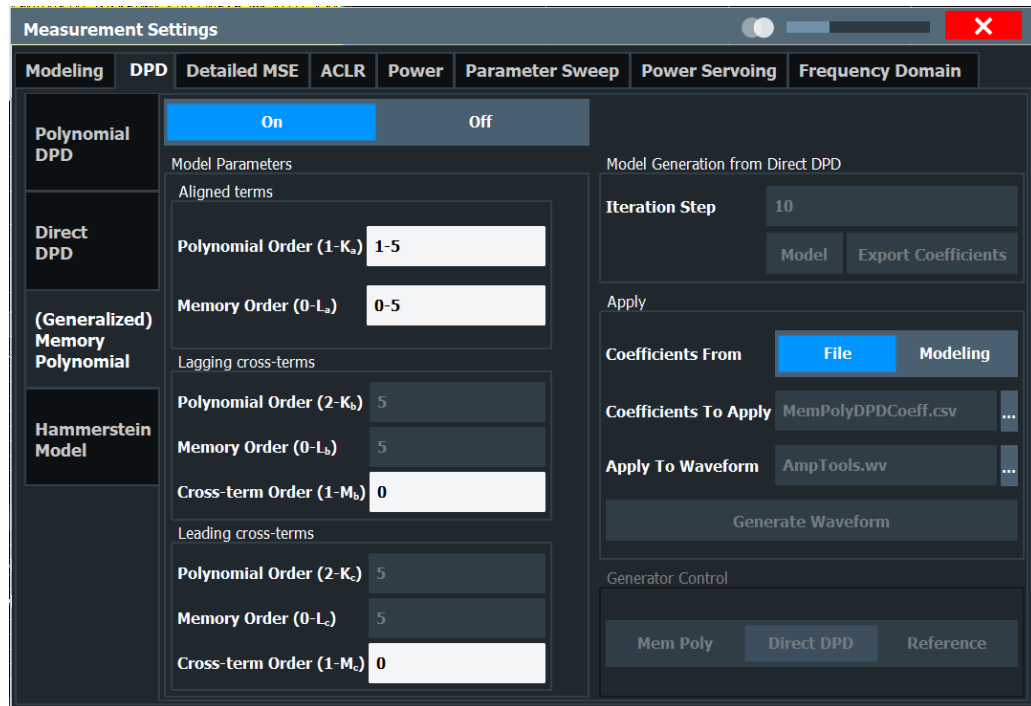
$$\begin{aligned}
 y_{GMP}(n) = & \sum_{k=1}^{K_a} \sum_{l=0}^{L_a} a_{kl} \cdot x(n-l) \cdot |x(n-l)|^{k-1} \\
 & + \sum_{k=2}^{K_b} \sum_{l=0}^{L_b} \sum_{m=1}^{M_b} b_{klm} \cdot x(n-l) \cdot |x(n-l-m)|^{k-1} \\
 & + \sum_{k=2}^{K_c} \sum_{l=0}^{L_c} \sum_{m=1}^{M_c} c_{klm} \cdot x(n-l) \cdot |x(n-l+m)|^{k-1}
 \end{aligned}$$

The reference signal is represented by x , scaled to volt. The coefficients are shown in the Memory DPD coefficients display, or directly exported into a `csv` file using the [export coefficients](#) function. In the Memory DPD coefficients display, only the values of the aligned terms are displayed as long as the cross-term order fields (1- M_b and 1- M_c) remain at default.

You can also apply the coefficients to the reference signal automatically and upload the resulting waveform to the generator using the [export waveform](#) function.

The results are visible in the [Memory DPD Coefficients](#) result display.

If a "Model generation failed" error occurs, it can be rectified as follows. Either reduce the reference signal length (by adjusting the evaluation range (see ["Defining the evaluation range"](#) on page 104) or using a shorter reference signal, e.g. by generating an own signal (see ["Designing a reference signal within the R&S FSW-K18"](#) on page 54). It also helps to reduce the number of coefficients.



The remote commands required to configure the memory polynomial DPD are described in [Chapter 5.6.13, "Applying digital predistortion"](#), on page 273.

Read-in the memory polynomial model coefficients from CSV file	120
Running a Memory Polynomial DPD sequence	120

Read-in the memory polynomial model coefficients from CSV file

After exporting a `csv` file by using "Export Coefficients", it is possible to change the coefficients and read-in the `csv` file again. All values for the columns will be return values of the DSP. Note that the coefficients should be comma "," separated. To activate the file mode select "File". The button "Modeling" deactivates the file mode.

In file mode, the number of coefficients for modeling and the number of coefficients in the selected `csv` file are checked. If there is a warning, it is displayed only in the status bar and the "Generate Waveform" or "Generate & Export Waveform" button is grayed out.

"Apply to Waveform" only supports `wv` files.

The level that is considered for the scaling of the "Apply to Waveform" is the one that can be selected in the "Reference Signal" dialog as "RMS Power" (see [Level \(RMS\)](#)). For the "RMS Power", an entry is required. When the generator control is on, the level changes accordingly to the value that is set for the finished memory polynomial model waveform that is selected at the generator.

Running a Memory Polynomial DPD sequence

The memory polynomial DPD method creates an equation with a memory polynomial, where the polynomial order and memory order can be specified on the user interface.

Per default, the "Polynomial Order" of the aligned terms is 1-5, i.e. all orders from 1 to 5. If not all orders shall be taken into account, the same notation as in the [modelling dialog](#) may be used, e.g. 1-3;5 includes 1, 2, 3, and 5.

The "Memory Order" of the aligned terms is configurable in the same way and describes the number of filter taps to be used per filter. It uses zero-based indexing, as it describes the "delays", so "0" corresponds to "no filter".

The input fields for the lagging and leading cross-terms require maximum values to be entered.

Keep in mind that the computational effort for the model increases with memory order, polynomial order, and length of the waveform (in samples).

Also, a specific "Iteration Step" to be used for the modeling can be selected. Per default, this is the last iteration, but any other step can be selected as well. The DDPD result window shows ACLR and / or EVM results over iterations and helps selecting the right iteration step.

After the parameters for "Polynomial Order", "Memory Order" and "Iteration Step" have been defined, selecting "Model" starts the fitting of the memory polynomial and calculates the coefficients.

Once the modeling is complete, the coefficients are visible in the [Memory DPD Coefficients](#) result display. You can either use "Export Waveform" to export the waveform with the model applied to the generator, or select "Export Coefficients" to export the coefficients to a file. "Export Waveform" and "Export Coefficients" is only available after a "Model" has been derived.

The model is applied to the file specified under "Apply to". The default value is the current reference file - however, the model may be applied to any waveform file. It is recommended to only apply the model to signals that are similar to the reference signal used for direct DPD, especially with regard to bandwidth and crest factor. "Export Waveform" with generator control off will open a "Save to" dialog allowing export of the waveform with the memory polynomial model applied.

With the memory-polynomial waveform transferred to the generator using "Export Waveform", you can switch between the "Memory Polynomial" and the "Direct DPD" waveform to compare the pre-distortion results. Selection of DPD signal (on the signal generator) is only available after "Export Waveform" in generator control mode.

Remote command:

State: [CONFigure:MDPD\[:STATE\]](#) on page 289

Iteration Step: [CONFigure:MDPD:ITERation](#) on page 289

Polynomial Order: [CONFigure:MDPD:ORDer:POLYnomial](#) on page 289

Memory Order: [CONFigure:MDPD:ORDer:MEMory](#) on page 289

Apply To: [CONFigure:MDPD:APPLy:MODEl](#) on page 288

Model: [CALCulate:MDPD:MODEl](#) on page 289

Export Waveform (only available when generator control is OFF): [MMEMorY:STORE:MDPD:WAVEform](#) on page 291

Export Coefficients: [MMEMorY:STORE:MDPD:COEFFicient](#) on page 291

Waveform Type: [CONFigure:MDPD:WAVEform:SElect](#) on page 290

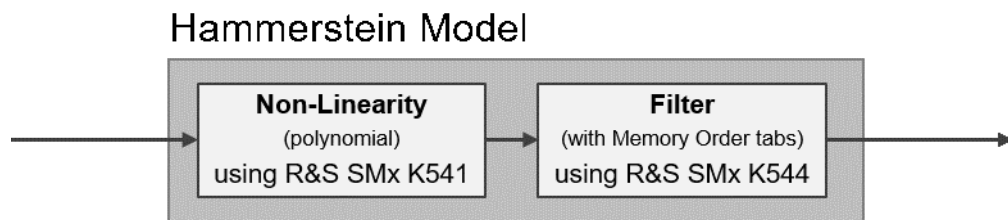
Send Waveform to Generator: [CONFigure:MDPD:WAVEform:UPDate](#) on page 290

3.13.4 Hammerstein model (FSW-K18M)

The Hammerstein model is a DPD approach that is, like the Memory Polynomial Model, available in FSW-K18M. Both are based on the results of the FSW-K18D [Direct DPD](#) and therefore require a valid Direct DPD result.

As the Hammerstein model is a real-time approach, i.e. the pre-distortion is applied in real time on the signal generator as it plays the undistorted signal, the signal generator must be equipped with options R&S SMx-K541 and K544. The Hammerstein model consists of a static non-linearity followed by a linear filter. The FSW-K18M Hammerstein model uses an FIR filter. Due to the combination of non-linearity and filter, the Hammerstein model can model non-linear behavior and memory effects. The Hammerstein model can be seen as a simplification of the Memory Polynomial model, which leads to a lower complexity for realization.

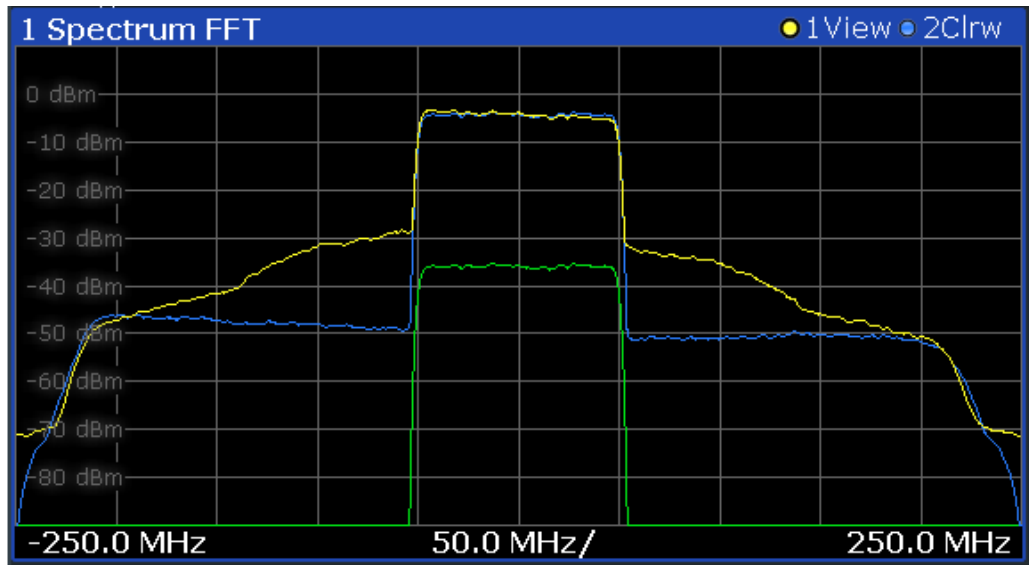
The parameters of the Hammerstein model are calculated based on the reference waveform (ideal waveform) and the pre-distorted waveform (K18D waveform), similar to the Memory Polynomial DPD. After a valid Direct DPD sequence, the Hammerstein model parameters can be computed. The Hammerstein model parameters are then used to configure R&S SMx-K541 and K544 at a connected R&S generator.



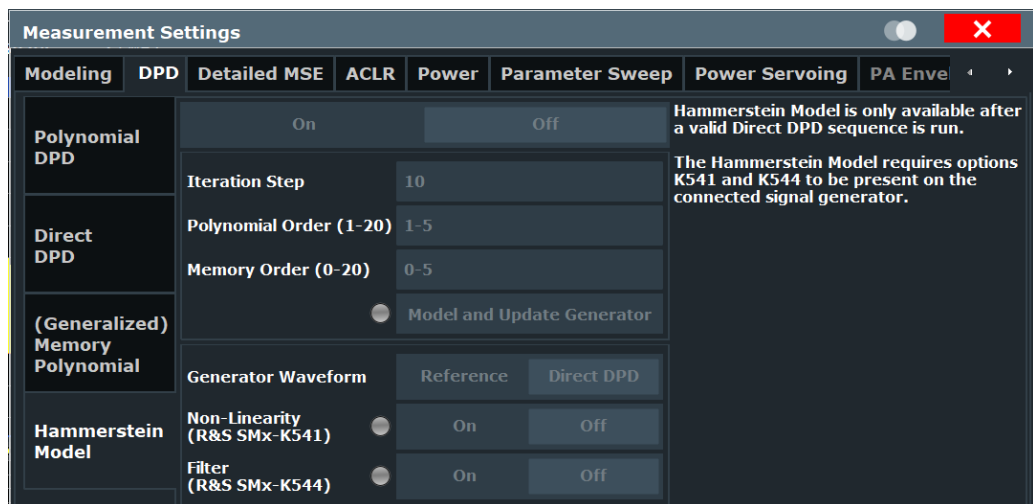
The advantage of the Hammerstein model is that by using R&S SMx-K541 and K544, the predistortion is applied in real time on the signal in an R&S generator. Real-time means that the pre-distortion is added to the undistorted signal by the signal generator as the undistorted signal is being created or played back. Due to its real-time applicability, a Hammerstein parameter set does not only apply to one given signal at a given level, but can be applied to a different signal or lower power levels as well.

Note that exchanging the signal while keeping the Hammerstein model parameters works only within certain boundaries, i.e. similar signal characteristics (e.g. PAPR, bandwidth). Keep in mind that a direct DPD with unlimited degrees of freedom in general results in better performance compared to any real-world model with limited degrees in freedom (e.g. polynomial degree and filter order).

For best results, it is recommended to use Direct DPD with I/Q averaging as well as an increased measurement bandwidth for better ACLR results. The I/Q averaging is not needed afterwards for the Hammerstein model. As usual for any modelling DPD - it is recommended to include all relevant out of band non-linearities into the analysis bandwidth. A well known rule of thumb is a factor of 3 to 5 times the signal bandwidth. The reason for the increased measurement bandwidth can be seen in the following figure with an increased bandwidth (factor 4).



The effect of the non-linear behavior of the DUT is not only limited to the bandwidth of the signal itself, but also affects adjacent frequencies. This leads to “shoulders” in the spectrum as can be seen for the measured signal (yellow) compared to the signal, read from file (green). These “shoulders” can be improved by the Direct DPD (blue) if they are included in the measurement by increasing the measurement bandwidth. The same holds for the Hammerstein model as it is derived from the Direct DPD result.



The remote commands required to configure the Hammerstein model are described in [Chapter 5.6.13, "Applying digital predistortion"](#), on page 273.

[Running a Hammerstein model sequence](#)..... 123

Running a Hammerstein model sequence

The Hammerstein model is a real-time approach, and consists of a static non-linearity followed by a linear filter.

Per default, the "Polynomial Order" is 1-5, i.e. all orders from 1 to 5. If not all orders shall be taken into account, the same notation as in the modeling dialog may be used, e.g. 1-3;5 includes 1, 2, 3, and 5.

The "Memory Order" is configurable in the same way and describes the number of filter taps to be used per filter. It uses zero-based indexing, as it describes the "delays", so "0" corresponds to "no filter".

Keep in mind that the computational effort for the model increases with memory order, polynomial order, and length of the waveform (in samples).

Also, a specific "Iteration Step" to be used for the modeling can be selected. Per default, this is the last iteration, but any other step can be selected as well. The DDPD result window shows ACLR and / or EVM results over iterations and helps selecting the right iteration step.

After the parameters for "Polynomial Order", "Memory Order" and "Iteration Step" have been defined, selecting "Model and Update Generator" starts the fitting of the model and exports the results to the signal generator.

After using "Model and Update Generator", you can compare the pre-distortion results by switching "Generator Waveform" from "Reference" to "Direct DPD". If "Reference" is selected, "Non-linearity" and "Filter" are automatically switched on and the Hammerstein Model is applied at the generator. Now the "Non-linearity" and "Filter" options can be switched on and off manually and independent from each other if needed.

Remote command:

State: [CONFigure:HAMMerstein\[:STATe\]](#) on page 292

Iteration Step: [CONFigure:HAMMerstein:ITERation](#) on page 292

Polynomial Order: [CONFigure:HAMMerstein:ORDER:POLYnomial](#) on page 292

Memory Order: [CONFigure:HAMMerstein:ORDER:MEMory](#) on page 292

Model and Update Generator: [CONFigure:HAMMerstein:MUPGenerator](#) on page 292

Generator Waveform: [CONFigure:HAMMerstein:GENWaveform\[:SElect\]](#) on page 293

Non-Linearity: [CONFigure:HAMMerstein:NONLinearity\[:STATe\]](#) on page 293

Filter: [CONFigure:HAMMerstein:FILTer\[:STATe\]](#) on page 293

3.14 Detailed MSE

Access: "Overview" > "Measurement" > "Detailed MSE"

Detailed MSE provides functionality to estimate the fraction of the error power of the three main distributors to the EVM: Noise, non-linearities and frequency response. Since the fraction of the error power is considered, the mean squared error (MSE) is measured as the squared EVM in percent.

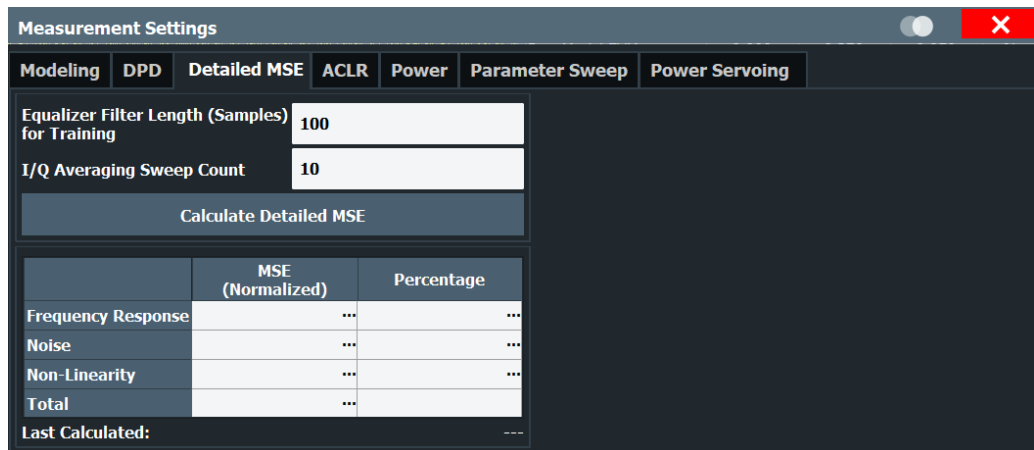
To measure the MSE values of the noise, non-linearities and the frequency response, IQ averaging and equalizer are used. The measurement sequence starts, when the button "Calculate Detailed MSE" is pressed.

MSE is normalized by the mean signal power and is calculated as follows, where "e_i" are elements of the complex error vector, "r_i" the complex amplitudes of the signal and "N" the length of the signal.

$$EVM_{in\%} = \sqrt{\frac{\frac{1}{N} \sum_{i=1}^N |e_i|^2}{\frac{1}{N} \sum_{i=1}^N |r_i|^2}} \cdot 100\%$$

$$MSE_{normalized} = EVM_{in\%}^2 = \frac{\frac{1}{N} \sum_{i=1}^N |e_i|^2}{\frac{1}{N} \sum_{i=1}^N |r_i|^2} \cdot (100\%)^2 = \frac{MSE}{Mean\ Signal\ Power} \cdot (100\%)^2$$

This functionality is a calculated estimation and not a precise measurement. It is only run if "Calculate Detailed MSE" on page 125 is executed and not updated automatically for every new measurement.



Equalizer Filter Length For Training.....	125
I/Q Averaging Sweep Count.....	125
Calculate Detailed MSE.....	125

Equalizer Filter Length For Training

Defines the number of FIR filter coefficients to be calculated. A larger number of samples generally yields better results, but takes longer to calculate.

Remote command:

[CONFigure:EQUalizer:FILTer:LENGth](#) on page 268

I/Q Averaging Sweep Count

Defines the number of single data captures the application uses to average the data.

Remote command:

[\[SENSe:\]SWEep:IQAVg:COUNT](#) on page 257

Calculate Detailed MSE

Runs the detailed MSE calculation.

Remote command:
[CALCulate:MSERror?](#) on page 294

3.15 Envelope measurements

Access: "Overview" > "Measurement" > "PA Envelope / Supply"

When you analyze power amplifiers supporting envelope tracking, you have to describe several characteristics of the measurement equipment to get valid results.

Modeling	DPD	PA Envelope/Supply	ACLR Settings	Power Settings	Parameter Sweep
PAE Measurement Settings					
Current Icc (Baseband Input I)					
Multiplier	<input type="text" value="1.0"/>				
R (Ohms)	<input type="text" value="1.0"/>				
Offset (Volts)	<input type="text" value="0.0"/>				
Voltage Vcc (Baseband Input Q)					
Multiplier	<input type="text" value="1.0"/>				
Offset (Volts)	<input type="text" value="0.0"/>				
Power Consumption(PC) PAE Settings					
PC Formula: (A x Vcc x Icc) - (B x Vcc^2)					
Parameter A	<input type="text" value="1.0"/>				
Parameter B	<input type="text" value="0.0"/>				

$$I_{cc} = (V_I + \text{Offset}) \times \frac{\text{Multiplier}}{R}$$

$$V_{cc} = (V_Q + \text{Offset}) \times \text{Multiplier}$$

The remote commands required to configure the envelope tracking are described in [Chapter 5.6.16, "Configuring envelope tracking"](#), on page 296.

Configuring PAE measurements (Power Added Efficiency)	126
Parameter A / B	127

Configuring PAE measurements (Power Added Efficiency)

When you are testing amplifiers that support envelope tracking, the Power Added Efficiency (PAE) of the system is the value that characterizes its performance.

To calculate the PAE, you have to measure the supply voltage and current drawn by the power amplifier. The PAE is calculated according to the following equation:

$$\text{PAE} = (\text{RF Output Power} - \text{RF Input Power}) / \text{DC Power}$$

with DC Power = Voltage * Current

Measuring the voltage and current requires additional equipment and components in the test setup. For valid measurement results, you have to define the characteristics for those components.

Required components

One way to measure the voltage is to use a probe. The voltage is measured on the Q channel of the baseband input provided by the optional baseband hardware option.

One way to measure the current is to use a shunt resistor and another probe. The current is measured on the I channel of the baseband input provided by the optional baseband hardware option.

For both types of components, you have to define their characteristics and behavior accurately.

Measuring current

When using a shunt resistor to measure the current, you have to define the **resistance R** of the shunt resistor you are using. The resistance is a value with the unit Ω .

If the test setup contains additional components (for example passive probes), you can define their characteristics by specifying a **multiplier**. The multiplier is a value without unit. When you are using an active probe from Rohde & Schwarz, you do not have to change the multiplier, because it is automatically detected by the FSW.

In addition, you have to compensate the DC offset of active probes. The DC offset is described by the **offset** value, which differs depending on the probe you are using. You can figure out the offset value by measuring it.

Measuring voltage

For voltage measurements, you have to define the **multiplier** (to take the attenuation of passive probes into account) and the **offset** (to compensate the DC offset of active probes).

Note that entering wrong values for these parameters yields invalid measurement results. Generally speaking, the multiplier multiplies the results by a certain value, the offset is added to the results.

These settings are available when you turn on the baseband input.

Remote command:

See [Chapter 5.6.16, "Configuring envelope tracking"](#), on page 296.

Parameter A / B

Undocumented feature.

Remote command:

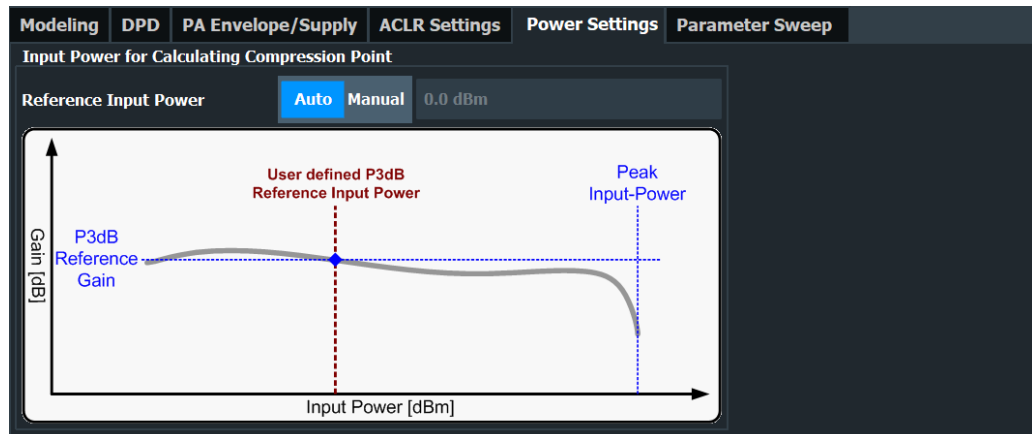
```
CONFigure:PAE:PCONsumption[:PARAmeter]:A
```

```
CONFigure:PAE:PCONsumption[:PARAmeter]:B
```

3.16 Power measurements

Access: "Overview" > "Measurement" > "Power Settings"

The Amplifier application features functionality to configure measurements that determine power characteristics of an amplifier.



The remote commands required to configure power measurements are described in [Chapter 5.6.18, "Configuring power measurements"](#), on page 303.

[Configuring compression point calculation](#)..... 128

Configuring compression point calculation

The application evaluates three compression points. The compression points represent the input power where the gain of the amplifier deviates by a certain amount from a reference point on the gain curve. The amount of deviation is either 1 dB, 2 dB or 3 dB.

Because these compression points are relative values, you have to define the reference gain.

There are two ways to get the reference gain: automatically or manually.

If you define the reference gain **manually**, the reference point is the gain at a certain input power (which you can define in the "Reference Input Power" input field).

In **automatic** mode, the FSW-K18 application tries to automatically find the constant gain (linear range) section using a dedicated algorithm.

In the "Gain Compression" result display, the reference point is indicated by a red line.

Remote command:

Method: [CONFigure:POWer:RESult:P3DB\[:STATE\]](#) on page 303

Input power: [CONFigure:POWer:RESult:P3DB:REFerence](#) on page 303

3.17 Adjacent channel leakage error (ACLR) measurements

Access: "Overview" > "Measurement" > "ACLR Settings"

The application allows you to define the basic characteristics of the Tx channel and neighboring channels when you perform ACLR measurements.

Adjacent channel leakage error (ACLR) measurements

The screenshot shows the ACLR Settings configuration window. At the top, there are tabs for Modeling, DPD, PA Envelope/Supply, ACLR Settings (selected), Power Settings, and Parameter Sweep. Below the tabs, the 'Channel Count' section has 'Tx' set to 1 and 'Adj' set to 2. The 'Data Acquisition' section has 'Auto Adjust Acquisition BW' set to 'Off'. The 'Reference Channel' section has 'Ref Channel' set to 'Max Power Tx Channel'. The 'Bandwidths' section is divided into 'Tx Channels' and 'Adjacent Channels'. 'Tx Channels' lists 8 channels, each with a bandwidth of 9.015 MHz. 'Adjacent Channels' lists 7 channels, labeled 'Alt 1' through 'Alt 7', each with a bandwidth of 9.015 MHz.

The remote commands required to configure the ACLR measurements are described in [Chapter 5.6.17, "Configuring ACLR measurements"](#), on page 297.

Number of channels: Tx, Adj	129
Selecting the measurement bandwidth	129
Reference Channel	130
Channel Bandwidth	130
Channel Spacings	130
Weighting Filters	131

Number of channels: Tx, Adj

Up to 18 carrier channels and up to 12 adjacent channels can be defined.

Results are provided for the Tx channel and the number of defined adjacent channels *above and below* the Tx channel. If more than one Tx channel is defined, the carrier channel to which the relative adjacent-channel power values should be referenced must be defined (see ["Reference Channel"](#) on page 130).

Remote command:

Number of Tx channels:

`[SENSe:]POWER:ACHannel:TXChannel:COUNT` on page 302

Number of Adjacent channels:

`[SENSe:]POWER:ACHannel:ACPairs` on page 298

Selecting the measurement bandwidth

When you perform an ACLR measurement, it is important to select a measurement bandwidth that is large enough to capture all channels you want to evaluate in the ACLR measurement.

The application provides automatic adjustment of the measurement bandwidth to the bandwidth occupied by all channels evaluated in the ACLR measurement. To do so, turn on the "Auto Adjust Acquisition Bandwidth" function.

Adjacent channel leakage error (ACLR) measurements

Note that you also have to turn on [automatic bandwidth selection](#) in the "Data Acquisition" dialog box in order to adjust the measurement bandwidth to the ACLR configuration.

If you define the bandwidth manually, make sure to take one that is large enough to capture all channels. Otherwise, the FSW does not evaluate measurement results. Also make sure that the FSW you are using can actually handle the bandwidth occupied by the transmission and adjacent channels. For larger bandwidths, one of the I/Q bandwidth extensions could be necessary (refer to the datasheet for a complete list of available bandwidth extensions).

Remote command:

[\[SENSe:\]POWer:ACHannel:AABW](#) on page 298

Reference Channel

The measured power values in the adjacent channels can be displayed relative to the transmission channel. If more than one Tx channel is defined, define which one is used as a reference channel.

Tx Channel 1	Transmission channel 1 is used. (Not available for MSR ACLR)
Min Power Tx Channel	The transmission channel with the lowest power is used as a reference channel.
Max Power Tx Channel	The transmission channel with the highest power is used as a reference channel (Default).
Lowest & Highest Channel	The outer left-hand transmission channel is the reference channel for the lower adjacent channels, the outer right-hand transmission channel that for the upper adjacent channels.

Remote command:

[\[SENSe:\]POWer:ACHannel:REference:TXChannel:MANual](#) on page 301

[\[SENSe:\]POWer:ACHannel:REference:TXChannel:AUTO](#) on page 301

Channel Bandwidth

The Tx channel bandwidth is normally defined by the transmission standard.

The value entered for any Tx channel is automatically also defined for all subsequent Tx channels. Thus, only enter one value if all Tx channels have the same bandwidth.

The value entered for any ADJ or ALT channel is automatically also defined for all alternate (ALT) channels. Thus, only enter one value if all adjacent channels have the same bandwidth.

Remote command:

[\[SENSe:\]POWer:ACHannel:BANDwidth\[:CHANnel<ch>\]](#) on page 299

[\[SENSe:\]POWer:ACHannel:BANDwidth:ACHannel](#) on page 298

[\[SENSe:\]POWer:ACHannel:BANDwidth:ALternate<ch>](#) on page 299

Channel Spacings

Channel spacings are normally defined by the transmission standard but can be changed.

If the spacings are not equal, the channel distribution in relation to the center frequency is as follows:

Odd number of Tx channels	The middle Tx channel is centered to center frequency.
Even number of Tx channels	The two Tx channels in the middle are used to calculate the frequency between those two channels. This frequency is aligned to the center frequency.

The spacings between all Tx channels can be defined individually. When you change the spacing for one channel, the value is automatically also defined for all subsequent Tx channels. This allows you to set up a system with equal Tx channel spacing quickly. For different spacings, set up the channels from top to bottom.

Tx1-2	Spacing between the first and the second carrier
Tx2-3	Spacing between the second and the third carrier
...	...

If you change the adjacent-channel spacing (ADJ), all higher adjacent channel spacings (ALT1, ALT2, ...) are multiplied by the same factor (new spacing value/old spacing value). Again, only enter one value for equal channel spacing. For different spacing, configure the spacings from top to bottom.

Remote command:

[\[SENSe:\] POWER:ACHannel:SPACing:CHANnel<ch>](#) on page 301

[\[SENSe:\] POWER:ACHannel:SPACing\[:ACHannel\]](#) on page 302

[\[SENSe:\] POWER:ACHannel:SPACing:ALternate<ch>](#) on page 302

Weighting Filters

Weighting filters allow you to determine the influence of individual channels on the total measurement result. For each channel you can activate or deactivate the use of the weighting filter and define an individual weighting factor ("Alpha:" value).

Remote command:

Activating/Deactivating:

[\[SENSe:\] POWER:ACHannel:FILTer\[:STATe\]:CHANnel<ch>](#) on page 301

[\[SENSe:\] POWER:ACHannel:FILTer\[:STATe\]:ACHannel](#) on page 300

[\[SENSe:\] POWER:ACHannel:FILTer\[:STATe\]:ALternate<ch>](#) on page 300

Alpha value:

[\[SENSe:\] POWER:ACHannel:FILTer:ALPHa:CHANnel<ch>](#) on page 300

[\[SENSe:\] POWER:ACHannel:FILTer:ALPHa:ACHannel](#) on page 299

[\[SENSe:\] POWER:ACHannel:FILTer:ALPHa:ALternate<ch>](#) on page 300

3.18 Parameter sweeps

Access: "Overview" > "Measurements" > "Meas Modes" > "Parameter Sweep"

The parameter sweep is a measurement that allows you to compare a result (that you can select arbitrarily) against two other parameters. The advantage of the parameter sweep is that it controls the signal generator and the analyzer, and automatically changes the signal characteristics (for example the frequency) without you having to

do those changes manually. In addition, it combines the results in a single and well arranged diagram and / or numerical result display (→ [Parameter Sweep Table](#)).

Example:

In the default state, the application compares the EVM against the frequency and the generator power.

In that case, the FSW first performs a measurement on the first frequency for each generator output level in the defined range. When this measurement is done, the FSW continues to measure all power levels on the second frequency and so on.

Frequency range: 10 MHz to 20 MHz, stepsize 1 MHz. Output level range: -10 dBm to 0 dBm, stepsize: 1 dB.

- 1st measurement: 10 MHz with a generator output level of -10 dBm.
- (...)
- 11th measurement: 10 MHz with a generator output level of 0 dBm.
- 12th measurement: 11 MHz with a generator output level of -10 dBm.
- (...)
- 22nd measurement: 11 MHz with a generator output level of 0 dBm.
- (...)
- nth measurement: 20 MHz with a generator output level of 0 dBm.

The configuration affects the number of measurements that will be performed. The number of measurements in turn has an effect on the overall measurement time of the parameter sweep.

The parameter sweep requires a connection to a signal generator. For more information about configuring generators, see [Chapter 3.4.7, "Controlling a signal generator"](#), on page 79.

The screenshot displays the configuration interface for the Parameter Sweep function. The interface includes several tabs: Modeling, DPD, PA Envelope/Supply, ACLR Settings, Power Settings, and Parameter Sweep. The Parameter Sweep tab is selected, showing the following settings:

- Enable Parameter Sweep:** A toggle switch currently set to 'Off'.
- 3d-Plot Display/Parameter Configuration:**
 - X-Axis:**
 - Setting: Center frequency
 - Parameter Settings:
 - Start: 1.0 GHz
 - Stop: 2.0 GHz
 - Step: 10.0 MHz
 - Y-Axis:**
 - Enable: A toggle switch currently set to 'On'.
 - Setting: Generator Power
 - Parameter Settings:
 - Start: -30.0 dBm
 - Stop: 0.0 dBm
 - Step: 1.0 dB
- Adjust Level:**
 - Couple FSx and SMx Level: A toggle switch currently set to 'On'.
 - Expected Gain: 0.0 dB

The remote commands required to configure the parameter sweep are described in [Chapter 5.6.19, "Configuring parameter sweeps"](#), on page 303.

Turning the parameter sweep on and off.....	133
Selecting the data to be evaluated during the parameter sweep.....	133
Synchronizing the levels of signal generator and analyzer.....	134

Turning the parameter sweep on and off

Before you can use the parameter sweep functionality, you have to turn it on deliberately.

When you turn it on, the FSW starts the parameter sweep in single sweep mode ([Run Sgl] and [Run Cont] both start the parameter sweep in that case). When the parameter sweep is on, other measurements are not possible, and vice versa.

Turning on the parameter sweep also expands the **channel bar** by several labels that carry information about the progress of the parameter sweep.

Remote command:

`CONFigure:PSweep[:STATe]` on page 304

Selecting the data to be evaluated during the parameter sweep

When you are performing a parameter sweep, you can compare an **arbitrary result** against one or two arbitrary parameters.

Depending on your selection, the FSW changes the values of the selected parameters on the signal generator during the measurement, and calculates the result for each combination of values.

If there is more than one instance of the parameter sweep, the FSW applies the selected parameters to all instances. The displayed results on the other hand, can be different for each instance.

- Center Frequency
Controls the frequency of the signal generator.
- Generator Power
Controls the output power of the signal generator.
- Envelope to RF Delay
Controls the delay between the envelope and the RF signal on the signal generator.
- Envelope Bias
Controls the envelope bias on the signal generator.

You can define the scope of the measurement by adjusting the start and stop values for both parameters, and assign a certain stepsize. Based on these values, the FSW changes the generator setup after each individual measurement.

The second parameter is not mandatory. You can turn it off with the "Y-Axis Enable" function. In that case, the parameter sweep is represented in a two-dimensional diagram (for example the EVM against the frequency).

Example:

When you define a level range from 0 dBm (start value) to 10 dBm (stop value) with a stepsize of 1 dB, the parameter sweep would perform 11 measurements on a single frequency.

When you also define a frequency range between 10 MHz and 20 MHz, and a stepsize of 1 MHz, the total number of measurements would be 121: 11 power level measurements on each of the 11 frequencies.

Remote command:

[Chapter 5.6.19, "Configuring parameter sweeps"](#), on page 303

Synchronizing the levels of signal generator and analyzer

When you sweep the output level of the generator, make sure to synchronize the reference level of the analyzer and the RMS level of the generator to avoid damage to the RF input of the analyzer (→ "Couple FSx and SMx Level"). When you do so, the application automatically matches the reference level of the analyzer to the output level of the generator.

For sensitive DUTs, you can define [maximum output level](#) that is not exceeded during the parameter sweep.

Note that it is mandatory to define the "Expected Gain" of the DUT. Otherwise, the synchronization between the levels can fail or lead to invalid results.

NOTICE! Risk of damage to the RF input of the analyzer.

Make sure to define the correct "Expected Gain". Otherwise, the FSW does not consider the gain of the amplifier during the level changes on signal analyzer and generator, which in turn can lead to a high-level signal damaging or destroying the RF input mixer of the analyzer.

With a correct "Expected Gain" value, however, the application is able to attenuate the signal accordingly.

Remote command:

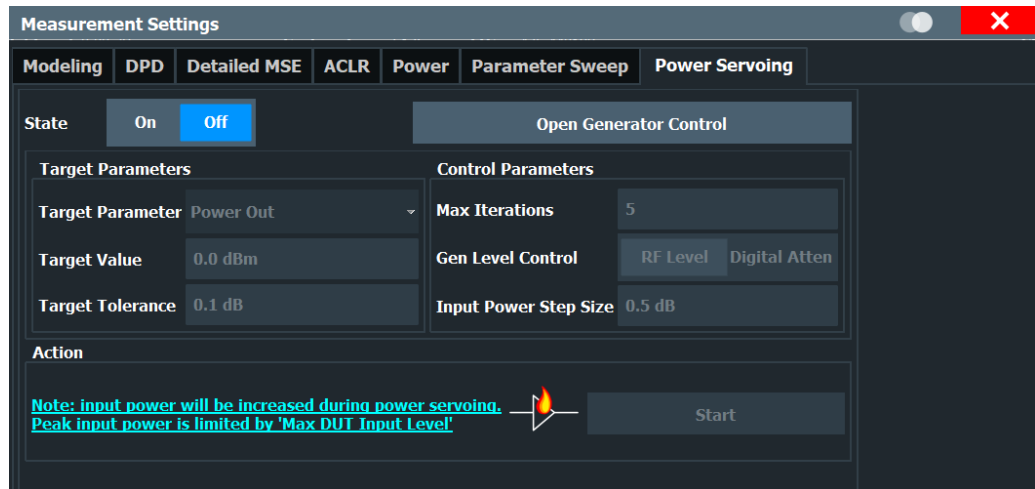
Synchronization state: [CONFigure:PSweep:ADJust:LEVel\[:STATe\]](#) on page 304

Expected gain: [CONFigure:PSweep:EXPEcted:GAIN](#) on page 304

3.19 Power servoing

Access: "Overview" > "Measurement" > "Power Servoing"

The power servoing measurement is an independent measurement mode that brings the output power of the DUT (amplifier) to a stable state (or level). This is done by automatically adjusting the input power or the digital attenuation until a stable state has been reached. When this state has been reached, you can proceed with measuring the actual amplifier performance.



The remote commands required to configure the power servoing are described in [Chapter 5.6.20, "Configuring power servoing"](#), on page 307.

[Power Servoing sequence](#)..... 135

Power Servoing sequence

To start a power servoing sequence, first enable the function using the "State" button. "Open Generator Control" provides a quick access to the generator setup dialog, e.g. to set the "Max DUT Input Level" to prevent damage to the DUT caused by a too high input level.

Now you can select a "Target Parameter" that is modified during the power servoing sequence until the desired "Target Value" is reached within the defined "Target Tolerance".

The maximum number of repetitions performed during the sequence depends on the number of "Max Iterations" you have defined. Using "Gen Level Control", you can select if the FSW adjusts the input power or the digital attenuation until a stable state is reached. "Input Power Step Size" defines the maximum allowed input power change for each step for all "Target Parameters" except from "Power Out".

After all settings have been made, use "Start" to run the power servoing sequence.

Remote command:

State: [\[SENSe:\]PSERvoing:STATe](#) on page 308

Target Parameter: [\[SENSe:\]PSERvoing:TARGet:PARAmeter](#) on page 308

Target Value: [\[SENSe:\]PSERvoing:TARGet:VALue](#) on page 309

Target Tolerance: [\[SENSe:\]PSERvoing:TARGet:TOLerance](#) on page 309

Max Iterations: [\[SENSe:\]PSERvoing:MAX:ITERation](#) on page 309

Gen Level Control: [\[SENSe:\]PSERvoing\[:GLC\]](#) on page 309

Input Power Step Size: [\[SENSe:\]PSERvoing:INPut:STEP](#) on page 309

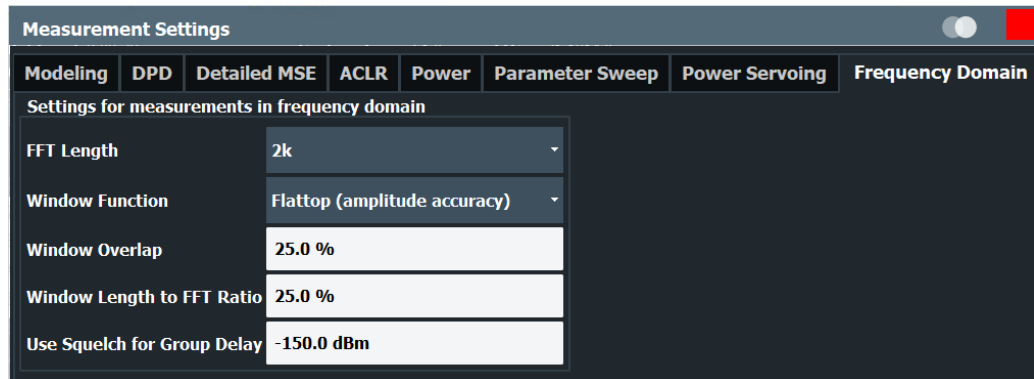
Start: [\[SENSe:\]PSERvoing:STARt](#) on page 310

Status: [FETCh:PSERvoing:OPERation:STATus?](#) on page 310

3.20 Frequency domain

Access: "Overview" > "Measurement" > "Frequency Domain"

You can configure how the results in the frequency domain are calculated, e.g. the FFT behavior to transform time values to frequency results.



FFT Length.....	136
Window Function.....	136
Window Overlap.....	136
Window Length to FFT Ratio.....	137
Use Squelch for Group Delay.....	137

FFT Length

Defines the number of frequency points determined by each FFT calculation. The more points are used, the higher the resolution in the spectrum becomes, but the longer the calculation takes.

Values from 1k to 32k in powers of 2 are supported. The default FFT length is 2k.

Remote command:

[CONFigure:FDOMain:FFTLength](#) on page 310

Window Function

You can select one of several FFT window types with different characteristics.

The following window types are available:

- Flattop (default, high amplitude accuracy)
- Gauss (high dynamic range)
- Rectangular (no window)
- 5-Term (minimal sidelobes)
- Blackman-Harris

Remote command:

[CONFigure:FDOMain:WFUNction](#) on page 311

Window Overlap

Defines the part of a single FFT window that is re-calculated by the next FFT calculation when using multiple FFT windows.

Values from 0 % to 99.9 % in 1 % steps are supported. The default value is 25 %.

Remote command:

[CONFigure:FDOMain:WOVerlap](#) on page 311

Window Length to FFT Ratio

Defines the window length as a percentage of the [FFT Length](#).

Values from 0 % to 100 % in 1 % steps are supported. The default value is 25 %.

Remote command:

[CONFigure:FDOMain:WLFRatio](#) on page 311

Use Squelch for Group Delay

For group delay results (requires R&S FSW-K18F), you can define a level threshold below which the group delay is set to 0. If the group delay does not exceed the threshold, it is ignored altogether. Squelching prevents strong fluctuation in phase vs. group delay diagrams. If enabled, squelching is also considered for "Channel Response Magnitude" and "Channel Response Phase" results.

Values from -200 dBm to +200 dBm are supported.

Remote command:

[CONFigure:FDOMain:SQUelch](#) on page 311

4 Analysis

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

Most of these tools work similar to those available in the spectrum application. For more information about these tools, refer to the FSW user manual.

- [Traces](#)..... 138
- [Markers](#)..... 143
- [Numerical result tables](#)..... 147
- [Result display settings](#)..... 149
- [X-axis scaling](#)..... 152
- [Y-axis scaling](#)..... 154

4.1 Traces

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

- [Trace information](#)..... 138
- [Trace export](#)..... 141
- [Trace detector](#)..... 142

4.1.1 Trace information

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

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

The number of traces available for each result display and the information these traces provide are described in [Chapter 2, "Measurements and result displays"](#), on page 12.

The screenshot shows the 'Traces' settings panel in the R&S FSW-K18 software. The 'Trace / Data Export' tab is selected. The 'Trace Modes' section contains a table with the following data:

Trace	Mode	Detector	Result Type
Trace 1	Clear Write	OFF	Meas
Trace 2	Blank	OFF	Meas
Trace 3	Blank	OFF	Meas
Trace 4	Blank	OFF	Meas
Trace 5	Blank	OFF	Meas
Trace 6	Blank	OFF	Meas

Below the table is the 'Quick Config' section with three buttons: 'Preset All Traces', 'Set Trace Mode Max | Avg | Min', and 'Set Trace Mode Max | ClrWrite | Min'. At the bottom, it shows 'Specifics for 1: Magnitude Capture RF'.

Trace Mode

Defines the update mode for subsequent traces.

Trace modes (except for "Clear Write", "View" and "Blank") are only available if **detector** is set to "Positive Peak", "Negative Peak" or "Average" and trace statistics are enabled.

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

Remote command:

`DISPlay[:WINDow<n>] [:SUBWindow<w>]:TRACe<t>:MODE` on page 312

Detector

Defines the trace detector to be used for trace analysis.

Positive Peak The positive detector displays the maximum level that has been detected during the measurement.

Negative Peak The negative peak detector displays the minimum level that has been detected during the measurement.

Average The average detector displays an RMS average (linear and quadratic) for most traces including EVM. Only for VCC/ICC traces (linear averaged) the average voltages and currents are displayed.

Off No specific detector is active and all values are recorded.

Remote command:

[\[SENSe:\] \[WINDow<n>:\] DETector<t> \[:FUNction\]](#) on page 316

Result Type

Defines the result type to be used for trace analysis.

IdealLine Displays a line that equals to a perfect linear device for "AM/AM", "AM/PM" and "Gain Compression" traces.

Meas Displays the measured signal.

Model Displays a modeled signal for "AM/AM" and "AM/PM" traces.

Reference Displays the reference signal for "FFT Spectrum" traces.

Remote command:

[DISPlay\[:WINDow<n>\] \[:SUBWindow<w>\]:TRACe<t>:RESult](#) on page 315

Predefined Trace Settings - Quick Config

Commonly required trace settings have been predefined and can be applied very quickly by selecting the appropriate button.

Function	Trace Settings	
Preset All Traces	Trace 1:	Clear Write
		Blank
Set Trace Mode Max Avg Min	Trace 1:	Max Hold
	Trace 2:	Average
	Trace 3:	Min Hold
		Blank
Set Trace Mode Max ClrWrite Min	Trace 1:	Max Hold
	Trace 2:	Clear Write
	Trace 3:	Min Hold
		Blank

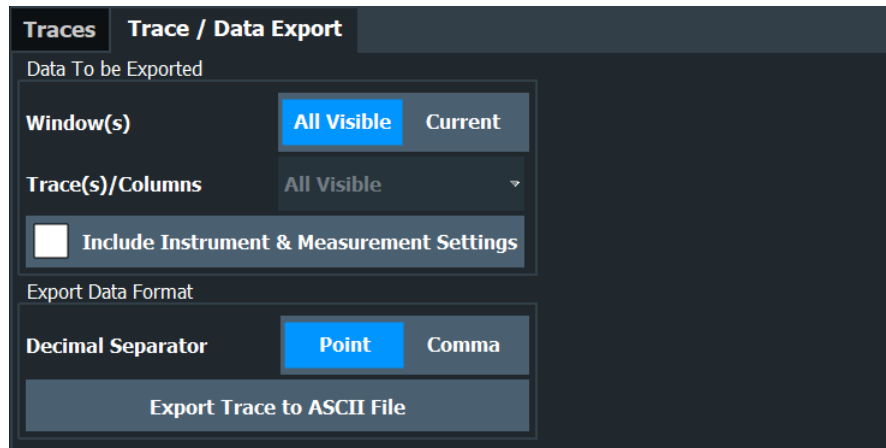
Remote command:

[DISPlay\[:WINDow<n>\] \[:SUBWindow<w>\]:TRACe<t>:PRESet](#) on page 315

4.1.2 Trace export

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

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



The remote commands required to configure the trace export are described in [Chapter 5.7.1, "Configuring traces"](#), on page 312.

Selecting data to export	141
Include Instrument & Measurement Settings	141
Decimal Separator	141
Export Trace	142

Selecting data to export

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

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

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

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

Remote command:

[MMEMory:STORe<n>:TRACe](#) on page 314

Include Instrument & Measurement Settings

Includes additional instrument and measurement settings in the header of the export file for result data.

Remote command:

[FORMat:DEXPort:HEADer](#) on page 313

Decimal Separator

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

Remote command:

[FORMat:DEXPort:DSEParator](#) on page 313

Export Trace

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

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

Note: Secure user mode.

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

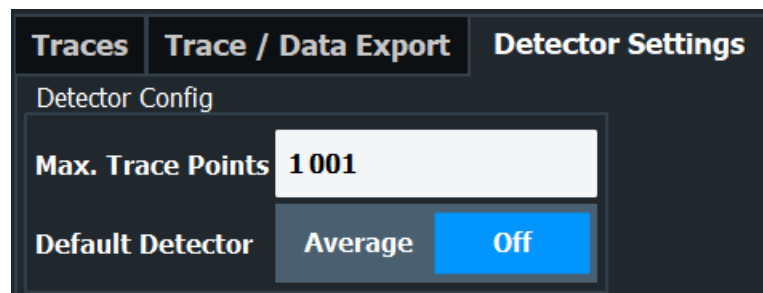
To store data permanently, select an external storage location such as a USB memory device.

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

Remote command:

[MMEMory:STORe<n>:TRACe](#) on page 314

4.1.3 Trace detector



Max. Trace Points

Sets the maximum number of trace points to be used by detectors.

Remote command:

[\[SENSe:\]DETEctor<t>:TRACe\[:POINT\]](#) on page 315

Default Detector

Selects the default detector for FSW-K18 result displays.

Note that changing the default detector to "Average" changes all traces with "Detector Off" to "Detector Average". Setting "Off" will change all traces with "Detector Average" to "Detector Off"

Remote command:

[\[SENSe:\]DETEctor<t>:DEFault\[:FUNCTION\]](#) on page 314

4.2 Markers

The amplifier application provides four markers in most result displays.

- [General marker settings](#)..... 143
- [Individual marker settings](#)..... 144
- [Marker positioning](#)..... 146

4.2.1 General marker settings

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

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

Marker Table Display	143
Marker Info	143
Link Markers Across Windows	144

Marker Table Display

Defines how the marker information is displayed.

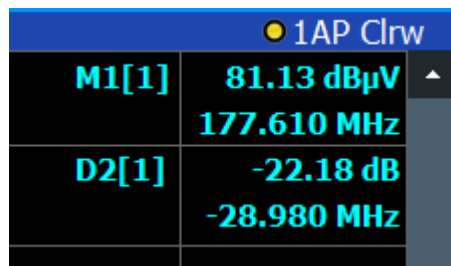
"On"	Displays the marker information in a table in a separate area beneath the diagram.
"Off"	No separate marker table is displayed. If Marker Info is active, the marker information is displayed within the diagram area.
"Auto"	(Default) If more than two markers are active, the marker table is displayed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

Remote command:

`DISPlay[:WINDow<n>]:MTABLE` on page 318

Marker Info

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



1AP Clrw	
M1[1]	81.13 dBµV 177.610 MHz
D2[1]	-22.18 dB -28.980 MHz

Remote command:

`DISPlay[:WINDow<n>]:MINFo[:STATe]` on page 318

Link Markers Across Windows

Turns marker coupling across result windows on and off.

When you link markers, moving a marker in one result display moves the marker to the same sample in another window. This is useful to compare results in result displays that have different information on their x- and y-axis (for example the [AM/AM](#) and [AM/PM](#) results).

Remote command:

`CALCulate<n>:MARKer<m>:LINK` on page 317

4.2.2 Individual marker settings

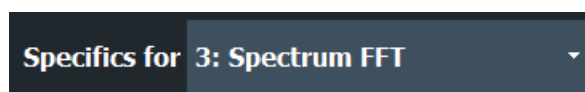
Access: "Overview" > "Result Config" > "Markers"

The functionality to position markers and query their position is similar to the marker functionality available in the Spectrum application.

**Availability of markers**

The "Markers" and "Marker Settings" tabs are available for result displays that support markers.

If the tabs are unavailable, make sure to select a result display that actually supports markers from the "Specifics for:" dropdown menu (for example the spectrum FFT result display).



Note that the amplifier application does not support more than four markers in any result display.

Selected Marker	144
Marker State	144
Marker Position X-value	145
Marker Type	145
Reference Marker	145
Linking to Another Marker	145
Assigning the Marker to a Trace	146
All Markers Off	146
Marker Table Display	146

Selected Marker

Marker name. The marker which is currently selected for editing is highlighted orange.

Remote command:

Marker selected via suffix <m> in remote commands.

Marker State

Activates or deactivates the marker in the diagram.

Remote command:

[CALCulate<n>:MARKer<m>\[:STATe\]](#) on page 323

[CALCulate<n>:DELTAmarker<m>\[:STATe\]](#) on page 320

Marker Position X-value

Defines the position (x-value) of the marker in the diagram. For normal markers, the absolute position is indicated. For delta markers, the position relative to the reference marker is provided.

Remote command:

[CALCulate<n>:MARKer<m>:X](#) on page 323

[CALCulate<n>:DELTAmarker<m>:X](#) on page 321

Marker Type

Toggles the marker type.

The type for marker 1 is always "Normal", the type for delta marker 1 is always "Delta". These types cannot be changed.

Note: If normal marker 1 is the active marker, switching the "Mkr Type" activates an additional delta marker 1. For any other marker, switching the marker type does not activate an additional marker, it only switches the type of the selected marker.

"Normal" A normal marker indicates the absolute value at the defined position in the diagram.

"Delta" A delta marker defines the value of the marker relative to the specified reference marker (marker 1 by default).

Remote command:

[CALCulate<n>:MARKer<m>\[:STATe\]](#) on page 323

[CALCulate<n>:DELTAmarker<m>\[:STATe\]](#) on page 320

Reference Marker

Defines a marker as the reference marker which is used to determine relative analysis results (delta marker values).

Remote command:

[CALCulate<n>:DELTAmarker<m>:MREference](#) on page 320

Linking to Another Marker

Links the current marker to the marker selected from the list of active markers. If the x-axis value of the initial marker is changed, the linked marker follows to the same position on the x-axis. Linking is off by default.

Using this function you can set two markers on different traces to measure the difference (e.g. between a max hold trace and a min hold trace or between a measurement and a reference trace).

For linked delta markers, the x-value of the delta marker is 0 Hz by default. To create a delta marker in a fixed distance to another marker, define the distance as the x-value for the linked delta marker.

Remote command:

[CALCulate<n>:MARKer<ms>:LINK:TO:MARKer<md>](#) on page 322

[CALCulate<n>:DELTamarker<ms>:LINK:TO:MARKer<md>](#) on page 320

[CALCulate<n>:DELTamarker<m>:LINK](#) on page 319

Assigning the Marker to a Trace

The "Trace" setting assigns the selected marker to an active trace. The trace determines which value the marker shows at the marker position. If the marker was previously assigned to a different trace, the marker remains on the previous frequency or time, but indicates the value of the new trace.

If a trace is turned off, the assigned markers and marker functions are also deactivated.

Remote command:

[CALCulate<n>:MARKer<m>:TRACe](#) on page 323

All Markers Off

Deactivates all markers in one step.

Remote command:

[CALCulate<n>:MARKer<m>:AOFF](#) on page 322

Marker Table Display

Defines how the marker information is displayed.

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

Remote command:

[DISPlay\[:WINDow<n>\]:MTABLE](#) on page 318

4.2.3 Marker positioning

Peak Search	146
Search Next Peak	147
Search Minimum	147
Search Next Minimum	147

Peak Search

Sets the selected marker/delta marker to the maximum of the trace. If no marker is active, marker 1 is activated.

Remote command:

[CALCulate<n>:MARKer<m>:MAXimum\[:PEAK\]](#) on page 327

[CALCulate<n>:DELTamarker<m>:MAXimum\[:PEAK\]](#) on page 325

Search Next Peak

Sets the selected marker/delta marker to the next (lower) maximum of the assigned trace. If no marker is active, marker 1 is activated.

Remote command:

[CALCulate<n>:MARKer<m>:MAXimum:NEXT](#) on page 327

[CALCulate<n>:MARKer<m>:MAXimum:RIGHT](#) on page 327

[CALCulate<n>:MARKer<m>:MAXimum:LEFT](#) on page 326

[CALCulate<n>:DELTamarker<m>:MAXimum:NEXT](#) on page 325

[CALCulate<n>:DELTamarker<m>:MAXimum:RIGHT](#) on page 325

[CALCulate<n>:DELTamarker<m>:MAXimum:LEFT](#) on page 324

Search Minimum

Sets the selected marker/delta marker to the minimum of the trace. If no marker is active, marker 1 is activated.

Remote command:

[CALCulate<n>:MARKer<m>:MINimum\[:PEAK\]](#) on page 328

[CALCulate<n>:DELTamarker<m>:MINimum\[:PEAK\]](#) on page 326

Search Next Minimum

Sets the selected marker/delta marker to the next (higher) minimum of the selected trace. If no marker is active, marker 1 is activated.

Remote command:

[CALCulate<n>:MARKer<m>:MINimum:NEXT](#) on page 328

[CALCulate<n>:MARKer<m>:MINimum:LEFT](#) on page 327

[CALCulate<n>:MARKer<m>:MINimum:RIGHT](#) on page 328

[CALCulate<n>:DELTamarker<m>:MINimum:NEXT](#) on page 326

[CALCulate<n>:DELTamarker<m>:MINimum:LEFT](#) on page 325

[CALCulate<n>:DELTamarker<m>:MINimum:RIGHT](#) on page 326

4.3 Numerical result tables

Access: "Overview" > "Result Config" > "Table Config"

By default, the application shows all supported numerical results in the result tables (result summary and parameter sweep table). However, you can add or remove results as you like.

Modulation Accuracy	Power	Voltage/Current				
Raw EVM	%	On	Off	Phase Error	°	On Off
Raw Model EVM	%	On	Off	Quadrature Error	°	On Off
Frequency Error	Hz	On	Off	Gain Imbalance	dB	On Off
Sample Rate Error	ppm	On	Off	I/Q Imbalance	dB	On Off
Magnitude Error	%	On	Off	I/Q Offset	dB	On Off



Accessing the "Table Config" tab

Note that the "Table Config" tab is only available after you have selected the "Specifics for: Result Summary" or "Specifics for: Parameter Sweep Table" item from the corresponding dropdown menu at the bottom of the dialog box.

The dialog box for the result summary is made up out of different tabs:

- One for modulation accuracy results.
- One for power-related results.
- One for voltage and current related results. The results in this tab are available after you have activated baseband measurements.

The supported results of the parameter sweep table are part of a separate dialog box.

You can add or remove individual results by turning them "On" or "Off".

Remote command:

Individual result summary items: `DISPlay[:WINDow<n>]:TABLE:ITEM` on page 329

Individual parameter sweep items: `DISPlay[:WINDow<n>]:PTABLE:ITEM` on page 328

All modulation accuracy items: `DISPlay[:WINDow<n>]:TABLE:ITEM:MACCuracy:ALL` on page 331

All power items: `DISPlay[:WINDow<n>]:TABLE:ITEM:POWer:ALL` on page 331

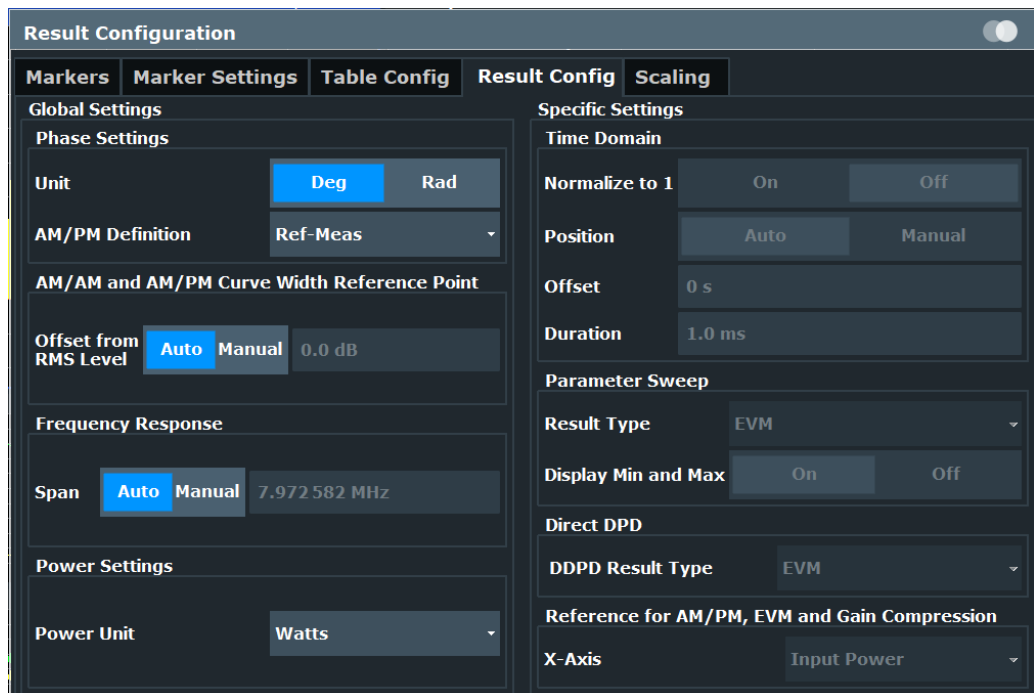
All voltage / current items: `DISPlay[:WINDow<n>]:TABLE:ITEM:VCURrent:ALL` on page 331

All parameter sweep items: `DISPlay[:WINDow<n>]:PTABLE:ITEM:ALL`
on page 329

4.4 Result display settings

Access: "Overview" > "Result Config"

The application allows you to configure the information displayed in various graphical result displays. The global settings apply to all relevant result displays, while the specific settings apply only to the selected result display ("Specifics for").



Phase Settings.....	149
└ Unit.....	150
└ AM/PM Definition.....	150
AM/AM and AM/PM Curve Width Reference Point.....	150
Frequency Response.....	150
Power Unit.....	150
Time domain result display.....	150
└ Normalize to 1.....	151
└ Position.....	151
└ Offset.....	151
└ Duration.....	151
Parameter sweep diagram.....	151
Direct DPD Result Type.....	152
Reference for AM/PM, EVM and Gain Compression.....	152

Phase Settings

Phase settings apply to the "AM/PM" results and the "Phase deviation vs time" result.

Unit ← Phase Settings

Determines whether phase information is provided in degrees or radians.

Remote command:

[CALCulate<n>:UNIT:ANGLE](#) on page 334

AM/PM Definition ← Phase Settings

Determines the way the "AM/PM" results are calculated.

"Ref - Meas" (Default:) The measured values are subtracted from the reference values.

"Meas - Ref" The reference values are subtracted from the measured values.

Remote command:

[CALCulate<n>:AMPM:DEFinition](#) on page 333

AM/AM and AM/PM Curve Width Reference Point

Determines the reference point for the curve width as an offset from the RMS level. By default, the input power is automatically set to the RMS level. Positive values describe a value above RMS power and negative values below RMS power.

Remote command:

[CONFigure:AMPM:CWIDTH:REFeRence:AUTO](#) on page 338

[CONFigure:AMPM:CWIDTH:REFeRence](#) on page 338

Frequency Response

Selects the span that the frequency response is applied to for FSW-K18F result displays.

- "Auto": Sets the span to the calculated OBW of the reference file.
- "Manual": Define the span manually.

Remote command:

[CONFigure:FRSPan](#) on page 335

[CONFigure:FRSPan:AUTO](#) on page 335

Power Unit

Switches the unit for power results from dBm (default) to Watts.

The following windows are then adjusted accordingly.

- "Result Summary": Adjusts all affected units in the result summary accordingly.
- "Magnitude Capture" and "Spectrum": Adjusts all axes for graphical results accordingly.
- "AM/AM": X-axis in dBm
- "AM/PM": X-axis in dBm
- "Gain Compression": X-axis in dBm
- "EVM (Input Power)": X-axis in dBm

Remote command:

[CONFigure:POWer:UNIT](#) on page 335

Time domain result display

The "Time Domain" settings configure the information displayed in the time domain result display, e.g.the displayed time range.

Normalize to 1 ← Time domain result display

Enables or disables normalization of the time domain trace to 1.

Remote command:

`DISPlay[:WINDow<n>]:TDOMain:Y[:SCALE]:NORMalise[:STATE]`

on page 338

Position ← Time domain result display

Defines whether the position of the time domain range is determined automatically or manually, by the [Offset](#) and [Duration](#).

Remote command:

`DISPlay[:WINDow<n>]:TDOMain:X[:SCALE]:MODE` on page 337

Offset ← Time domain result display

Defines an offset to the time of the first recorded sample or the first sample of the synchronized data. The x-axis of the time domain result display starts at this value.

This setting is only available for manual positioning (see ["Position"](#) on page 151).

Remote command:

`DISPlay[:WINDow<n>]:TDOMain:X[:SCALE]:OFFSet` on page 337

Duration ← Time domain result display

Defines the length of the x-axis in time domain results.

This setting is only available for manual positioning (see ["Position"](#) on page 151).

Remote command:

`DISPlay[:WINDow<n>]:TDOMain:X[:SCALE]:DURation` on page 336

Parameter sweep diagram

You can select one of several result types to evaluate in the parameter sweep diagram. If you open more than one parameter sweep window, you can select a different result for each window.

By default, the application indicates the highest and lowest values that have been measured in the diagram.



Optionally, you can disable the "Display Min and Max" feature.

The following result types are evaluated in the parameter sweep.

- "ACLR Adj 1 Lower"
- "ACLR Adj 1 Upper"
- "ACLR Adj 1 Balanced"
- "ACLR Alt 1 Balanced"
- "ACLR Alt 2 Balanced"
- "AM/AM Curve Width"
- "AM/PM Curve Width"
- "Balanced ACLR Magnitude"
- Compression Point "P (1 dB / 2 dB / 3 dB)"
- "Crest Factor Out"
- "Current OBW"

- "EVM"
- "Gain"
- "Power Out"
- "RMS Power"
- "Voltage (V_{cc})"
- "Current (I_{cc})"
- "Power (V_{cc} * I_{cc})"

For details on the parameters, see [Chapter 2.2, "Amplifier parameters"](#), on page 33.

Remote command:

[CONFigure:PSweep:Z<n>:RESult](#) on page 335

Direct DPD Result Type

Selects the result type for [direct DPD](#) measurements.

For a description of the supported result types, see ["DDPD Results \(FSW-K18D\)"](#) on page 18.

Remote command:

[CONFigure:DDPD:WINDow<n>:RESult](#) on page 285

Reference for AM/PM, EVM and Gain Compression

For the following power result displays, you can select the information that is used as a reference for the x-axis.

- [AM/PM](#)
- [EVM vs Power](#)
- [Gain Compression](#)
- [Vcc Power](#)
- [Icc Power](#)

You can analyze these results either at the DUT input or at the DUT output. By default, the results show the information against the "Input Power".

To analyze the signal against the output power, select "Output Power".

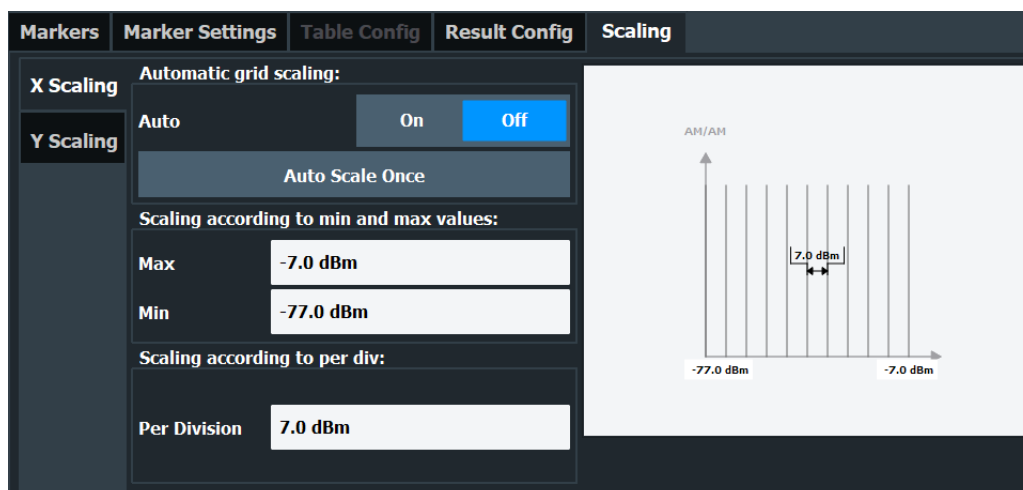
Remote command:

[CALCulate<n>:PREference:X](#) on page 334

4.5 X-axis scaling

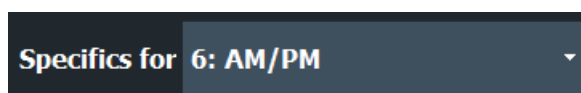
Access: "Overview" > "Result Config" > "Scaling" > "X Scaling"

By default, the application automatically scales the x-axis based on the current results. The scale changes when new measurement results are available. When you change the scale manually, the changes are shown in the diagram next to the settings.



Scope of the scaling

Scaling is applied only to the result display that you have selected from the "Specifics for:" dropdown menu at the bottom of the dialog box.



(In this case, the scale is applied to the "AM/PM" result display.)

Scaling the x-axis in particular is available for result displays that plot any kind of level values on both axes (for example the "AM/PM" result display).

Scaling the x-axis automatically..... 153
 Scaling the x-axis manually..... 153

Scaling the x-axis automatically

By default, the application scales the x-axis in all diagrams automatically (→ "Auto" = ON).

Automatic scaling tries to obtain the ideal scale for the current measurement results. The application adjusts the scale each time the results change.

You can also force an automatic scaling of the x-axis at any time with the "Auto Scale Once" function. When you select this function, the application scales the x-axis even if the results have not been changed.

Remote command:

```
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALE]:AUTO
```

on page 339

Scaling the x-axis manually

Settings for manual scaling of the x-axis become available when you turn automatic scaling off.

The application provides two methods to scale the x-axis.

- Scaling according to minimum and maximum values
 The scale is defined by the values at the lower and upper end of the x-axis.

- Scaling according to the distance between two grid lines
The scale is defined by the value range within two grid lines in the diagram (→ per division). The distance between grid lines refers to diagrams that are split into 10 divisions.

Remote command:

Minimum: `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALE]:MINimum` on page 340

Maximum: `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALE]:MAXimum` on page 339

Distance: `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALE]:PDIVision` on page 340

4.6 Y-axis scaling

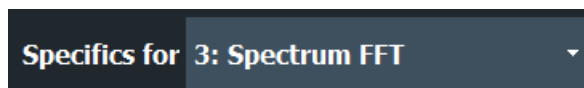
Access: "Overview" > "Result Config" > "Scaling" > "Y Scaling"

By default, the application automatically scales the y-axis based on the current results. The scale changes when new measurement results are available. When you change the scale manually, the changes are shown in the diagram next to the settings.



Scope of the scaling

Scaling is applied only to the result display that you have selected from the "Specifics for:" dropdown menu at the bottom of the dialog box.



(In this case, the scale is applied to the spectrum FFT result display.)

Scaling the y-axis automatically.....	155
Scaling the y-axis manually.....	155

Scaling the y-axis automatically

By default, the application scales the y-axis in all diagrams automatically (→ "Auto" = ON).

Automatic scaling tries to obtain the ideal scale for the current measurement results. The application adjusts the scale each time the results change.

You can also force an automatic scaling of the y-axis at any time with the "Auto Scale Once" function. When you select this function, the application scales the y-axis even if the results have not been changed.

Remote command:

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

on page 341

Scaling the y-axis manually

Settings for manual scaling of the y-axis become available when you turn automatic scaling off.

The application provides two methods to scale the y-axis.

- Scaling according to minimum and maximum values
The scale is defined by the values at the lower and upper end of the y-axis.
- Scaling according to reference value
The scale is defined relative to the reference value and a constant distance between the grid lines (→ per division). The distance between grid lines refers to diagrams that are split into 10 divisions.
The position of the reference value is arbitrary. By default it is at the upper end of the y-axis (100 %).

Remote command:

Minimum: `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MAXimum` on page 342

Maximum: `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MINimum` on page 342

Reference value: `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RVALue` on page 344

Position: `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RPOSITION` on page 343

Distance: `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:PDIVision` on page 343

5 Remote control commands for amplifier measurements

The following remote control commands are required to configure and perform amplifier measurements in a remote environment. The FSW must already be set up for remote operation in a network as described in the base unit manual.



Universal functionality

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

In particular, this includes:

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



SCPI Recorder - automating tasks with remote command scripts

The Amplifier measurement application also supports the SCPI Recorder functionality. Using the SCPI Recorder functions, you can create a SCPI script directly on the instrument and then export the script for use on the controller. You can also edit or write a script manually, using a suitable editor on the controller. For manual creation, the instrument supports you by showing the corresponding command syntax for the current setting value.

For details see the "Network and Remote Operation" chapter in the FSW User Manual.

• Introduction	156
• Common suffixes	161
• Selecting the application	162
• Configuring the screen layout	166
• Performing amplifier measurements	174
• Configuring amplifier measurements	177
• Analyzing results	312
• Retrieving results	344
• Managing measurement data	404
• Deprecated remote commands for amplifier measurements	405

5.1 Introduction

Commands are program messages that a controller (e.g. a PC) sends to the instrument or software. They operate its functions ('setting commands' or 'events') and request information ('query commands'). Some commands can only be used in one

way, others work in two ways (setting and query). If not indicated otherwise, the commands can be used for settings and queries.

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

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

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



Remote command examples

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

5.1.1 Conventions used in descriptions

The following conventions are used in the remote command descriptions:

- **Command usage**

If not specified otherwise, commands can be used both for setting and for querying parameters.

If a command can be used for setting or querying only, or if it initiates an event, the usage is stated explicitly.

- **Parameter usage**

If not specified otherwise, a parameter can be used to set a value, and it is the result of a query.

Parameters required only for setting are indicated as **Setting parameters**.

Parameters required only to refine a query are indicated as **Query parameters**.

Parameters that are only returned as the result of a query are indicated as **Return values**.

- **Conformity**

Commands that are taken from the SCPI standard are indicated as **SCPI confirmed**. All commands used by the FSW follow the SCPI syntax rules.

- **Asynchronous commands**

A command which does not automatically finish executing before the next command starts executing (overlapping command) is indicated as an **Asynchronous command**.

- **Reset values (*RST)**

Default parameter values that are used directly after resetting the instrument (*RST command) are indicated as ***RST** values, if available.

- **Default unit**

The default unit is used for numeric values if no other unit is provided with the parameter.

- **Manual operation**

If the result of a remote command can also be achieved in manual operation, a link to the description is inserted.

5.1.2 Long and short form

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

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

Example:

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

5.1.3 Numeric suffixes

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

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

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

Example:

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

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

5.1.4 Optional keywords

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



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

Optional keywords are emphasized with square brackets.

Example:

Without a numeric suffix in the optional keyword:

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

With a numeric suffix in the optional keyword:

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

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

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

5.1.5 Alternative keywords

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

Example:

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

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

5.1.6 SCPI parameters

Many commands feature one or more parameters.

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

Example:

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

Parameters can have different forms of values.

- [Numeric values](#)..... 159
- [Boolean](#)..... 160
- [Character data](#)..... 161
- [Character strings](#)..... 161
- [Block data](#)..... 161

5.1.6.1 Numeric values

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

Example:

With unit: SENSe:FREQuency:CENTer 1GHZ

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

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

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

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

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

Querying numeric values

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

Example:

Setting: `SENSe:FREQuency:CENTer 1GHZ`

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

Sometimes, numeric values are returned as text.

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

5.1.6.2 Boolean

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

Querying Boolean parameters

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

Example:

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

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

5.1.6.3 Character data

Character data follows the syntactic rules of keywords. You can enter text using a short or a long form. For more information, see [Chapter 5.1.2, "Long and short form"](#), on page 158.

Querying text parameters

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

Example:

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

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

5.1.6.4 Character strings

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

Example:

`INSTRument:DELeTe 'Spectrum'`

5.1.6.5 Block data

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

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

5.2 Common suffixes

In the Amplifier measurement application, the following common suffixes are used in remote commands:

Table 5-1: Common suffixes used in remote commands in the Amplifier measurement application

Suffix	Value range	Description
<m>	1..16	Marker
<n>	1..16	Window (in the currently selected channel)

Suffix	Value range	Description
<t>	1..6	Trace
	1 to 8	Limit line

5.3 Selecting the application

INSTrument:CREate:DUPLicate	162
INSTrument:CREate:REPLace	162
INSTrument:CREate[:NEW]	163
INSTrument:DELeTe	163
INSTrument:LIST?	163
INSTrument:REName	165
INSTrument[:SELeCt]	165
SYSTem:PRESet:CHANnel[:EXEC]	166

INSTrument:CREate:DUPLicate

Duplicates the currently selected channel, i.e. creates a new channel of the same type and with the identical measurement settings. The name of the new channel is the same as the copied channel, extended by a consecutive number (e.g. "IQAnalyzer" -> "IQAnalyzer 2").

The channel to be duplicated must be selected first using the `INST:SEL` command.

Example:

```
INST:SEL 'IQAnalyzer'
```

```
INST:CRE:DUPL
```

Duplicates the channel named 'IQAnalyzer' and creates a new channel named 'IQAnalyzer2'.

Usage: Event

INSTrument:CREate:REPLace <ChannelName1>, <ChannelType>, <ChannelName2>

Replaces a channel with another one.

Setting parameters:

<ChannelName1> String containing the name of the channel you want to replace.

<ChannelType> Channel type of the new channel.
For a list of available channel types, see `INSTrument:LIST?` on page 163.

- <ChannelName2> String containing the name of the new channel.
Note: If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel (see [INSTrument:LIST?](#) on page 163).
 Channel names can have a maximum of 31 characters, and must be compatible with the Windows conventions for file names. In particular, they must not contain special characters such as ":", "*", "?".
- Example:** `INST:CRE:REPL 'IQAnalyzer2', IQ, 'IQAnalyzer'`
 Replaces the channel named "IQAnalyzer2" by a new channel of type "IQ Analyzer" named "IQAnalyzer".
- Usage:** Setting only

INSTrument:CREate[:NEW] <ChannelType>, <ChannelName>

Adds a measurement channel. You can configure up to 10 measurement channels at the same time (depending on available memory).

Parameters:

- <ChannelType> Channel type of the new channel.
 For a list of available channel types, see [INSTrument:LIST?](#) on page 163.
- <ChannelName> String containing the name of the channel.
 Note that you cannot assign an existing channel name to a new channel. If you do, an error occurs.
- Example:** `INST:CRE SAN, 'Spectrum 2'`
 Adds a spectrum display named "Spectrum 2".

INSTrument:DELeTe <ChannelName>

Deletes a channel.

If you delete the last channel, the default "Spectrum" channel is activated.

Setting parameters:

- <ChannelName> String containing the name of the channel you want to delete.
 A channel must exist to delete it.
- Example:** `INST:DEL 'IQAnalyzer4'`
 Deletes the channel with the name 'IQAnalyzer4'.
- Usage:** Setting only

INSTrument:LIST?

Queries all active channels. The query is useful to obtain the names of the existing channels, which are required to replace or delete the channels.

Return values:

<ChannelType>
<ChannelName>

For each channel, the command returns the channel type and channel name (see tables below).

Tip: to change the channel name, use the `INST:REName` command.

Example:

`INST:LIST?`

Result for 3 channels:

```
'ADEM', 'Analog Demod', 'IQ', 'IQ Analyzer', 'IQ', 'IQ Analyzer2'
```

Usage:

Query only

Table 5-2: Available channel types and default channel names in Signal and Spectrum Analyzer mode

Application	<ChannelType> parameter	Default Channel name*)
Spectrum	SANALYZER	Spectrum
1xEV-DO BTS (FSW-K84)	BDO	1xEV-DO BTS
1xEV-DO MS (FSW-K85)	MDO	1xEV-DO MS
3GPP FDD BTS (FSW-K72)	BWCD	3G FDD BTS
3GPP FDD UE (FSW-K73)	MWCD	3G FDD UE
802.11ad (FSW-K95)	WIGIG	802.11ad
802.11ay (FSW-K97)	EDMG	802.11ay EDMG
Amplifier Measurements (FSW-K18)	AMPLifier	Amplifier
AM/FM/PM Modulation Analysis (FSW-K7)	ADEM	Analog Demod
Avionics (FSW-K15)	AVIonics	Avionics
Bluetooth (FSW-K8)	BTO	Bluetooth
cdma2000 BTS (FSW-K82)	BC2K	CDMA2000 BTS
cdma2000 MS (FSW-K83)	MC2K	CDMA2000 MS
DOCSIS 3.1 (FSW-K192/193)	DOCSis	DOCSIS 3.1
Fast Spur Search (FSW-K50)	SPUR	Spurious
GSM (FSW-K10)	GSM	GSM
HRP UWB (FSW-K149)	UWB	HRP UWB
I/Q Analyzer	IQ	I/Q Analyzer
LTE (FSW-K10x)	LTE	LTE
Multi-Carrier "Group Delay" (FSW-K17)	MCGD	MC "Group Delay"
NB-IoT (FSW-K106)	NIOT	NB-IoT
Noise (FSW-K30)	NOISE	Noise
5G NR (FSW-K144)	NR5G	5G NR
*) If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel.		

Application	<ChannelType> parameter	Default Channel name*)
OFDM VSA (FSW-K96)	OFDMVSA	OFDM VSA
OneWeb (FSW-K201)	OWEB	OneWeb
Phase Noise (FSW-K40)	PNOISE	Phase Noise
Pulse (FSW-K6)	PULSE	Pulse
"Real-Time Spectrum"	RTIM	"Real-Time Spectrum"
TD-SCDMA BTS (FSW-K76)	BTDS	TD-SCDMA BTS
TD-SCDMA UE (FSW-K77)	MTDS	TD-SCDMA UE
Transient Analysis (FSW-K60)	TA	Transient Analysis
Verizon 5GTF Measurement Application (V5GTF, FSW-K118)	V5GT	V5GT
VSA (FSW-K70)	DDEM	VSA
WLAN (FSW-K91)	WLAN	WLAN
*) If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel.		

INSTrument:REName <ChannelName1>, <ChannelName2>

Renames a channel.

Setting parameters:

<ChannelName1> String containing the name of the channel you want to rename.

<ChannelName2> String containing the new channel name.
 Note that you cannot assign an existing channel name to a new channel. If you do, an error occurs.
 Channel names can have a maximum of 31 characters, and must be compatible with the Windows conventions for file names. In particular, they must not contain special characters such as ":", "*", "?".

Example: `INST:REN 'IQAnalyzer2', 'IQAnalyzer3'`
 Renames the channel with the name 'IQAnalyzer2' to 'IQAnalyzer3'.

Usage: Setting only

INSTrument[:SElect] <ChannelType> | <ChannelName>

Activates a new channel with the defined channel type, or selects an existing channel with the specified name.

Also see

- [INSTrument:CREate\[:NEW\]](#) on page 163

Parameters:

<ChannelType> Channel type of the new channel.
For a list of available channel types see [INSTrument:LIST?](#) on page 163.

<ChannelName> String containing the name of the channel.

Example:

```
INST IQ
```

Activates a channel for the I/Q Analyzer application (evaluation mode).

```
INST 'MyIQSpectrum'
```

Selects the channel named 'MyIQSpectrum' (for example before executing further commands for that channel).

SYSTem:PRESet:CHANnel[:EXEC]

Restores the default instrument settings in the current channel.

Use `INST:SEL` to select the channel.

Example:

```
INST:SEL 'Spectrum2'
```

Selects the channel for "Spectrum2".

```
SYST:PRESet:CHAN:EXEC
```

Restores the factory default settings to the "Spectrum2" channel.

Usage:

Event

Manual operation: See "[Preset Channel](#)" on page 46

5.4 Configuring the screen layout

DISPlay:FORMat	167
DISPlay[:WINDow<n>]:SIZE	167
LAYout:ADD[:WINDow]?	167
LAYout:CATalog[:WINDow]?	169
LAYout:DIRection	170
LAYout:IDENtify[:WINDow]?	170
LAYout:REMove[:WINDow]	170
LAYout:REPLace[:WINDow]	170
LAYout:SPLitter	171
LAYout:WINDow<n>:ADD?	172
LAYout:WINDow<n>:IDENtify?	173
LAYout:WINDow<n>:REMove	173
LAYout:WINDow<n>:REPLace	173
LAYout:WINDow<n>:TYPE?	174

DISPlay:FORMat <Format>

Determines which tab is displayed.

Parameters:

<Format>

SPLit

Displays the MultiView tab with an overview of all active channels

SINGle

Displays the measurement channel that was previously focused.

*RST: SING

Example:

DISP:FORM SPL

DISPlay[:WINDow<n>]:SIZE <Size>

Maximizes the size of the selected result display window *temporarily*. To change the size of several windows on the screen permanently, use the `LAY:SPL` command (see [LAYout:SPLitter](#) on page 171).

Suffix:

<n>

Window

Parameters:

<Size>

LARGE

Maximizes the selected window to full screen. Other windows are still active in the background.

SMALI

Reduces the size of the selected window to its original size. If more than one measurement window was displayed originally, these are visible again.

*RST: SMALI

Example:

DISP:WIND2:SIZE LARG

LAYout:ADD[:WINDow]? <WindowName>, <Direction>, <WindowType>

Adds a window to the display in the active channel.

Is always used as a query so that you immediately obtain the name of the new window as a result.

To replace an existing window, use the `LAYout:REPLace[:WINDow]` command.

Query parameters:

<WindowName>

String containing the name of the existing window the new window is inserted next to.

By default, the name of a window is the same as its index. To determine the name and index of all active windows, use the `LAYout:CATalog[:WINDow]?` query.

<Direction> LEFT | RIGHT | ABOVE | BELOW
 Direction the new window is added relative to the existing window.

<WindowType> text value
 Type of result display (evaluation method) you want to add. See the table below for available parameter values.

Return values:

<NewWindowName> When adding a new window, the command returns its name (by default the same as its number) as a result.

Example:

```
LAY:ADD? '1', LEFT, MTAB
```

Result:

```
'2'
```

Adds a new window named '2' with a marker table to the left of window 1.

Usage:

Query only

Manual operation:

See "[Magnitude Capture](#)" on page 22

See "[Spectrum FFT](#)" on page 29

Table 5-3: <WindowType> parameter values for Amplifier Measurement application

Parameter value	Window type
ACP	"Adjacent Channel Power" (Table)
AMAM	"AM/AM"
AMEVm	"EVM" vs Power
AMPM	"Phase Deviation vs Input Power"("AM/PM")
DDPD	DDPD Results
GCOMpression	"Gain Compression"
GDEL	"Group Delay"
GDVTime	"Gain Deviation vs Time"
IMAGnitude	"Magnitude Capture" I
ICCPower	Icc vs Power
ISPectrum	"Spectrum FFT" I
MDPD	"Memory DPD Coefficients"
MRES	Channel Response Magnitude
MTABle	"Marker Table"
PAEI	PAE Input Power
PAEO	PAE Output Power
PAETime	PAE Time
PRES	Channel Response Phase

Parameter value	Window type
PSweep	"Parameter Sweep" (Diagram)
PTABLE	"Parameter Sweep" (Table)
PDVTime	"Phase Deviation vs Time"
PVTime	Power vs. Time (I x Q)
QMAGnitude	"Magnitude Capture" Q
QSPpectrum	"Spectrum FFT" Q
REVM	Raw "EVM"
RFMAGnitude	"Magnitude Capture" RF
RFSPpectrum	"Spectrum FFT"
RTABLE	"Result Summary" (Table)
SEVM	Spectrum "EVM"
STAB	"Statistics Table"
TDOMain	"Time Domain"
VCCPower	Vcc vs Power
VICC	Vcc vs. Icc

LAYout:CATalog[:WINDow]?

Queries the name and index of all active windows in the active channel from top left to bottom right. The result is a comma-separated list of values for each window, with the syntax:

<WindowName_1>,<WindowIndex_1>..<WindowName_n>,<WindowIndex_n>

Return values:

<WindowName> string
Name of the window.
In the default state, the name of the window is its index.

<WindowIndex> **numeric value**
Index of the window.

Example:

LAY:CAT?

Result:

'2',2,'1',1

Two windows are displayed, named '2' (at the top or left), and '1' (at the bottom or right).

Usage: Query only

LAYout:DIRection <Direction>

This command selects the general direction of the smart grid.

Parameters:

<Direction>	HORizontal
	VERTical
*RST:	HORizontal

Example: LAY:DIR HOR

LAYout:IDENtify[:WINDow]? <WindowName>

Queries the **index** of a particular display window in the active channel.

Note: to query the **name** of a particular window, use the [LAYout:WINDow<n>:IDENtify?](#) query.

Query parameters:

<WindowName>	String containing the name of a window.
--------------	---

Return values:

<WindowIndex>	Index number of the window.
---------------	-----------------------------

Example: LAY:IDEN:WIND? '2'
 Queries the index of the result display named '2'.
 Response:
 2

Usage: Query only

LAYout:REMOve[:WINDow] <WindowName>

Removes a window from the display in the active channel.

Setting parameters:

<WindowName>	String containing the name of the window. In the default state, the name of the window is its index.
--------------	--

Example: LAY:REM '2'
 Removes the result display in the window named '2'.

Usage: Setting only

LAYout:REPLace[:WINDow] <WindowName>,<WindowType>

Replaces the window type (for example from "Diagram" to "Result Summary") of an already existing window in the active channel while keeping its position, index and window name.

To add a new window, use the [LAYout:ADD\[:WINDow\]?](#) command.

Setting parameters:

<WindowName> String containing the name of the existing window.
By default, the name of a window is the same as its index. To determine the name and index of all active windows in the active channel, use the `LAYout:CATalog[:WINDow]?` query.

<WindowType> Type of result display you want to use in the existing window.
See `LAYout:ADD[:WINDow]?` on page 167 for a list of available window types.

Example: `LAY:REPL:WIND '1',MTAB`
Replaces the result display in window 1 with a marker table.

Usage: Setting only

LAYout:SPLitter <Index1>, <Index2>, <Position>

Changes the position of a splitter and thus controls the size of the windows on each side of the splitter.

Compared to the `DISPlay[:WINDow<n>]:SIZE` on page 167 command, the `LAYout:SPLitter` changes the size of all windows to either side of the splitter permanently, it does not just maximize a single window temporarily.

Note that windows must have a certain minimum size. If the position you define conflicts with the minimum size of any of the affected windows, the command does not work, but does not return an error.

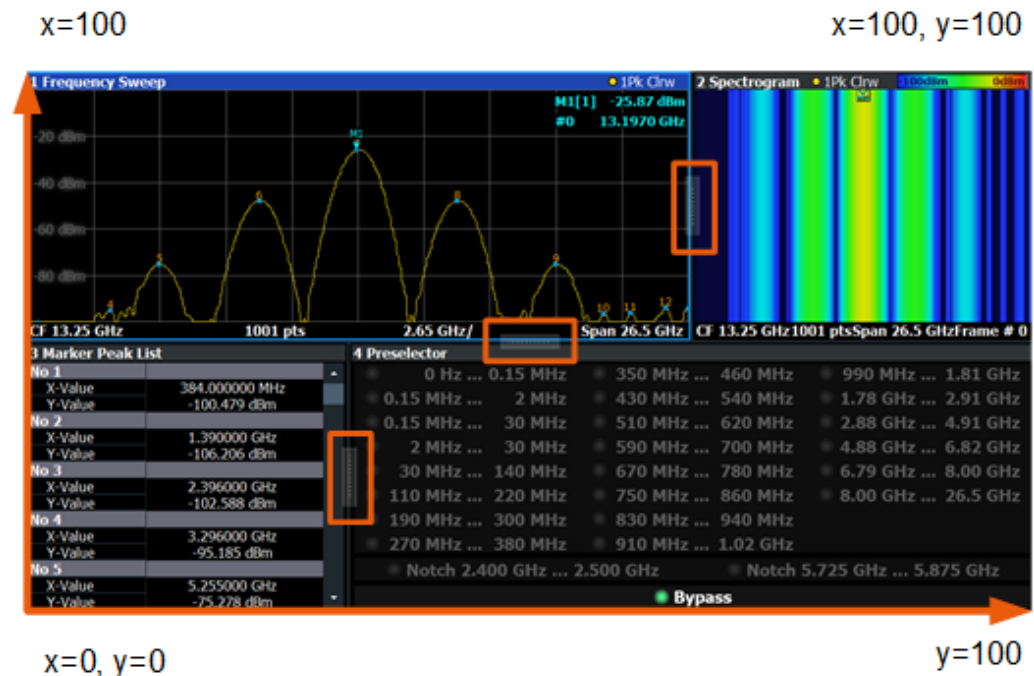


Figure 5-1: SmartGrid coordinates for remote control of the splitters

Setting parameters:

<Index1>	The index of one window the splitter controls.
<Index2>	The index of a window on the other side of the splitter.
<Position>	New vertical or horizontal position of the splitter as a fraction of the screen area (without channel and status bar and softkey menu). The point of origin (x = 0, y = 0) is in the lower left corner of the screen. The end point (x = 100, y = 100) is in the upper right corner of the screen. (See Figure 5-1 .) The direction in which the splitter is moved depends on the screen layout. If the windows are positioned horizontally, the splitter also moves horizontally. If the windows are positioned vertically, the splitter also moves vertically. Range: 0 to 100

Example:

```
LAY:SPL 1,3,50
```

Moves the splitter between window 1 ('Frequency Sweep') and 3 ('Marker Table') to the center (50%) of the screen, i.e. in the figure above, to the left.

Example:

```
LAY:SPL 1,4,70
```

Moves the splitter between window 1 ('Frequency Sweep') and 3 ('Marker Peak List') towards the top (70%) of the screen.

The following commands have the exact same effect, as any combination of windows above and below the splitter moves the splitter vertically.

```
LAY:SPL 3,2,70
```

```
LAY:SPL 4,1,70
```

```
LAY:SPL 2,1,70
```

Usage:

Setting only

LAYout:WINDow<n>:ADD? <Direction>,<WindowType>

Adds a measurement window to the display. Note that with this command, the suffix <n> determines the existing window next to which the new window is added. Unlike [LAYout:ADD\[:WINDow\]?](#), for which the existing window is defined by a parameter.

To replace an existing window, use the [LAYout:WINDow<n>:REPLace](#) command.

Is always used as a query so that you immediately obtain the name of the new window as a result.

Suffix:

<n> [Window](#)

Query parameters:

<Direction> LEFT | RIGHT | ABOVE | BELOW

<WindowType> Type of measurement window you want to add.
See [LAYout:ADD\[:WINDow\]?](#) on page 167 for a list of available window types.

Return values:

<NewWindowName> When adding a new window, the command returns its name (by default the same as its number) as a result.

Example:

```
LAY:WIND1:ADD? LEFT,MTAB
```

Result:

```
'2'
```

Adds a new window named '2' with a marker table to the left of window 1.

Usage:

Query only

LAYout:WINDow<n>:IDENtify?

Queries the **name** of a particular display window (indicated by the <n> suffix) in the active channel.

Note: to query the **index** of a particular window, use the [LAYout:IDENtify\[:WINDow\]?](#) command.

Suffix:

<n> [Window](#)

Return values:

<WindowName> String containing the name of a window.
In the default state, the name of the window is its index.

Example:

```
LAY:WIND2:IDEN?
```

Queries the name of the result display in window 2.

Response:

```
'2'
```

Usage:

Query only

LAYout:WINDow<n>:REMOve

Removes the window specified by the suffix <n> from the display in the active channel.

The result of this command is identical to the [LAYout:REMOve\[:WINDow\]](#) command.

Suffix:

<n> [Window](#)

Example:

```
LAY:WIND2:REM
```

Removes the result display in window 2.

Usage:

Event

LAYout:WINDow<n>:REPLace <WindowType>

Changes the window type of an existing window (specified by the suffix <n>) in the active channel.

The effect of this command is identical to the `LAYout:REPLace[:WINDow]` command.

To add a new window, use the `LAYout:WINDow<n>:ADD?` command.

Suffix:

<n> [Window](#)

Setting parameters:

<WindowType> Type of measurement window you want to replace another one with.
See `LAYout:ADD[:WINDow]?` on page 167 for a list of available window types.

Example:

`LAY:WIND2:REPL MTAB`

Replaces the result display in window 2 with a marker table.

Usage:

Setting only

LAYout:WINDow<n>:TYPE?

Queries the window type of the window specified by the index <n>. For a list of possible window types see `LAYout:ADD[:WINDow]?` on page 167.

Suffix:

<n> [Window](#)

Example:

`LAY:WIND2:TYPE?`

Usage:

Query only

5.5 Performing amplifier measurements

- [Performing measurements](#)..... 174

5.5.1 Performing measurements

You can include the Amplifier measurements in a sequence of measurements. For a comprehensive description of commands required to do so, refer to the FSW User Manual.

INITiate<n>:CONMeas	175
INITiate<n>:CONTinuous	175
INITiate<n>[:IMMEDIATE]	175
INITiate:SEQuencer:ABORT	176
INITiate:SEQuencer:IMMEDIATE	176
INITiate:SEQuencer:MODE	176
SYSTem:SEQuencer	177
[SENSe:]ADJust:TIME:TRIGger	177

INITiate<n>:CONMeas

Restarts a (single) measurement that has been stopped (using `ABORT`) or finished in single measurement mode.

The measurement is restarted at the beginning, not where the previous measurement was stopped.

As opposed to `INITiate<n>[:IMMEDIATE]`, this command does not reset traces in maxhold, minhold or average mode. Therefore it can be used to continue measurements using maxhold or averaging functions.

Suffix:

<n> irrelevant

Usage:

Asynchronous command

Manual operation: See "[Continue Single Sweep](#)" on page 48

INITiate<n>:CONTinuous <State>

Controls the measurement mode for an individual channel.

Note that in single measurement mode, you can synchronize to the end of the measurement with `*OPC`, `*OPC?` or `*WAI`. In continuous measurement mode, synchronization to the end of the measurement is not possible. Thus, it is not recommended that you use continuous measurement mode in remote control, as results like trace data or markers are only valid after a single measurement end synchronization.

For details on synchronization see [Remote control via SCPI](#).

Suffix:

<n> irrelevant

Parameters:

<State> ON | OFF | 0 | 1
ON | 1
 Continuous measurement
OFF | 0
 Single measurement
 *RST: 1 (some applications can differ)

Example:

```
INIT:CONT OFF
Switches the measurement mode to single measurement.
INIT:CONT ON
Switches the measurement mode to continuous measurement.
```

Manual operation: See "[Continuous Sweep / Run Cont](#)" on page 47

INITiate<n>[:IMMEDIATE]

Starts a (single) new measurement.

You can synchronize to the end of the measurement with `*OPC`, `*OPC?` or `*WAI`.

For details on synchronization see [Remote control via SCPI](#).

Suffix:

<n> irrelevant

Usage:

Asynchronous command

Manual operation: See "[Single Sweep / Run Single](#)" on page 47

INITiate:SEQuencer:ABORt

Stops the currently active sequence of measurements.

You can start a new sequence any time using [INITiate:SEQuencer:IMMediate](#) on page 176.

Usage:

Event

INITiate:SEQuencer:IMMediate

Starts a new sequence of measurements by the Sequencer.

Its effect is similar to the [INITiate<n>\[:IMMediate\]](#) command used for a single measurement.

Before this command can be executed, the Sequencer must be activated (see [SYSTem:SEQuencer](#) on page 177).

Example:

```
SYST:SEQ ON
```

Activates the Sequencer.

```
INIT:SEQ:MODE SING
```

Sets single sequence mode so each active measurement is performed once.

```
INIT:SEQ:IMM
```

Starts the sequential measurements.

INITiate:SEQuencer:MODE <Mode>

Defines the capture mode for the entire measurement sequence and all measurement groups and channels it contains.

Note: To synchronize to the end of a measurement sequence using *OPC, *OPC? or *WAI, use [SINGLE](#) Sequencer mode.

Parameters:

<Mode>

SINGLE

Each measurement group is started one after the other in the order of definition. All measurement channels in a group are started simultaneously and performed once. After *all* measurements are completed, the next group is started. After the last group, the measurement sequence is finished.

CONTInuous

Each measurement group is started one after the other in the order of definition. All measurement channels in a group are started simultaneously and performed once. After *all* measurements are completed, the next group is started. After the last group, the measurement sequence restarts with the first one and continues until it is stopped explicitly.

*RST: CONTInuous

SYSTem:SEQuencer <State>

Turns the Sequencer on and off. The Sequencer must be active before any other Sequencer commands (`INIT:SEQ...`) are executed, otherwise an error occurs.

Parameters:

<State> ON | OFF | 0 | 1

ON | 1

The Sequencer is activated and a sequential measurement is started immediately.

OFF | 0

The Sequencer is deactivated. Any running sequential measurements are stopped. Further Sequencer commands (`INIT:SEQ...`) are not available.

*RST: 0

Example:

SYST:SEQ ON

Activates the Sequencer.

INIT:SEQ:MODE SING

Sets single Sequencer mode so each active measurement is performed once.

INIT:SEQ:IMM

Starts the sequential measurements.

SYST:SEQ OFF

[SENSe:]ADJust:TIME:TRIGger

Calculates the time trigger.

Example: [SENSe]:ADJust:TIME:TRIGger

Usage: Event

5.6 Configuring amplifier measurements

- [Designing a reference signal](#)..... 178
- [Selecting and configuring the input source](#)..... 194
- [Power sensor measurements](#)..... 222
- [Configuring the frequency](#)..... 234

• Defining level characteristics.....	235
• Controlling a signal generator.....	242
• Configuring the data capture.....	252
• Sweep configuration.....	257
• Synchronizing measurement data.....	259
• Defining the evaluation range.....	263
• Estimating and compensating signal errors.....	265
• Applying a system model.....	271
• Applying digital predistortion.....	273
• Detailed MSE.....	293
• Trigger.....	294
• Configuring envelope tracking.....	296
• Configuring ACLR measurements.....	297
• Configuring power measurements.....	303
• Configuring parameter sweeps.....	303
• Configuring power servoing.....	307
• Frequency domain measurements.....	310

5.6.1 Designing a reference signal

CONFigure:REFSignal:CGW:AMODE[:STATe].....	179
CONFigure:REFSignal:CGW:LEDState?.....	179
CONFigure:REFSignal:CGW:READ.....	180
CONFigure:REFSignal:CGW:DPIPower.....	180
CONFigure:REFSignal:CGW:ETGenerator[:STATe].....	180
CONFigure:REFSignal:CGW:FPAth.....	181
CONFigure:REFSignal:CGW:LEDState?.....	181
CONFigure:REFSignal:CGW:WRITe.....	182
CONFigure:REFSignal:GOS:BWIDth.....	182
CONFigure:REFSignal:GOS:CRESt.....	183
CONFigure:REFSignal:GOS:DCYCLe.....	183
CONFigure:REFSignal:GOS:FPAth.....	183
CONFigure:REFSignal:GOS:LEDState?.....	183
CONFigure:REFSignal:GOS:NPOSition.....	184
CONFigure:REFSignal:GOS:NWIDth.....	184
CONFigure:REFSignal:GOS:PATH.....	185
CONFigure:REFSignal:GOS:RLENgth.....	185
CONFigure:REFSignal:GOS:SLENgth.....	185
CONFigure:REFSignal:GOS:SRATe.....	185
CONFigure:REFSignal:GOS:WNAME.....	186
CONFigure:REFSignal:GOS:WRITe.....	186
CONFigure:REFSignal:SEGMENT.....	186
CONFigure:REFSignal:SINFo:FPAth?.....	187
CONFigure:REFSignal:SINFo:SLENgth?.....	187
CONFigure:REFSignal:SINFo:SRATe?.....	187
CONFigure:REFSignal:SINFo:CFACtor?.....	188
CONFigure:REFSignal:SINFo:OBW?.....	188
CONFigure:CFReduction[:STATe].....	188
CONFigure:CFReduction[:STATe]:LEDState?.....	188

CONFigure:CFReduction:SBANdwidth.....	188
CONFigure:CFReduction:SBANdwidth:AUTO.....	189
CONFigure:CFReduction:SBANdwidth:LEDState?.....	189
CONFigure:CFReduction:RSORignal.....	189
CONFigure:CFReduction:ITERations.....	189
CONFigure:CFReduction:ITERations:LEDState?.....	190
CONFigure:CFReduction:FILTer.....	190
CONFigure:CFReduction:FILTer:LEDState?.....	190
CONFigure:CFReduction:CSPacing.....	190
CONFigure:CFReduction:CSPacing:AUTO.....	190
CONFigure:CFReduction:CSPacing:LEDState?.....	191
CONFigure:CFReduction:CFDelta.....	191
CONFigure:CFReduction:CFDelta:LEDState?.....	191
CONFigure:CFReduction:CCFactor?.....	191
CONFigure:CFReduction:APPLY.....	192
CONFigure:CFReduction:APPLY:LEDState?.....	192
CONFigure:CFReduction:READ.....	192
CONFigure:CFReduction:READ:LEDState?.....	192
CONFigure:CFReduction:MFORder.....	192
CONFigure:CFReduction:MFORder:LEDState?.....	193
CONFigure:CFReduction:PFRequency.....	193
CONFigure:CFReduction:PFRequency:LEDState?.....	193
CONFigure:CFReduction:SFRequency.....	193
CONFigure:CFReduction:SFRequency:LEDState?.....	194

CONFigure:REFSignal:CGW:AMODE[:STATE] <State>

Sets and queries the "Force ARB Mode" setting.

Parameters:

<State> ON | OFF | 1 | 0

Example:

CONFigure:REFSignal:CGW:AMODE:STAT ON

Manual operation: See "[Designing a reference signal on a signal generator](#)" on page 51

CONFigure:REFSignal:CGW:LEDState?

This command queries the processing state of the reference signal generation if the reference signal was designed on a signal generator.

Prerequisites for this command

- Configure reference signal on a signal generator.

Return values:

<State> **GREen**
Reference signal was successfully generated and loaded into the application.

GREY
Unknown processing state.

RED

Reference signal was not successfully generated or loaded into the application.

Example: `CONF:REFS:CGW:READ`
`CONF:REFS:CGW:LEDS?`
 would return, e.g.
 GRE

Usage: Query only

Manual operation: See "[Designing a reference signal on a signal generator](#)" on page 51

CONFigure:REFSignal:CGW:READ

This command transfers a reference signal designed on a signal generator into the R&S FSW-K18.

Example: `//Import reference signal data from the generator`
`CONF:REFS:CGW:READ`

Usage: Event

Manual operation: See "[Designing a reference signal on a signal generator](#)" on page 51

CONFigure:REFSignal:CWF:DPIPower <Power>

This command defines the peak input power of the DUT.

This is necessary when you turn off `CONFigure:REFSignal:CWF:ETGenerator[:STATe]` (otherwise, the command has no effect).

Prerequisites for this command

- Generate reference signal with a waveform file

Parameters:

<Power> <numeric value>
 Default unit: dBm

Example: `//Define DUT input power`
`CONF:REFS:CWF:ETG OFF`
`CONF:REFS:CWF:DPIP 3`

Manual operation: See "[Designing a reference signal in a waveform file](#)" on page 52

CONFigure:REFSignal:CWF:ETGenerator[:STATe] <State>

This command turns the transfer of the reference signal data to a generator on and off.

Prerequisites for this command

- Generate reference signal with a waveform file

Parameters:

<State>

ON | 1

Reference signal data is transferred to the generator and generated with the generator.

OFF | 0

Reference signal data is loaded into the application without transferring the waveform to the generator.

When you turn it off, you have to define the peak input power of the DUT with `CONFigure:REFSignal:CWF:DPIPower`. Otherwise, measurement result may be invalid.

*RST: 1

Example:

//Generate reference signal without transferring the waveform file to a generator.

```
CONF:REFS:CWF:ETG OFF
```

Manual operation: See "[Designing a reference signal in a waveform file](#)" on page 52

CONFigure:REFSignal:CWF:FPATH <FileName>

This command selects a waveform file containing a reference signal.

Parameters:

<FileName>

String containing the name and path to the waveform file.

Example:

//Select a waveform file

```
CONF:REFS:CWF:FPAT 'C:\RefSignal.wv'
```

Manual operation: See "[Designing a reference signal in a waveform file](#)" on page 52

CONFigure:REFSignal:CWF:LEDState?

This command queries the processing status of a reference signal generated with a waveform file.

Available when you generate the reference signal with a waveform file.

Return values:

<State>

GREen

The reference signal was successfully loaded into the application.

When `CONFigure:REFSignal:CWF:ETGenerator[STATE]` = ON, this also indicates that the waveform file was accepted by the signal generator.

GREY

Unknown processing state.

RED

The reference signal could not have been loaded into the application.

When `CONF:REFSignal:CWF:ETGenerator[:STATe] = ON`, this could also mean that the waveform file was not accepted by the signal generator.

Example:

```
CONF:REFS:CWF:FPAT 'C:\RefSignal.wv'
CONF:REFS:CWF:WRITE
CONF:REFS:CWF:LEDS?
would return, e.g.
GRE
```

Usage:

Query only

Manual operation:

See ["Designing a reference signal in a waveform file"](#) on page 52

CONF:REFSignal:CWF:WRITE

This command loads a reference signal based on a waveform file into the application.

When you turn on the reference signal export to the generator (`CONF:REFSignal:CWF:ETGenerator[:STATe]`), the command also transfers the waveform file to the generator.

Make sure to synchronize with `*OPC?` or `*WAI` to make sure that the command was successfully applied on the generator before sending the next command.

Example:

```
//Load the reference signal into the application and, if the feature
has been turned on, transfer the reference signal to the genera-
tor
CONF:REFS:CWF:FPAT 'C:\RefSignal.wv';
CONF:REFS:CWF:WRITE;*WAI
```

Usage:

Event

Manual operation:

See ["Designing a reference signal in a waveform file"](#) on page 52

CONF:REFSignal:GOS:BWIDth <Bandwidth>

This command defines the bandwidth of the internally generated reference signal.

Parameters:

<Bandwidth> <numeric value>
Default unit: Hz

Example:

```
//Define reference signal bandwidth
CONF:REFS:GOS:BWID 10MHZ
```

Manual operation:

See ["Signal Bandwidth"](#) on page 55

CONFigure:REFSignal:GOS:CRESt <CrestFactor>

This command defines the crest factor of the internally generated reference signal.

Parameters:

<CrestFactor> <numeric value>
 Default unit: dB

Example: //Define crest factor
 CONF:REFS:GOS:CRES 15

Manual operation: See "[Target Crest Factor](#)" on page 56

CONFigure:REFSignal:GOS:DCYClE <DutyCycle>

This command defines the duty cycle of an internally generated pulsed reference signal.

Parameters:

<DutyCycle> <numeric value>
 Default unit: %

Example: //Define duty cycle
 CONF:REFS:GOS:DCYC 75

Manual operation: See "[Pulse Duty Cycle](#)" on page 56

CONFigure:REFSignal:GOS:FPATh <FilePath>

Defines the name and path of the user-defined reference waveform file when loaded to the analyzer.

Parameters:

<FilePath> String containing the path and name of the file.

Example: //Generator control disabled
 //Define waveform file name and path on the analyzer
 CONF:REFS:GOS:FPATh 'C:\RefSignal.wv'
 //Create waveform file on generator and load it to analyzer in
 specified path
 CONF:REFS:GOS:WRIT
 Select the waveform file containing the reference signal
 CONF:REFS:CWF:FPAT 'C:\RefSignal.wv'
 //Load waveform file to analyzer in specified path
 CONF:REFS:CWF:WRITE;*WAI

CONFigure:REFSignal:GOS:LEDState?

This command queries the processing status of an internally generated reference signal.

Available when you configure the reference signal within the R&S FSW-K18.

Return values:

<State>

GREen

Generation of the internally generated reference signal was successful. Transmission of the waveform file to the signal generator was also successful.

GREY

Unknown transmission state.

RED

Generation and / or transmission of the internally generated reference signal was not successful.

Example:

```
CONF:REFS:GOS:WRITE
CONF:REFS:GOS:LEDS?
would return, e.g.
GRE
```

Usage:

Query only

Manual operation:

See "[Designing a reference signal within the R&S FSW-K18](#)" on page 54

CONFigure:REFSignal:GOS:NPosition <Frequency>

This command defines the offset of a notch relative to the center frequency in the internally generated reference signal.

Parameters:

<Frequency> <numeric value>
Default unit: Hz

Example:

```
//Define a notch offset
CONF:REFS:GOS:NPOS 10000
```

Manual operation:

See "[Notch Position](#)" on page 57

CONFigure:REFSignal:GOS:NWidth <Frequency>

This command defines the notch width of an internally generated reference signal.

Parameters:

<Frequency> <numeric value>
Default unit: Hz

Example:

```
//Define notch width
CONF:REFS:GOS:NWID 150000
```

Manual operation:

See "[Notch Width](#)" on page 56

CONFigure:REFSignal:GOS:PATH <FileName>

Defines the path to load user-defined reference waveform files to. If you do not specify a path, the file is loaded to C:\R_S\INSTR\USER\K18\ReferenceFiles.

Parameters:

<FileName> String containing the path of the file.

Example:

```
//Enable generator control
CONF:GEN:CONT ON
//Define waveform file name
CONF:REFSignal:GOS:WNAME 'RefFile'
//Define storage location for waveform file on analyzer after loading
CONF:REFS:GOS:PATH 'c:\user\'
//Create waveform file on generator and load it to analyzer in specified path
CONF:REFSignal:GOS:WRIT
```

CONFigure:REFSignal:GOS:RLENgth <Samples>

This command defines the ramp length of an internally generated pulsed reference signal.

Parameters:

<Samples> <numeric value>: (integer only)
Number of samples on each side of the pulse (= ramp length).
Default unit: Samples

Example:

```
//Define ramp length
CONF:REFS:GOS:RLEN 5
```

Manual operation: See ["Ramp Length"](#) on page 56

CONFigure:REFSignal:GOS:SLENgth <Samples>

This command defines the length of the internally generated reference signal.

Parameters:

<Samples> <numeric value>: (integer only)
Default unit: Samples

Example:

```
//Define reference signal size
CONF:REFS:GOS:SLEN 1024
```

Manual operation: See ["Signal Length"](#) on page 56

CONFigure:REFSignal:GOS:SRATe <SampleRate>

This command defines the clock (or sample) rate of the internally generated reference signal.

Parameters:

<SampleRate> <numeric value>
 Default unit: Hz

Example:

```
//Defines sample rate
CONF:REFS:GOS:SRAT 20000000
```

CONFigure:REFSignal:GOS:WNAME <FileName>

This command defines a file name for the waveform of the reference signal.

Parameters:

<FileName> String containing the name of the waveform file.
 The file extension (.wav) is added automatically.

Example:

```
//Define name for the waveform file
CONF:REFS:GOS:WNAME 'RefSignal'
```

Manual operation: See ["Waveform File Name"](#) on page 56

CONFigure:REFSignal:GOS:WRITE

This command internally generates the reference signal based on the signal characteristics that you have defined.

The waveform file that has been created is loaded into the DSP of the R&S FSW-K18 and is additionally transferred into the ARB of the signal generator.

Make sure to synchronize with *OPC? or *WAI to make sure that the command was successfully applied on the generator before sending the next command.

Example:

```
//Generate the reference signal and transfer it into the
R&S FSW-K18. In addition, the waveform file that has been cre-
ated is transferred into the signal generator.
CONF:REFS:GOS:WRITE; *WAI
```

Usage:

Event

Manual operation: See ["Designing a reference signal within the R&S FSW-K18"](#) on page 54

CONFigure:REFSignal:SEGMENT <Segment>

This command selects the segment of the reference signal that should be used in the measurement when the reference signal is based on a multi segment waveform file.

Parameters:

<Segment> <numeric value>: (integer only)
 Range: Depends on the number of segments in the wave-
 form file.
 *RST: 0

Example: //Select a segment
CONF:REFS:SEGM 3

Manual operation: See ["Using multi-segment waveform files"](#) on page 50

CONFigure:REFSignal:SINFo:FPATH?

This command queries the file name and location of the currently used reference signal.

Return values:

<FileName> String containing the file name and location of the file.

Example: CONF:REFS:SINF:FPAT?
would return, e.g.
C:\waveform.wv

Usage: Query only

Manual operation: See ["Reference signal information"](#) on page 49

CONFigure:REFSignal:SINFo:SLENgth?

This command queries the sample length of the currently used reference signal.

Return values:

<Samples> <numeric value>: (integer only)
Default unit: Samples

Example: CONF:REFS:SINF:SLEN?
would return, e.g.
40000

Usage: Query only

Manual operation: See ["Reference signal information"](#) on page 49

CONFigure:REFSignal:SINFo:SRATe?

This command queries the sample rate of the currently used reference signal.

Return values:

<SampleRate> <numeric value>
Default unit: Hz

Example: CONF:REFS:SINF:SRAT?
would return, e.g.
32000000

Usage: Query only

Manual operation: See ["Reference signal information"](#) on page 49

CONFigure:REFSignal:SINFo:CFACTOR?

Returns the crest factor of the reference signal.

Return values:

<CrestFactor> <numeric value>

Example: CONFigure:REFSignal:SINFo:CFACTOR?

Usage: Query only

Manual operation: See "[Reference signal information](#)" on page 49

CONFigure:REFSignal:SINFo:OBW?

Returns the occupied bandwidth of the reference signal.

Return values:

<Bandwidth> <numeric value>

Example: CONFigure:REFSignal:SINFo:OBW?

Usage: Query only

Manual operation: See "[Reference signal information](#)" on page 49

CONFigure:CFReduction[:STATe] <State>

Enables the crest factor reduction calculation.

Parameters:

<State>

Example: CONFigure:CFR ON

Manual operation: See "[Crest Factor Reduction State](#)" on page 58

CONFigure:CFReduction[:STATe]:LEDState?

Reads the LED status of the crest factor reduction calculation.

Return values:

<State> GREY | RED | GREen

Example: CONFigure:CFReduction:STATe:LEDState

Usage: Query only

Manual operation: See "[Crest Factor Reduction State](#)" on page 58

CONFigure:CFReduction:SBANdwidth <Time>

Sets and queries the signal bandwidth.

Parameters:

<Time> <numeric value>
 Default unit: Hz

Example: CONF:CFR:SBAN 10MHz

Manual operation: See "[Signal Bandwidth](#)" on page 59

CONFigure:CFReduction:SBANdwidth:AUTO <State>

Sets and queries the signal bandwidth mode.

Parameters:

<State>

Example: CONFigure:CFReduction:SBANdwidth:AUTO ON

Manual operation: See "[Signal Bandwidth](#)" on page 59

CONFigure:CFReduction:SBANdwidth:LEDState?

Reads the LED status of the signal bandwidth.

Return values:

<State> GREY | RED | GREen

Example: CONFigure:CFReduction:SBANdwidth:LEDState

Usage: Query only

Manual operation: See "[Signal Bandwidth](#)" on page 59

CONFigure:CFReduction:RSORignal <State>

Switches the EVM reference signal.

Parameters:

<State>

Example: CONFigure:CFReduction:RSORignal ON

Manual operation: See "[EVM Ref. Signal](#)" on page 59

CONFigure:CFReduction:ITERations <Iterations>

Sets and queries the crest factor reduction maximum iterations.

Parameters:

<Iterations> <numeric value>

Example: CONFigure:CFReduction:ITERations 2

Manual operation: See "[Max Iterations](#)" on page 59

CONFigure:CFReduction:ITERations:LEDState?

Reads the LED status of the crest factor reduction maximum iterations.

Return values:

<State> GREY | RED | GREen

Example: CONFigure:CFReduction:ITERations:LEDState

Usage: Query only

Manual operation: See "[Max Iterations](#)" on page 59

CONFigure:CFReduction:FILTer <FilterMode>

Selects simple or enhanced filter mode for crest factor reduction.

Parameters:

<FilterMode> SIMPlE | ENHanced

Example: CONFigure:CFReduction:FILTer ENH

Manual operation: See "[Filter Mode](#)" on page 59

CONFigure:CFReduction:FILTer:LEDState?

Reads the LED status of crest factor reduction filter mode.

Return values:

<State> GREY | RED | GREen

Example: CONFigure:CFReduction:FILTer:LEDState

Usage: Query only

Manual operation: See "[Filter Mode](#)" on page 59

CONFigure:CFReduction:CSPacing <Time>

Sets and queries the crest factor reduction channel spacing.

Parameters:

<Time> <numeric value>

Default unit: Hz

Example: CONF:CFR:CSP 10MHz

Manual operation: See "[Channel Spacing](#)" on page 60

CONFigure:CFReduction:CSPacing:AUTO <State>

Sets and queries the crest factor reduction channel spacing mode.

Parameters:

<State>

Example: `CONFigure:CFReduction:CSPacing:AUTO ON`

Manual operation: See ["Channel Spacing"](#) on page 60

CONFigure:CFReduction:CSPacing:LEDState?

Reads the LED status of the crest factor reduction channel spacing.

Return values:

<State> GREY | RED | GREen

Example: `CONFigure:CFReduction:CSPacing:LEDState`

Usage: Query only

Manual operation: See ["Channel Spacing"](#) on page 60

CONFigure:CFReduction:CFDelta <CFDelta>

Sets the value difference by which you want to change the crest factor.

Parameters:

<CFDelta> <numeric value>
Default unit: dB

Example: `CONFigure:CFReduction:CFDelta 10`

Manual operation: See ["Crest Factor Delta"](#) on page 59

CONFigure:CFReduction:CFDelta:LEDState?

Reads the LED status of the crest factor delta.

Return values:

<State> GREY | RED | GREen

Example: `CONFigure:CFReduction:CFDelta:LEDState`

Usage: Query only

Manual operation: See ["Crest Factor Delta"](#) on page 59

CONFigure:CFReduction:CCFactor?

Queries the crest factor of the waveform after the calculation of the resulting crest factor is completed.

Return values:

<CCF>

Example: `CONFigure:CFReduction:CCFactor?`

Usage: Query only

Manual operation: See ["Current Crest Factor"](#) on page 59

CONFigure:CFReduction:APPLY

Applies crest factor reduction on the connected signal generator.

Only available for backward compatibility, use [CONFigure:CFReduction:READ](#) on page 192 instead.

Example: `CONFigure:CFReduction:APPLY`

Usage: Event

CONFigure:CFReduction:APPLY:LEDState?

Reads the LED status of crest factor reduction apply on the connected signal generator.

Only available for backward compatibility, use [CONFigure:CFReduction:READ:LEDState?](#) on page 192 instead.

Return values:

<State> GREY | RED | GREen

Example: `CONFigure:CFReduction:APPLY:LEDState`

Usage: Query only

CONFigure:CFReduction:READ

Applies crest factor reduction on the connected signal generator.

Example: `CONFigure:CFReduction:READ`

Usage: Event

Manual operation: See "[Read CFR from Generator, Load](#)" on page 60

CONFigure:CFReduction:READ:LEDState?

Reads the LED status of crest factor reduction apply on the connected signal generator.

Return values:

<State> GREY | RED | GREen

Example: `CONFigure:CFReduction:READ:LEDState`

Usage: Query only

Manual operation: See "[Read CFR from Generator, Load](#)" on page 60

CONFigure:CFReduction:MFORder <MaximumFilterOrder>

Sets and queries the maximum filter order for crest factor reduction.

Parameters:`<MaximumFilterOrder>` numeric value**Example:** `CONF:CFR:MFOR 100`**Manual operation:** See "[Maximum Filter Order](#)" on page 60**CONFigure:CFReduction:MFORder:LEDState?**

Reads the LED status of crest factor reduction maximum filter order.

Return values:`<State>` GREY | RED | GREen**Example:** `CONFigure:CFReduction:MFORder:LEDState`**Usage:** Query only**Manual operation:** See "[Maximum Filter Order](#)" on page 60**CONFigure:CFReduction:PFRequency <Time>**

Sets and queries the passband frequency for crest factor reduction.

Parameters:`<Time>` numeric value
Default unit: Hz**Example:** `CONF:CFR:PFR 10MHz`**Manual operation:** See "[Passband Frequency](#)" on page 60**CONFigure:CFReduction:PFRequency:LEDState?**

Reads the LED status of crest factor reduction passband frequency.

Return values:`<State>` GREY | RED | GREen**Example:** `CONFigure:CFReduction:PFRequency:LEDState`**Usage:** Query only**Manual operation:** See "[Passband Frequency](#)" on page 60**CONFigure:CFReduction:SFRequency <Time>**

Sets and queries the stopband frequency for crest factor reduction.

Parameters:`<Time>` numeric value
Default unit: Hz**Example:** `CONF:CFR:SFR 10MHz`

Manual operation: See ["Stopband Frequency"](#) on page 60

CONFigure:CFReduction:SFRequency:LEDState?

Reads the LED status of crest factor reduction stopband frequency.

Return values:

<State> GREY | RED | GREen

Example: CONFigure:CFReduction:SFRequency:LEDState

Usage: Query only

Manual operation: See ["Stopband Frequency"](#) on page 60

5.6.2 Selecting and configuring the input source

The following commands are required to configure data input and output.

- [RF input](#).....194
- [Remote commands for external frontend control](#).....200

5.6.2.1 RF input

CALibration:AIQ:HATiming[:STATe] <State>

Activates a mode with enhanced timing accuracy between analog baseband, RF and external trigger signals.

Parameters:

<State> ON | OFF | 0 | 1
OFF | 0
 Switches the function off
ON | 1
 Switches the function on

Example: CAL:AIQ:HAT:STAT ON

Manual operation: See ["High Accuracy Timing Trigger - Baseband - RF"](#) on page 65

INPut:CONNector <ConnType>

Determines which connector the input for the measurement is taken from.

If an external frontend is active, the connector is automatically set to RF.

Parameters:

<ConnType> **RF**
 RF input connector

AIQI

Analog Baseband I connector

This setting is only available if the "Analog Baseband" interface (FSW-B71) is installed and active for input. It is not available for the FSW67 or FSW85.

For more information on the "Analog Baseband" interface (FSW-B71), see the FSW I/Q Analyzer and I/Q Input User Manual.

RFPRobe

Active RF probe

*RST: RF

Example:

INP:CONN RF

Selects input from the RF input connector.

Manual operation: See ["Input Connector"](#) on page 64

INPut:COUPling <CouplingType>

Selects the coupling type of the RF input.

If an external frontend is active, the coupling is automatically set to AC.

Parameters:

<CouplingType> AC | DC

AC

AC coupling

DC

DC coupling

*RST: AC

Example:

INP:COUP DC

Manual operation: See ["Input Coupling"](#) on page 62

INPut:DPATH <DirectPath>

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

If an external frontend is active, the direct path is always used.

Parameters:

<DirectPath> AUTO | OFF

AUTO | 1

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

OFF | 0

The analog mixer path is always used.

Example:

INP:DPAT OFF

Manual operation: See ["Direct Path"](#) on page 63

INPut:FILE:PATH <FileName>[, <AnalysisBW>]

Selects the I/Q data file to be used as input for further measurements.

The I/Q data file must be in one of the following supported formats:

- .iq.tar
- .iqw
- .csv
- .mat
- .wv
- .aid

Only a single data stream or channel can be used as input, even if multiple streams or channels are stored in the file.

For some file formats that do not provide the sample rate and measurement time or record length, you must define these parameters manually. Otherwise the traces are not visible in the result displays.

Parameters:

<FileName> String containing the path and name of the source file.
The file type is determined by the file extension. If no file extension is provided, the file type is assumed to be .iq.tar.
For .mat files, Matlab® v4 is assumed.

<AnalysisBW> Optionally: The analysis bandwidth to be used by the measurement. The bandwidth must be smaller than or equal to the bandwidth of the data that was stored in the file.
Default unit: HZ

Example: INP:FILE:PATH 'C:\R_S\Instr\user\data.iq.tar'
Uses I/Q data from the specified file as input.

Example: //Load an IQW file
INP:SEL:FIQ
INP:FILE:PATH 'C:\R_S\Instr\user\data.iqw'
//Define the sample rate
TRAC:IQ:SRAT 10MHz
//Define the measurement time
SENSE:SWEp:TIME 0.001001
//Start the measurement
INIT:IMM

Manual operation: See "[Select I/Q data file](#)" on page 67

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

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

Requires an additional high-pass filter hardware option.

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

Parameters:

<State> ON | OFF | 0 | 1
OFF | 0
 Switches the function off
ON | 1
 Switches the function on
 *RST: 0

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

Manual operation: See "[High Pass Filter 1 to 3 GHz](#)" on page 63

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

Enables or disables the YIG filter.

Parameters:

<State> ON | OFF | 0 | 1

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

Manual operation: See "[YIG-Preselector](#)" on page 63

INPut:IMPedance <Impedance>

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

Parameters:

<Impedance> 50 | 75
 *RST: 50 Ω
 Default unit: OHM

Example: INP:IMP 75

Manual operation: See "[Impedance](#)" on page 62

INPut:IQ:BALanced[:STATe] <State>

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

Parameters:

<State> ON | OFF | 1 | 0
ON | 1
 Differential

OFF | 0

Single ended

*RST: 1

Example: INP:IQ:BAL OFF**Manual operation:** See "[Input Configuration](#)" on page 65**INPut:SElect** <Source>

Selects the signal source for measurements, i.e. it defines which connector is used to input data to the FSW.

If no additional input options are installed, only RF input or file input is supported.

Only selects the RF input or file input. To select the analog baseband input, you have to use `INPut:SElect:BBANalog[:STATE]`.

For FSW85 models with two RF input connectors, you must select the input connector to configure first using `INPut:TYPE`.

Parameters:

<Source>

RF

Radio Frequency ("RF INPUT" connector)

FIQ

I/Q data file

(selected by `INPut:FILE:PATH` on page 196)

Not available for Input2.

AIQ

Analog Baseband signal (only available with optional "Analog Baseband" interface)

Not available for Input2.

RFAiq

RF and analog baseband input active at the same time (for envelope tracking only).

*RST: RF

Example: INP:TYPE INP1

For FSW85 models with two RF input connectors: selects the 1.00 mm RF input connector for configuration.

INP:SEL RF

Manual operation: See "[I/Q Input File State](#)" on page 66**INPut:SElect:BBANalog[:STATE]** <State>

This command turns simultaneous use of RF input and analog baseband input on and off.

Parameters:

<State>

ON | OFF | 1 | 0

Example: `INP:SEL:BBAN ON`
Turns on the analog baseband input.

Manual operation: See ["Enable Parallel BB Capture"](#) on page 65

INPut:TYPE <Input>

The command selects the input path.

Parameters:

<Input>

INPUT1

Selects RF input 1.
1 mm [RF Input] connector

INPUT2

Selects RF input 2.
For FSW85 models with two RF input connectors:
1.85 mm [RF2 Input] connector
For all other models: not available

*RST: INPUT1

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

MMEMory:LOAD:IQ:STReam <Channel>

Only available for files that contain more than one data stream from multiple channels: selects the data stream to be used as input for the currently selected channel.

Automatic mode (`MMEMory:LOAD:IQ:STReam:AUTO`) is set to OFF.

Parameters:

<Channel>

String containing the channel name.

Example:

```
MMEM:LOAD:IQ:STR?
//Result: 'Channel1','Channel2'
MMEM:LOAD:IQ:STR 'Channel2'
```

Manual operation: See ["Selected Channel"](#) on page 67

MMEMory:LOAD:IQ:STReam:AUTO <State>

Only available for files that contain more than one data stream from multiple channels: automatically defines which data stream in the file is used as input for the channel.

Parameters:

<State>

ON | OFF | 0 | 1

OFF | 0

The data stream specified by `MMEMory:LOAD:IQ:STReam` is used as input for the channel.

ON | 1

The first data stream in the file is used as input for the channel. Applications that support multiple data streams use the first data stream in the file for the first input stream, the second for the second stream etc.

```
*RST:      1
```

Manual operation: See "[Selected Channel](#)" on page 67

MMEMory:LOAD:IQ:STReam:LIST?

Returns the available channels in the currently loaded input file.

Example:

```
MMEM:LOAD:IQ:STR?
//Result: 'Channel1','Channel2'
```

Usage: Query only

Manual operation: See "[Selected Channel](#)" on page 67

TRACe:IQ:FILE:REPetition:COUNt <RepetitionCount>

Determines how often the data stream is repeatedly copied in the I/Q data memory. If the available memory is not sufficient for the specified number of repetitions, the largest possible number of complete data streams is used.

Parameters:

<RepetitionCount> integer

Example:

```
TRAC:IQ:FILE:REP:COUN 3
```

Manual operation: See "[File Repetitions](#)" on page 67

5.6.2.2 Remote commands for external frontend control

The following commands are available and required only if the external frontend control option (R&S FSW-K553) is installed.

Further commands for external frontend control described elsewhere:

- `INPut:SElect RF`; see [INPut:SElect](#) on page 198
- [\[SENSE:\]FREQuency:CENTer](#) on page 234
- [DISPlay\[:WINDow<n>\]\[:SUBWindow<w>\]:TRACe<t>:Y\[:SCALE\]:RLEVEL](#) on page 235
- [INPut:ATTenuation:AUTO](#) on page 237
- [INPut:ATTenuation](#) on page 236
- [INPut:SANalyzer:ATTenuation](#) on page 237
- [INPut:SANalyzer:ATTenuation:AUTO](#) on page 237
- [Commands for initial configuration](#).....201
- [Commands for test, alignment, and diagnosis](#).....209
- [Commands for external devices](#).....211

- Format of selftest result file..... 215
- Programming example: Configuring an external frontend..... 219
- Programming example 2: Configuring an external frontend with a connected amplifier..... 221

Commands for initial configuration

The following commands are required when you initially set up an external frontend.

[SENSe:]EFRontend:CONNection[:STATe].....	201
[SENSe:]EFRontend:CONNection:CONFig.....	202
[SENSe:]EFRontend:CONNection:CSTate?.....	202
[SENSe:]EFRontend:FREQuency:BAND:COUNT?.....	203
[SENSe:]EFRontend:FREQuency:BAND:LOWer?.....	203
[SENSe:]EFRontend:FREQuency:BAND:UPPer?.....	203
[SENSe:]EFRontend:FREQuency:BCONfig:AUTO.....	204
[SENSe:]EFRontend:FREQuency:BCONfig:LIST?.....	204
[SENSe:]EFRontend:FREQuency:BCONfig:SElect.....	205
[SENSe:]EFRontend:FREQuency:IFRequency:SIDeband?.....	205
[SENSe:]EFRontend:FREQuency:IFRequency:VALue]?.....	205
[SENSe:]EFRontend:FREQuency:LOSCillator:INPut:FREQuency?.....	206
[SENSe:]EFRontend:FREQuency:LOSCillator:MODE.....	206
[SENSe:]EFRontend:FREQuency:LOSCillator:OUTPut:FREQuency?.....	206
[SENSe:]EFRontend:FREQuency:LOSCillator:OUTPut:STATe.....	207
[SENSe:]EFRontend:FREQuency:REFerence.....	207
[SENSe:]EFRontend:FREQuency:REFerence:LIST?.....	207
[SENSe:]EFRontend:IDN?.....	208
[SENSe:]EFRontend:NETWork.....	208
[SENSe:]EFRontend[:STATe].....	209

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

Queries the external frontend connection state in the firmware.

Note: to query the physical connection state of the external frontend, use [SENSe:]EFRontend:CONNection:CSTate? on page 202.

Parameters:

<State>

ON | OFF | 0 | 1

OFF | 0

The connection to the frontend is deactivated temporarily. The frontend is thus available for use elsewhere, for example by a signal generator. The measurement settings on the FSW remain untouched.

ON | 1

Frontend connection enabled.

The frontend is reserved for exclusive use by the FSW.

*RST: 0

Example:

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

[SENSe:]EFRontend:CONNectioN:CONFIg <Type>, <IPAddress>[, <DeviceID>, <SymbolicName>]

Configures the connection to the external frontend.

Parameters:

<Type> | "FE44S" | "FE50DTR" | "FE170SR" | "FE110SR"
String in double quotes containing the type of frontend to be connected.

<IPAddress> string in double quotes
The IP address or computer name of the frontend connected to the FSW via LAN. The IP address and computer name are indicated on the electronic ink display on the side panel of the frontend.

<DeviceID> string in double quotes
Unique device ID consisting of <type>-<serialnumber>
Not required or relevant for the FSW.

<SymbolicName> string in double quotes
Symbolic name of the external frontend.
Not required or relevant for the FSW.

Example:

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

[SENSe:]EFRontend:CONNectioN:CStAtE?

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

Return values:

<State> ON | OFF | 0 | 1
OFF | 0
Frontend not connected; connection error
ON | 1
Frontend connected

Usage: Query only

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

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

Return values:

<NoBands> integer
Number of frequency bands

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

Usage: Query only

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

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

Suffix:

 1..n
Band for multi-band frontends
Use [\[SENSe:\]EFRontend:FREQuency:BAND:COUNT?](#)
on page 203 to determine the number of available bands.

Return values:

<StartFreq> Start frequency of the specified band

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

Usage: Query only

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

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

Suffix:

 1..n
Band for multi-band frontends
Use [\[SENSe:\]EFRontend:FREQuency:BAND:COUNT?](#)
on page 203 to determine the number of available bands.

Return values:

<StopFreq> End frequency of the specified band

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

Usage: Query only

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

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

Parameters:

<State>

ON | OFF | 0 | 1

OFF | 0

Uses the frequency band configured by [\[SENSe:\]EFRontend:FREQUENCY:BCONfig:SElect](#) on page 205.

ON | 1

Configures the frequency band automatically

Currently, auto mode always applies the "IF Low" range.

*RST: 1

Example:

```
//Configures the use of the IF high band manually.
```

```
EFR:FREQ:BCON:AUTO 0
```

```
EFR:FREQ:BCON:SEL "IF HIGH"
```

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

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

Return values:

<BandConfigs>

string

"IF LOW"

(Not for R&S FE170SR/R&S FE110SR frontends.)

A higher intermediate frequency is used on the external frontend, resulting in a higher input frequency at the FSW.

"IF HIGH"

(Not for R&S FE170SR/R&S FE110SR frontends.)

A lower intermediate frequency is used on the external frontend, resulting in a lower input frequency at the FSW.

"Spur Optimized"

The selected IF range avoids unwanted spurious effects.

"EVM Optimized"

The selected IF range provides an optimal EVM result.

Example:

```
EFR:FREQ:BCON:LIST?
```

```
//Result: "IF HIGH", "IF LOW"
```

```
EFR:FREQ:BCON:SEL "IF HIGH"
```

Usage:

Query only

[SENSe:]EFRontend:FREQUENCY:BCONfig:SElect <BandConfig>

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

Parameters:

<BandConfig>

"IF HIGH"

(R&S FE44S/ R&S FE50DTR)

A higher intermediate frequency is used on the external frontend, resulting in a higher input frequency at the FSW.

"IF LOW"

(R&S FE44S/ R&S FE50DTR)

A lower intermediate frequency is used on the external frontend, resulting in a lower input frequency at the FSW.

"Spur Optimized"

(R&S FE170SR/R&S FE110SR only)

The selected IF range avoids unwanted spurious effects.

"EVM Optimized"

(R&S FE170SR/R&S FE110SR only)

The selected IF range provides an optimal EVM result.

"Shared LO"

(R&S FE170SR/R&S FE110SR only)

Ensures that multiple external frontends (R&S FE170SR/ R&S FE170ST or R&S FE110SR/R&S FE110ST) use the same LO frequencies for upconversion and downconversion.

Example:

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

[SENSe:]EFRontend:FREQUENCY:IFrequency:SIDeband?

Queries the currently used sideband for frequency conversion.

Return values:

<Sideband>

"USB" | "LSB"

"USB"

Upper sideband

"LSB"

Lower sideband

Example:

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

Usage:

Query only

[SENSe:]EFRontend:FREQUENCY:IFrequency[:VALue]?

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

Return values:

<IFFrequency> numeric

Example: EFR:FREQ:IFR?

Usage: Query only

[SENSe:]EFRontend:FREQUENCY:LOSCillator:INPut:FREQUENCY?

Queries the frequency of the LO input for [SENSe:]EFRontend:FREQUENCY:LOSCillator:MODE EXT.

Return values:

<LOInFreq> Default unit: Hz

Example: The external frontend uses the external LO provided at the "LO IN" connector.

```
EFR:FREQ:LOSC:MODE EXT
```

Query the frequency that the external LO must be provided at.

```
EFR:FREQ:LOSC:INP:FREQ?
```

```
//Result: 10615000000
```

Usage: Query only

[SENSe:]EFRontend:FREQUENCY:LOSCillator:MODE <Type>

Determines whether the external frontend uses its internal LO or an external LO.

Parameters:

<Type> EXTernal | INTernal

EXTernal

Uses the external LO provided at the LO input connector of the external frontend. Query the frequency at which the LO must be input to the external frontend using [SENSe:]EFRontend:FREQUENCY:LOSCillator:INPut:FREQUENCY? on page 206.

INTernal

Uses the internal LO.

```
*RST: EXTernal
```

Example: EFR:FREQ:LOSC:MODE EXT
EFR:FREQ:LOSC:INP:FREQ?
//Result: 10615000000

[SENSe:]EFRontend:FREQUENCY:LOSCillator:OUTPut:FREQUENCY?

Queries the frequency of the LO output for [SENSe:]EFRontend:FREQUENCY:LOSCillator:OUTPut:STATe ON.

Return values:

<LOOutFreq> Default unit: Hz

Example: The external frontend uses the internal LO and provides it as output to the "LO OUT" connector.

```
EFR:FREQ:LOSC:MODE INT
EFR:FREQ:LOSC:OUTP:STAT ON
Query the frequency of the LO output.
EFR:FREQ:LOSC:OUTP:FREQ?
//Result: 10615000000
```

Usage: Query only

[SENSe:]EFRontend:FREQUENCY:LOSCillator:OUTPut:STATe <State>

Enables or disables output of the LO by the external frontend. The output frequency is returned by [SENSe:]EFRontend:FREQUENCY:LOSCillator:OUTPut:FREQUENCY? on page 206.

Parameters:

<State> ON | OFF | 0 | 1
OFF | 0
 Switches the function off
ON | 1
 Switches the function on
 *RST: 0

Example: The external frontend provides the LO as output at the "LO OUT" connector.

```
EFR:FREQ:LOSC:OUTP:STAT ON
Query the frequency of the LO output.
EFR:FREQ:LOSC:OUTP:FREQ?
//Result: 10615000000
```

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

Sets the reference frequency that is used for frequency conversion on the frontend. Depending on the connected type of frontend, different values are available. To determine which reference levels are available, use [SENSe:]EFRontend:FREQUENCY:REFerence:LIST? on page 207.

Parameters:

<Frequency> Default unit: HZ

Example:

```
//Query the available reference levels
EFR:FREQ:REF:LIST?
//Result: 100000000,640000000,1000000000
//Use 640 MHz reference
EFR:FREQ:REF 640000000
```

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

Queries the available reference signals for the connected frontend type.

Return values:

<References> 10000000 | 640000000 | 1000000000

Example:

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

Usage:

Query only

[SENSe:]EFRontend:IDN?

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

Return values:

<DevInfo> string without quotes
Rohde&Schwarz,<device type>,<part number>/<serial number>,<firmware version>

Example:

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

Usage:

Query only

[SENSe:]EFRontend:NETWork <IPAddress>, <Subnet>, <DHCP State>

Sets or queries the network information for the frontend.

This information is also indicated on the electronic paper display on the side panel of the device.

Beware that if you change the network setting to DHCP = ON, the connection is aborted and you must re-establish a connection to the frontend (see [\[SENSe:\]EFRontend:CONNECTION\[:STATe\]](#) on page 201).

Parameters:

<IPAddress> string in double quotes
IP address of the frontend

<Subnet> string in double quotes
Subnet mask of the frontend

<DHCP State> ON | OFF | 0 | 1
Indicates whether a DHCP server is used.

OFF | 0
DHCP off

ON | 1
DHCP on

*RST: 0

Example: EFR:NETW?
 //Result: "123.456.78.90", "255.255.255.0", ON

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

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

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
The frontend is disconnected. The application adapts the measurement settings to the common settings supported by the FSW.

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

*RST: 0

Example: EFR ON

Commands for test, alignment, and diagnosis

The following commands are required to test and optimize the connection after it has initially been set up.

[SENSe:]JEFRontend:ALIGnment<ch>:FILE.....	209
[SENSe:]JEFRontend:ALIGnment<ch>:STATe.....	210
[SENSe:]JEFRontend:FWUPdate.....	210
[SENSe:]JEFRontend<fe>:SELftest?.....	210
[SENSe:]JEFRontend<fe>:SELftest:RESult?.....	210

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

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

Suffix:

<ch> 1..n
 Currently irrelevant

Parameters:

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

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

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

Activates correction of the IF signal due to cable loss from the frontend to the analyzer. Specify the file with correction data using [\[SENSe:\]EFRontend:ALIGnment<ch>:FILE](#) on page 209.

Suffix:

<ch> 1..n
Currently irrelevant

Parameters:

<State> ON | OFF | 0 | 1
OFF | 0
Switches the function off
ON | 1
Switches the function on
*RST: 0

[SENSe:]EFRontend:FWUPdate

Updates the firmware on the external frontend. Note that this process can take some time.

Usage: Event

[SENSe:]EFRontend<fe>:SELFtest?

Performs a selftest on the frontend to compare the current performance and characteristic values with the specified values for the frontend.

As a result, the success is returned.

Suffix:

<fe> 1
Connected frontend

Return values:

<Result> **0**
No error
>0
Error
*RST: 0

Example: EFR:SELF?
//Result: 0

Usage: Query only

[SENSe:]EFRontend<fe>:SELFtest:RESult?

Queries the results of the selftest on the frontend.

Suffix:	
<fe>	1 Connected frontend
Return values:	
<Result>	string containing xml data in double quotes
Example:	EFR:SELF:RES?
Usage:	Query only

Commands for external devices

You can insert additional external devices in the signal path between the DUT and the external frontend, such as preamplifiers or filters. The external frontend must then consider the additional gain or correction values.

[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:CORRection:FILE.....	211
[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:CORRection:STATe.....	212
[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:CORRection:VALid?.....	212
[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:LIST?.....	212
[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:REFresh.....	213
[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:FREQuency:MAXimum?.....	213
[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:FREQuency:MINimum?.....	214
[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:GAIN?.....	214
[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:NAME?.....	214
[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:TYPE?.....	215

[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:CORRection:FILE <File>

Defines the correction file to compensate for signal losses by the external devices occurring at different IF signal frequencies.

To query whether the loaded file is valid or not, use [SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:CORRection:VALid? on page 212.

Suffix:	
<ch>	1..n For future use.
<di>	1..n irrelevant

Parameters:

<File>

Example:	SENS:EFR:CHAN:EXTD:CORR:FILE 'ExtDev_Corr.s2p'
	SENS:EFR:CHAN:EXTD:CORR:STAT ON
	SENS:EFR:CHAN:EXTD:CORR:FILE:VAL?

[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:CORRection:STATe <State>

Enables or disables the use of a correction file for the connected external devices. The file is defined by [SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:CORRection:FILE on page 211.

Suffix:

<ch> 1..n
For future use.

<di> 1..n
irrelevant

Parameters:

<State> ON | OFF | 0 | 1
OFF | 0
Switches the function off
ON | 1
Switches the function on
*RST: 0

Example: SENS:EFR:CHAN:EXTD:CORR:FILE 'ExtDev_Corr.s2p'
SENS:EFR:CHAN:EXTD:CORR:STAT ON

[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:CORRection:VALid?

Queries whether the loaded correction file for an external device is valid or not.

Suffix:

<ch> 1..n
For future use.

<di> 1..n
irrelevant

Return values:

<Result> ON | OFF | 0 | 1
OFF | 0
File is valid.
ON | 1
File is not valid.

Example: SENS:EFR:CHAN:EXTD:CORR:STAT ON
SENS:EFR:CHAN:EXTD:CORR:FILE 'ExtDev_Corr.s2p'
SENS:EFR:CHAN:EXTD:CORR:VAL?

Usage: Query only

[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:LIST?

Queries the names of all detected connected devices at the external frontend.

Suffix:	
<ch>	1..n For future use.
<di>	1..n irrelevant
Return values:	
<Devices>	Comma-separated list of the names of the devices.
Example:	<code>:SENSe1:EFRontend1:CHANnel1:EXTDevice1:LIST?</code> <code>//Result:</code> <code>//"fe170_z50","fe170_z01"</code>
Usage:	Query only

[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:REFResh

Scans the ports of the external frontend and refreshes the display with detected information on connected devices. This function is useful after connecting a new device to the frontend.

Suffix:	
<ch>	1..n For future use.
<di>	1..n irrelevant
Example:	<code>SENSe1:EFRontend1:CHANnel:EXTDevice1:REFResh</code>
Usage:	Event

[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:FREQuency:MAXimum?

Queries the upper limit of the supported frequency range of the connected device.

Suffix:	
<ch>	1..n For future use.
<di>	1..n Connected external device
Return values:	
<RFFrequency>	numeric value Maximum frequency Default unit: Hz
Example:	<code>SENS:EFR:EXTD1:FREQ:MAX?</code> <code>//Result:</code> <code>170000000000</code>
Usage:	Query only

[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:FREQUENCY:MINimum?

Queries the lower limit of the supported frequency range of the connected device.

Suffix:

<ch>	1..n For future use.
<di>	1..n Connected external device

Return values:

<RFFrequency>	numeric value Minimum frequency Default unit: Hz
---------------	--

Example: SENS:EFR:EXTD1:FREQ:MIN?
 //Result:
 110000000000

Usage: Query only

[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:GAIN?

Queries the gain provided by a connected external amplifier.

Suffix:

<ch>	1..n For future use.
<di>	1..n Connected external device

Return values:

<Gain>	numeric value Default unit: dB
--------	-----------------------------------

Example: SENSe1:EFRontend1:CHANnel1:EXTDevice1:GAIN?
 //Result:
 //10

Usage: Query only

[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:NAME?

Queries the name of the external device for reference.

Suffix:

<ch>	1..n For future use.
<di>	1..n Connected external device

Return values:

<Type> string

Example:

```
SENS:EFR:CHAN:EXTD1:NAME?
//Result:
//'fe170_z50'
```

Usage:

Query only

[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:TYPE?

Queries the type of the detected device for reference.

Suffix:

<ch> 1..n
For future use.

<di> 1..n
Connected external device

Return values:

<Type> 'Amplifier' | 'Filter'

Example:

```
SENSe1:EFRontend1:CHANnel1:EXTDevice1:TYPE?
//Result:
//'Filter'
```

Usage:

Query only

Format of selftest result file

As a result of the selftest, an XML file with test details is created. It contains the following information in the specified order. Mandatory elements and attributes are indicated in bold font.

Element	Attributes	Description
<Sequence>		Main element
	Name	="Selftest"
	Description	Optional description of the test process
	FirmwareVersion	Firmware version of the controlling instrument (FSW)
	FrontendLibrary-Version	Version of the <code>control.dll</code> with the format <code>x.y.z</code>
	FrontendServerVersion	Version of the RRH server with the format <code>x.y.z</code> (FE44A only)
	Date	Date the selftest was performed, with the format <code>dd/mm/yyyy</code>
	Time	Time the selftest was performed, with the format <code>hh:mm:ss</code>
	State	Test result state, combined result of all <SequenceCategory>s: "PASSED"/ "FAILED"
	Version	For internal use.

Element	Attributes	Description
	Comment	Optional comment on the test process
<SequenceCategory>		Set of test steps
	Name	Name of the test sequence, e.g. "Frontend voltages"
	Description	Optional description of the test sequence
	State	Test sequence result state, combined result of all <SequenceStep>s: "PASSED"/ "FAILED"
	Version	For internal use.
	Comment	Optional comment on the test sequence
<SequenceStep>		Subelement of <SequenceCategory> for an individual test step
	Name	Name of the individual test step, e.g. FE1_3V3
	Description	Optional description of the test step
	LimitLow	Optional: lower limit to be checked
	LimitHigh	Optional: upper limit to be checked
	MeasValue	Optional: measured value
	Unit	Optional: unit of the measured value
	State	Test step result state: "PASSED"/ "FAILED"
	Version	For internal use.
	Comment	Optional comment on the test step

Example for selftest result xml file

```
<?xml version="1.0" encoding="UTF-8"?>
<Sequence xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:noNamespaceSchemaLocation="SelfTest_Schema.xsd">
  <Name>DeviceCheck</Name>
  <FirmwareVersion>1.50-21.1.1.0 Beta</FirmwareVersion>
  <FrontendLibraryVersion>0.8.0</FrontendLibraryVersion>
  <Date>15/01/2021</Date>
  <Time>08:51:35</Time>
  <State>FAILED</State>
  <Version>1.0.0</Version>
  <SequenceCategory>
    <Name>Frontend Voltages</Name>
    <Description>test description</Description>
    <State>FAILED</State>
    <Version>1.0.0</Version>
    <Type>Diagnose</Type>
    <SequenceStep>
      <Name>FE1_3V3</Name>
      <LimitLow>3.000</LimitLow>
      <LimitHigh>3.600</LimitHigh>
```



```

    <MeasValue>3.311</MeasValue>
    <State>PASSED</State>
    <Version>1.0.0</Version>
  </SequenceStep>
</SequenceStep>
<SequenceStep>
  <Name>FE1_5V</Name>
  <LimitLow>4.250</LimitLow>
  <LimitHigh>5.750</LimitHigh>
  <MeasValue>5.027</MeasValue>
  <State>PASSED</State>
  <Version>1.0.0</Version>
</SequenceStep>
</SequenceStep>
<SequenceStep>
  <Name>FE1_6V5</Name>
  <LimitLow>6.000</LimitLow>
  <LimitHigh>7.000</LimitHigh>
  <MeasValue>5.893</MeasValue>
  <State>FAILED</State>
  <Version>1.0.0</Version>
</SequenceStep>
</SequenceStep>
<SequenceStep>
  <Name>FE1_M3V3</Name>
  <LimitLow>-3.600</LimitLow>
  <LimitHigh>-3.000</LimitHigh>
  <MeasValue>3.347</MeasValue>
  <State>FAILED</State>
  <Version>1.0.0</Version>
</SequenceStep>
</SequenceStep>
</SequenceCategory>
<SequenceCategory>
  <Name>Frontend Temperature</Name>
  <Description>test description</Description>
  <State>PASSED</State>
  <Version>1.0.0</Version>
  <Type>Diagnose</Type>
  <SequenceStep>
    <Name>TEMP_FE1</Name>
    <LimitLow>0.000</LimitLow>
    <LimitHigh>60.000</LimitHigh>
    <MeasValue>39.300</MeasValue>
    <State>PASSED</State>
    <Version>1.0.0</Version>
  </SequenceStep>
</SequenceCategory>
</SequenceCategory>
<SequenceCategory>
  <Name>Synthesizer Voltage</Name>
  <Description>test description</Description>
  <State>PASSED</State>
  <Version>1.0.0</Version>
  <Type>Diagnose</Type>

```

```

<SequenceStep>
  <Name>SYNTH_3V4</Name>
  <LimitLow>3.200</LimitLow>
  <LimitHigh>3.910</LimitHigh>
  <MeasValue>3.576</MeasValue>
  <State>PASSED</State>
  <Version>1.0.0</Version>
</SequenceStep>
<SequenceStep>
  <Name>SYNTH_5V4_SYN</Name>
  <LimitLow>4.860</LimitLow>
  <LimitHigh>5.940</LimitHigh>
  <MeasValue>5.405</MeasValue>
  <State>PASSED</State>
  <Version>1.0.0</Version>
</SequenceStep>
<SequenceStep>
  <Name>SYNTH_5V4_YIG</Name>
  <LimitLow>4.860</LimitLow>
  <LimitHigh>5.940</LimitHigh>
  <MeasValue>5.438</MeasValue>
  <State>PASSED</State>
  <Version>1.0.0</Version>
</SequenceStep>
<SequenceStep>
  <Name>SYNTH_M5V</Name>
  <LimitLow>-5.500</LimitLow>
  <LimitHigh>-4.500</LimitHigh>
  <MeasValue>-4.948</MeasValue>
  <State>PASSED</State>
  <Version>1.0.0</Version>
</SequenceStep>
<SequenceStep>
  <Name>SYNTH_REF5V</Name>
  <LimitLow>4.500</LimitLow>
  <LimitHigh>5.500</LimitHigh>
  <MeasValue>5.031</MeasValue>
  <State>PASSED</State>
  <Version>1.0.0</Version>
</SequenceStep>
</SequenceCategory>
<SequenceCategory>
  <Name>Supply Voltage</Name>
  <Description>test description</Description>
  <State>PASSED</State>
  <Version>1.0.0</Version>
  <Type>Diagnose</Type>
  <SequenceStep>
    <Name>SUPPLY_12V</Name>
    <LimitLow>10.800</LimitLow>

```

```

    <LimitHigh>13.200</LimitHigh>
    <MeasValue>11.909</MeasValue>
    <State>PASSED</State>
    <Version>1.0.0</Version>
  </SequenceStep>
</SequenceStep>
<SequenceStep>
  <Name>SUPPLY_3V3D</Name>
  <LimitLow>2.970</LimitLow>
  <LimitHigh>3.630</LimitHigh>
  <MeasValue>3.318</MeasValue>
  <State>PASSED</State>
  <Version>1.0.0</Version>
</SequenceStep>
</SequenceStep>
<SequenceStep>
  <Name>SUPPLY_4V</Name>
  <LimitLow>3.650</LimitLow>
  <LimitHigh>4.460</LimitHigh>
  <MeasValue>4.053</MeasValue>
  <State>PASSED</State>
  <Version>1.0.0</Version>
</SequenceStep>
</SequenceStep>
<SequenceStep>
  <Name>SUPPLY_6V</Name>
  <LimitLow>5.400</LimitLow>
  <LimitHigh>6.600</LimitHigh>
  <MeasValue>6.076</MeasValue>
  <State>PASSED</State>
  <Version>1.0.0</Version>
</SequenceStep>
</SequenceStep>
<SequenceStep>
  <Name>SUPPLY_M5V</Name>
  <LimitLow>-6.050</LimitLow>
  <LimitHigh>-4.950</LimitHigh>
  <MeasValue>-5.507</MeasValue>
  <State>PASSED</State>
  <Version>1.0.0</Version>
</SequenceStep>
</SequenceCategory>
</Sequence>

```

Programming example: Configuring an external frontend

The following example describes how to configure RF frontend settings in remote operation.

```

// Prepare the instrument
// Preset
*RST
// Create new IQ-Analyzer channel
:INST:SEL IQ
// Enable 640MHz Reference

```

```

:ROSC:O640 ON

//Enable general use of external frontend
SENSE:EFRontend:STATe ON
//Configure connection to ext. FE named "FE44S-1000826"
SENSE:EFRontend:CONNECTION:CONFig "FE44S","FE44S-1000826"
//Activate exclusive use of frontend by FSW.
SENSE:EFRontend:CONNECTION:STATe ON

//For demonstration purposes only: assign a static IP address
SENSE:EFRontend:NETWork "123.456.7.8", "255.255.255.00", OFF

// Query information about the connected RF frontend.
SENSE:EFRontend:CONNECTION:CSTATe?
// Response: 1 (connected)
SENSE:EFRontend:IDN?
////Result: Rohde&Schwarz,FE44S,1234.5678K00/123456,0.8.0

// Specify frontend settings
//Query available intermediate frequency bands
SENSE:EFRontend:FREQuency:BCONfig:LIST?
//Result: "IF HIGH", "IF LOW"
//Use high IF
SENSE:EFRontend:FREQuency:BCONfig:SElect "IF HIGH"
//Query used intermediate frequency
SENSE:EFRontend:FREQuency:IFREquency?
//Result: 8.595000000

//Query available reference frequencies
SENSE:EFRontend:FREQuency:REFerence:LIST?
//Result: 10000000,640000000,1000000000
//Use 640 MHz reference
SENSE:EFRontend:FREQuency:REFerence 640000000

// Query ranges of the operating frequency band.
SENSE:EFRontend:FREQuency:BAND1:LOWer?
// Response in Hz: "24000000000" (= 24 GHz)
SENSE:EFRontend:FREQuency:BAND1:UPPer?
// Response in Hz: "44000000000" (= 44 GHz)

// Add cable correction data by loading an *.s2p file.
SENSE:EFRontend:ALIGNment:FILE "C:\R_S\Instr\user\external_frontends\FE44S\
touchstonefiles\if_default_cable_1347_7552_00.s2p"
SENSE:EFRontend:ALIGNment:STATe ON

//Update FW version on frontend (only available if external frontend firmware
//is incompatible to FSW firmware)
SENSE:EFRontend:FWUPdate
//Perform a selftest on the frontend and query results
SENSE:EFRontend:SELFTest?
//Result: 0 (no errors)

```

```
SENSe:EFRontend:SELftest:RESult?
//Result: "<?xml version="1.0" encoding="UTF-8"?>
//<Sequence xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
//xsi:noNamespaceSchemaLocation="
//<Name>DeviceCheck</Name>
//<FirmwareVersion>1.50-21.1.1.0 Beta</FirmwareVersion>
//..."
```

Programming example 2: Configuring an external frontend with a connected amplifier

The following example demonstrates how to configure an R&S FE170SR external frontend with a connected amplifier.

Some commands may not be necessary as they reflect the default settings; however, they are included to demonstrate the command usage.

```
// Prepare the instrument
// Preset
*RST
// Create new IQ-Analyzer channel
:INST:SEL IQ
// Enable 640MHz Reference
:ROSC:O640 ON

//Enable general use of external frontend
SENSe:EFRontend:STATe ON
//Configure connection to ext. FE named "FE170SR-123456"
SENSe:EFRontend:CONNECTION:CONFig "FE170SR","FE170SR-123456"
//Activate exclusive use of frontend by FSW.
SENSe:EFRontend:CONNECTION:STATe ON

// Query information about the connected RF frontend.
SENSe:EFRontend:CONNECTION:CSTATe?
// Response: 1 (connected)
SENSe:EFRontend:IDN?
////Result: Rohde&Schwarz,FE170SR,1234.5678K00/123456,0.8.0

// Specify frontend settings
//Query available intermediate frequency bands
SENSe:EFRontend:FREQuency:BCONfig:LIST?
//Result: "Spur Optimized","EVM Optimized"
//Use spur optimized
SENSe:EFRontend:FREQuency:BCONfig:SElect "Spur Optimized"
//Query used intermediate frequency
SENSe:EFRontend:FREQuency:IFREquency?
//Result: 9940000000

//Query available reference frequencies
SENSe:EFRontend:FREQuency:REFerence:LIST?
//Result: 10000000,640000000,1000000000
```

```

//Use 1 GHz reference
SENSe:EFRontend:FREQuency:REFeRence 1000000000

// Query ranges of the operating frequency band.
SENSe:EFRontend:FREQuency:BAND1:LOWer?
// Response in Hz: "110000000000" (= 110 GHz)
SENSe:EFRontend:FREQuency:BAND1:UPPer?
// Response in Hz: "170000000000" (= 170 GHz)

// Add cable correction data by loading an *.s2p file.
SENSe:EFRontend:ALIGnment:FILE "C:\R_S\Instr\user\external_frontends\FE170SR\
touchstonefiles\if_default_cable_1348_3850_00.s2p"
SENSe:EFRontend:ALIGnment:STATe ON

//Configure external amplifier named "fe170_z50" connected to frontend
//Refresh and query the list of detected external devices
SENSe:EFRontend:EXTDevice:REFresh
SENSe:EFRontend:EXTDevice:LIST?
//Result:
//"fe170_z50"
//Query the type of the external device
SENSe:EFRontend:EXTDevice:TYPE?
//Result:
//'Amplifier'
//Query the supported frequency range of the amplifier
SENSe:EFRontend:EXTDevice1:FREQuency:MINimum?
//Result:
//110000000000
SENSe:EFRontend:EXTDevice1:FREQuency:MAXimum?
//Result:
//170000000000
//Query the gain of the amplifier
SENSe:EFRontend:EXTDevice1:GAIN?
//Result:
//10
//Only for demonstration purposes:
//Load and enable a correction file for the amplifier.
//The correction file is automatically considered if the IX cable is used to connect
//the external device to the frontend.
SENSe:EFRontend:EXTDevice1:CORRection:FILE 'C:\temp\ExtDev_Corr.s2p'
SENSe:EFRontend:EXTDevice1:CORRection:STATe ON
//Check if the loaded file is valid
SENSe:EFRontend:EXTDevice1:CORRection:VALid?

```

5.6.3 Power sensor measurements

The following commands describe how to work with power sensors.

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

- [Configuring power sensor measurements](#)..... 223
- [Triggering with power sensors](#)..... 232

5.6.3.1 Configuring power sensor measurements

SYSTem:COMMunicate:RDEvice:PMETer<p>:CONFigure:AUTO[:STATe]	223
SYSTem:COMMunicate:RDEvice:PMETer<p>:COUNT?	223
SYSTem:COMMunicate:RDEvice:PMETer<p>:DEFine	224
CALibration:PMETer<p>:ZERO:AUTO ONCE	224
CALCulate<n>:PMETer<p>:RELative[:MAGNitude]	225
CALCulate<n>:PMETer<p>:RELative[:MAGNitude]:AUTO ONCE	225
CALCulate<n>:PMETer<p>:RELative:STATe	225
FETCh:PMETer<p>?	226
READ:PMETer<p>?	226
[SENSe:]PMETer<p>:DCYClE[:STATe]	226
[SENSe:]PMETer<p>:DCYClE:VALue	226
[SENSe:]PMETer<p>:FREQuency	227
[SENSe:]PMETer<p>:FREQuency:LINK	227
[SENSe:]PMETer<p>:MTIME	228
[SENSe:]PMETer<p>:MTIME:AVERage:COUNT	228
[SENSe:]PMETer<p>:MTIME:AVERage[:STATe]	228
[SENSe:]PMETer<p>:ROFFset[:STATe]	229
[SENSe:]PMETer<p>:SOFFset	229
[SENSe:]PMETer<p>[:STATe]	229
[SENSe:]PMETer:LEVel:CORRection:APPLY	230
CALCulate:PMETer:LEVel:CORRection	230
TRIGger[:SEQuence]:SOURce	230
UNIT<n>:PMETer<p>:POWer	231
UNIT<n>:PMETer<p>:POWer:RATio	231

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

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

Suffix:

<p> Power sensor index

Parameters:

<State> ON | OFF | 0 | 1

*RST: 1

Example:

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

Manual operation: See "[Select](#)" on page 76

SYSTem:COMMunicate:RDEvice:PMETer<p>:COUNT?

Queries the number of power sensors currently connected to the FSW.

Suffix:	
<p>	Power sensor index
Return values:	
<NumberSensors>	Number of connected power sensors.
Example:	SYST:COMM:RDEV:PMET:COUN?
Usage:	Query only
Manual operation:	See " Select " on page 76

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

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

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

Suffix:	
<p>	Power sensor index
Parameters:	
<Placeholder>	Currently not used
<Type>	Detected power sensor type, e.g. "NRP-Z81".
<Interface>	Interface the power sensor is connected to; always "USB"
<SerialNo>	Serial number of the power sensor assigned to the specified index
Example:	<pre>SYST:COMM:RDEV:PMET2:DEF ' ', 'NRP-Z81', ' ', '123456'</pre> <p>Assigns the power sensor with the serial number '123456' to the configuration "Power Sensor 2".</p> <pre>SYST:COMM:RDEV:PMET2:DEF?</pre> <p>Queries the sensor assigned to "Power Sensor 2".</p> <p>Result:</p> <pre>' ', 'NRP-Z81', 'USB', '123456'</pre> <p>The NRP-Z81 power sensor with the serial number '123456' is assigned to the "Power Sensor 2".</p>
Manual operation:	See " Select " on page 76

CALibration:PMETer<p>:ZERO:AUTO ONCE

Zeroes the power sensor.

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

Suffix:	
<p>	Power sensor index

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

Usage: Event

Manual operation: See "[Zeroing Power Sensor](#)" on page 76

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

Defines the reference value for relative measurements.

Suffix:

<n> [Window](#)

<p> Power sensor index

Parameters:

<RefValue> Range: -200 dBm to 200 dBm

*RST: 0

Default unit: DBM

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

Manual operation: See "[Reference Value](#)" on page 77

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

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

Suffix:

<n> [Window](#)

<p> Power sensor index

Example:

`CALC:PMET2:REL:AUTO ONCE`

Takes the current measurement value as reference value for relative measurements for power sensor 2.

Usage: Event

Manual operation: See "[Setting the Reference Level from the Measurement Measurement Meas - > Ref](#)" on page 77

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

Turns relative power sensor measurements on and off.

Suffix:

<n> [Window](#)

<p> Power sensor index

Parameters:

<State> ON | OFF | 0 | 1
OFF | 0
 Switches the function off
ON | 1
 Switches the function on

Example:

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

FETCH:PMETer<p>?

Queries the results of power sensor measurements.

Suffix:

<p> Power sensor index

Usage: Query only

READ:PMETer<p>?

Initiates a power sensor measurement and queries the results.

Suffix:

<p> Power sensor index

Usage: Query only

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

Turns the duty cycle correction on and off.

Suffix:

<p> Power sensor index

Parameters:

<State> ON | OFF | 0 | 1
OFF | 0
 Switches the function off
ON | 1
 Switches the function on

Example:

PMET2:DCYC:STAT ON

Manual operation: See "[Duty Cycle](#)" on page 78

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

Defines the duty cycle for the correction of pulse signals.

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

Suffix:

<p> Power sensor

Parameters:

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

Example:

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

Manual operation: See "[Duty Cycle](#)" on page 78

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

Defines the frequency of the power sensor.

Suffix:

<p> Power sensor index

Parameters:

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

Example:

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

Manual operation: See "[Frequency Manual](#)" on page 76

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

Selects the frequency coupling for power sensor measurements.

Suffix:

<p> Power sensor index

Parameters:

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

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

Manual operation: See "[Frequency Coupling](#)" on page 76

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

Selects the duration of power sensor measurements.

Suffix:
<p> Power sensor index

Parameters:
<Duration> SHORT | NORMAl | LONG
*RST: NORMAl

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

Manual operation: See "[Meas Time/Average](#)" on page 77

[SENSe:]PMETer<p>:MTIMe:AVERAge:COUNT <NumberReadings>

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

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

Suffix:
<p> Power sensor index

Parameters:
<NumberReadings> An average count of 0 or 1 performs one power reading.
Range: 0 to 256
Increment: binary steps (1, 2, 4, 8, ...)

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

Manual operation: See "[Average Count \(Number of Readings\)](#)" on page 78

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

Turns averaging for power sensor measurements on and off.

Suffix:

<p> Power sensor index

Parameters:

<State> ON | OFF | 0 | 1
OFF | 0
 Switches the function off
ON | 1
 Switches the function on

Example:

PMET2:MTIM:AVER ON
 Activates manual averaging.

Manual operation: See "[Meas Time/Average](#)" on page 77

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

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

Suffix:

<p> Power sensor index

Parameters:

<State> ON | OFF | 0 | 1
OFF | 0
 Switches the function off
ON | 1
 Switches the function on

Example:

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

Manual operation: See "[Use Ref Level Offset](#)" on page 77

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

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

Suffix:

<p> Power sensor index

Parameters:

<SensorOffset> Default unit: DB

Example:

PMET2:SOFF 0.001

Manual operation: See "[Sensor Level Offset](#)" on page 77

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

Turns a power sensor on and off.

Suffix:

<p> Power sensor index

Parameters:

<State> ON | OFF | 0 | 1
OFF | 0
 Switches the function off
ON | 1
 Switches the function on

Example:

PMET1 ON
 Switches the power sensor measurements on.

Manual operation: See ["Select"](#) on page 76

[SENSe:]PMETer:LEVel:CORRection:APPLy <State>

Sets and queries the toggle to apply the auto level correction.

Parameters:

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

Manual operation: See ["Apply Auto Level Correction"](#) on page 75

CALCulate:PMETer:LEVel:CORRection

Calculates the level correction for power sensors.

Example: CALCulate:PMETer:LEVel:CORRection

Usage: Event

Manual operation: See ["Apply Auto Level Correction"](#) on page 75

TRIGger[:SEQuence]:SOURce <Source>

Selects the trigger source.

Note on external triggers:

If a measurement is configured to wait for an external trigger signal in a remote control program, remote control is blocked until the trigger is received and the program can continue. Make sure that this situation is avoided in your remote control programs.

Parameters:

<Source> **IMMEDIATE**
 Free Run
EXTERNAL
 Trigger signal from the "Trigger Input" connector.

EXT2

Trigger signal from the "Trigger Input/Output" connector.

For FSW85 models, Trigger 2 is not available due to the second RF input connector on the front panel. The trigger signal is taken from the "Trigger Input/Output" connector on the rear panel.

Note: Connector must be configured for "Input".

EXT3

Trigger signal from the "TRIGGER 3 INPUT/ OUTPUT" connector.

Note: Connector must be configured for "Input".

BBPower

Baseband power

For input from the optional "Analog Baseband" interface.

For input from the optional "Digital Baseband" interface.

PSEN

External power sensor

*RST: IMMEDIATE

Example:

TRIG:SOUR EXT

Selects the external trigger input as source of the trigger signal

Manual operation:

See ["Using the power sensor as an external trigger"](#) on page 78

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

Selects the unit for absolute power sensor measurements.

Suffix:

<n> irrelevant

<p> Power sensor index

Parameters:

<Unit> DBM | WATT | W | DB | PCT

*RST: DBM

Example:

UNIT:PMET:POW DBM

Manual operation:

See ["Unit/Scale"](#) on page 77

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

Selects the unit for relative power sensor measurements.

Suffix:

<n> irrelevant

<p> Power sensor index

Parameters:

<Unit> DB | PCT

*RST: DB

Example: UNIT:PMET:POW:RAT DB

Manual operation: See "[Unit/Scale](#)" on page 77

5.6.3.2 Triggering with power sensors

[SENSe:]PMETer<p>:TRIGger:DTIME.....	232
[SENSe:]PMETer<p>:TRIGger:HOLDoff.....	232
[SENSe:]PMETer<p>:TRIGger:HYSteresis.....	232
[SENSe:]PMETer<p>:TRIGger:LEVel.....	233
[SENSe:]PMETer<p>:TRIGger:SLOPe.....	233
[SENSe:]PMETer<p>:TRIGger[:STATe].....	234

[SENSe:]PMETer<p>:TRIGger:DTIME <Time>

Defines the time period that the input signal has to stay below the IF power trigger level before the measurement starts.

Suffix:

<p> Power sensor index

Parameters:

<Time> Range: 0 s to 1 s
 Increment: 100 ns
 *RST: 100 µs
 Default unit: S

Example: PMET2:TRIG:DTIME 0.001

[SENSe:]PMETer<p>:TRIGger:HOLDoff <Holdoff>

Defines the trigger holdoff for external power triggers.

Suffix:

<p> Power sensor index

Parameters:

<Holdoff> Time period that has to pass between the trigger event and the start of the measurement, in case another trigger event occurs.
 Range: 0 s to 1 s
 Increment: 100 ns
 *RST: 0 s
 Default unit: S

Example: PMET2:TRIG:HOLD 0.1
 Sets the holdoff time of the trigger to 100 ms

Manual operation: See "[Trigger Holdoff](#)" on page 78

[SENSe:]PMETer<p>:TRIGger:HYSteresis <Hysteresis>

Defines the trigger hysteresis for external power triggers.

The hysteresis in dB is the value the input signal must stay below the IF power trigger level to allow a trigger to start the measurement.

Suffix:

<p> Power sensor index

Parameters:

<Hysteresis> Range: 3 dB to 50 dB
 Increment: 1 dB
 *RST: 0 dB
 Default unit: DB

Example:

PMET2:TRIG:HYST 10
 Sets the hysteresis of the trigger to 10 dB.

Manual operation: See "[Hysteresis](#)" on page 78

[SENSe:]PMETer<p>:TRIGger:LEVel <Level>

Defines the trigger level for external power triggers.

Suffix:

<p> Power sensor index

Parameters:

<Level> -20 to +20 dBm
 Range: -20 dBm to 20 dBm
 *RST: -10 dBm
 Default unit: DBM

Example:

PMET2:TRIG:LEV -10 dBm
 Sets the level of the trigger

Manual operation: See "[External Trigger Level](#)" on page 78

[SENSe:]PMETer<p>:TRIGger:SLOPe <Edge>

Selects the trigger condition for external power triggers.

Suffix:

<p> Power sensor index

Parameters:

<Edge> **POSitive**
 The measurement starts in case the trigger signal shows a positive edge.
NEGative
 The measurement starts in case the trigger signal shows a negative edge.
 *RST: POSitive

Example:

PMET2:TRIG:SLOP NEG

Manual operation: See "[Slope](#)" on page 79

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

Turns the external power trigger on and off.

Suffix:

<p> Power sensor index

Parameters:

<State> ON | OFF | 0 | 1
OFF | 0
 Switches the function off
ON | 1
 Switches the function on

Example: PMET2:TRIG ON
 Switches the external power trigger on

Manual operation: See ["Using the power sensor as an external trigger"](#) on page 78

5.6.4 Configuring the frequency

[SENSe:]FREQUENCY:CENTer.....	234
[SENSe:]FREQUENCY:CENTer:STEP.....	234
[SENSe:]FREQUENCY:OFFSet.....	235

[SENSe:]FREQUENCY:CENTer <Frequency>

Defines the center frequency.

Parameters:

<Frequency> For the allowed range and f_{\max} , refer to the specifications document.
 *RST: $f_{\max}/2$
 Default unit: Hz

Example: `FREQ:CENT 100 MHz`
`FREQ:CENT:STEP 10 MHz`
`FREQ:CENT UP`
 Sets the center frequency to 110 MHz.

Manual operation: See ["Center Frequency"](#) on page 68

[SENSe:]FREQUENCY:CENTer:STEP <StepSize>

Defines the center frequency step size.

Parameters:

<StepSize> For f_{\max} , refer to the specifications document.
 Range: 1 to f_{\max}
 *RST: 0.1 x span
 Default unit: Hz

Example: //Set the center frequency to 110 MHz.
 FREQ:CENT 100 MHz
 FREQ:CENT:STEP 10 MHz
 FREQ:CENT UP

Manual operation: See "[Center Frequency Stepsize](#)" on page 68

[SENSe:]FREQuency:OFFSet <Offset>

Defines a frequency offset.

If this value is not 0 Hz, the application assumes that the input signal was frequency shifted outside the application. All results of type "frequency" will be corrected for this shift numerically by the application.

Parameters:

<Offset> Range: -1 THz to 1 THz
 *RST: 0 Hz
 Default unit: HZ

Example: FREQ:OFFS 1GHZ

Manual operation: See "[Frequency Offset](#)" on page 68

5.6.5 Defining level characteristics

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel.....	235
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet.....	236
INPut:ATTenuation.....	236
INPut:ATTenuation:AUTO.....	237
INPut:SANalyzer:ATTenuation.....	237
INPut:SANalyzer:ATTenuation:AUTO.....	237
INPut:ATTenuation:AUTO:MODE.....	238
INPut:EATT.....	238
INPut:EATT:AUTO.....	239
INPut:EATT:STATE.....	239
INPut:EGAIN[:STATE].....	239
INPut:IQ:FULLscale:AUTO.....	240
INPut:IQ:FULLscale[:LEVel].....	240
INPut:GAIN:STATE.....	241
INPut:GAIN[:VALue].....	241
[SENSe:]IQ:WBANd.....	242

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel <ReferenceLevel>

Defines the reference level (for all traces in all windows).

With a reference level offset $\neq 0$, the value range of the reference level is modified by the offset.

Suffix:

<n>	irrelevant
<w>	subwindow Not supported by all applications
<t>	irrelevant

Parameters:

<ReferenceLevel>	The unit is variable. Range: see specifications document *RST: 0 dBm Default unit: DBM
------------------	---

Example: `DISP:TRAC:Y:RLEV -60dBm`

Manual operation: See ["Reference Level"](#) on page 69

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet
<Offset>

Defines a reference level offset (for all traces in all windows).

Suffix:

<n>	irrelevant
<w>	subwindow Not supported by all applications
<t>	irrelevant

Parameters:

<Offset>	Range: -200 dB to 200 dB *RST: 0dB Default unit: DB
----------	---

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

Manual operation: See ["Shifting the Display \(Offset\)"](#) on page 70

INPut:ATTenuation <Attenuation>

Defines the total attenuation for RF input.

If you set the attenuation manually, it is no longer coupled to the reference level, but the reference level is coupled to the attenuation. Thus, if the current reference level is not compatible with an attenuation that has been set manually, the command also adjusts the reference level.

If an external frontend is active (see [\[SENSe:\]EFRontend\[:STATe\]](#) on page 209), you can configure the attenuation of the external frontend and the analyzer separately. See also [INPut:SANalyzer:ATTenuation:AUTO](#) on page 237 and [INPut:SANalyzer:ATTenuation](#) on page 237.

Parameters:

<Attenuation> Range: see specifications document
 Increment: 5 dB (with optional electr. attenuator: 1 dB)
 *RST: 10 dB (AUTO is set to ON)
 Default unit: DB

Example:

INP:ATT 30dB
 Defines a 30 dB attenuation and decouples the attenuation from the reference level.

Manual operation: See "[Attenuation Mode / Value](#)" on page 72

INPut:ATTenuation:AUTO <State>

Couples or decouples the attenuation to the reference level. Thus, when the reference level is changed, the FSW determines the signal level for optimal internal data processing and sets the required attenuation accordingly.

If an external frontend is active (see [[SENSe:\]EFRontend\[:STATe\]](#) on page 209), you can configure the attenuation of the external frontend and the analyzer separately. See also [INPut:SANalyzer:ATTenuation:AUTO](#) on page 237 and [INPut:SANalyzer:ATTenuation](#) on page 237.

Parameters:

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

Example:

INP:ATT:AUTO ON
 Couples the attenuation to the reference level.

Manual operation: See "[Attenuation Mode / Value](#)" on page 72

INPut:SANalyzer:ATTenuation <Attenuation>

Configures attenuation at the analyzer input for an active external frontend manually.

Parameters:

<Attenuation> Range: see specifications document
 Increment: 1 dB
 Default unit: DB

Manual operation: See "[Attenuation Mode / Value](#)" on page 72

INPut:SANalyzer:ATTenuation:AUTO <State>

Enables or disables automatic configuration of attenuation at the analyzer input for an active external frontend.

By default, the attenuation settings are applied at the input of the external frontend, see [INPut:ATTenuation:AUTO](#) on page 237 and [INPut:ATTenuation](#) on page 236.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0

Auto mode for analyzer attenuation is disabled. Allows you to configure attenuation at the analyzer using `INPut:SANalyzer:ATTenuation` on page 237.

ON | 1

Auto mode for analyzer attenuation is enabled. No attenuation is configured at the analyzer.

*RST: 0

Example:

```
//Enable external frontend
EFR ON
//Query the currently configured RF attenuation
INP:ATT?
//Result: 10 dB
//Disable auto mode for analyzer attenuation
INP:SAN:ATT:AUTO OFF
//Configure 10 dB attenuation at the analyzer
INP:SAN:ATT 10
//Query the currently configured RF attenuation at the ext. FE
INP:ATT?
//Result: 0 dB
```

Manual operation: See "[Attenuation Mode / Value](#)" on page 72

INPut:ATTenuation:AUTO:MODE <OptMode>

Selects the priority for signal processing *after* the RF attenuation has been applied.

Parameters:

<OptMode>

LNOise | LDISTortion

LNOise

Optimized for high sensitivity and low noise levels

LDISTortion

Optimized for low distortion by avoiding intermodulation

*RST: LDISTortion (WLAN application: LNOise)

Example:

```
INP:ATT:AUTO:MODE LNO
```

Manual operation: See "[Optimization](#)" on page 72

INPut:EATT <Attenuation>

Defines an electronic attenuation manually. Automatic mode must be switched off (`INP:EATT:AUTO OFF`, see [INPut:EATT:AUTO](#) on page 239).

If the current reference level is not compatible with an attenuation that has been set manually, the command also adjusts the reference level.

Parameters:

<Attenuation> attenuation in dB
 Range: see specifications document
 Increment: 1 dB
 *RST: 0 dB (OFF)
 Default unit: DB

Example:

```
INP:EATT:AUTO OFF
INP:EATT 10 dB
```

Manual operation: See ["Using Electronic Attenuation"](#) on page 73

INPut:EATT:AUTO <State>

Turns automatic selection of the electronic attenuation on and off.

If on, electronic attenuation reduces the mechanical attenuation whenever possible.

Parameters:

<State> ON | OFF | 0 | 1
OFF | 0
 Switches the function off
ON | 1
 Switches the function on
 *RST: 1

Example:

```
INP:EATT:AUTO OFF
```

Manual operation: See ["Using Electronic Attenuation"](#) on page 73

INPut:EATT:STATe <State>

Turns the electronic attenuator on and off.

Parameters:

<State> ON | OFF | 0 | 1
OFF | 0
 Switches the function off
ON | 1
 Switches the function on
 *RST: 0

Example:

```
INP:EATT:STAT ON
```

Switches the electronic attenuator into the signal path.

Manual operation: See ["Using Electronic Attenuation"](#) on page 73

INPut:EGAIN[:STATe] <State>

Before this command can be used, the external preamplifier must be connected to the FSW. See the preamplifier's documentation for details.

When activated, the FSW automatically compensates the magnitude and phase characteristics of the external preamplifier in the measurement results.

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

For FSW85 models with two RF inputs, you must enable correction from the external preamplifier for each input individually. Correction cannot be enabled for both inputs at the same time.

When deactivated, no compensation is performed even if an external preamplifier remains connected.

Parameters:

<State> ON | OFF | 0 | 1
 OFF | 0
 No data correction is performed based on the external preamplifier
 ON | 1
 Performs data corrections based on the external preamplifier
 *RST: 0

Example: INP:EGA ON

Manual operation: See "[Ext. PA Correction](#)" on page 71

INPut:IQ:FULLscale:AUTO <State>

Defines whether the full scale level (i.e. the maximum input power on the Baseband Input connector) is defined automatically according to the reference level, or manually.

Parameters:

<State> **ON | 1**
 Automatic definition
 OFF | 0
 Manual definition according to [INPut:IQ:FULLscale\[:LEVel\]](#) on page 240
 *RST: 1

Example: INP:IQ:FULL:AUTO OFF

INPut:IQ:FULLscale[:LEVel] <PeakVoltage>

Defines the peak voltage at the Baseband Input connector if the full scale level is set to manual mode (see [INPut:IQ:FULLscale:AUTO](#) on page 240).

Parameters:

<PeakVoltage> 0.25 V | 0.5 V | 1 V | 2 V
 Peak voltage level at the connector.
 For probes, the possible full scale values are adapted according to the probe's attenuation and maximum allowed power.
 *RST: 1V
 Default unit: V

Example: INP:IQ:FULL 0.5V

Manual operation: See "[Full Scale Level](#)" on page 70

INPut:GAIN:STATe <State>

Turns the internal preamplifier on and off. It requires the optional preamplifier hardware.

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

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

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

Parameters:

<State> ON | OFF | 0 | 1
OFF | 0
 Switches the function off
ON | 1
 Switches the function on
 *RST: 0

Example: INP:GAIN:STAT ON
 INP:GAIN:VAL 15
 Switches on 15 dB preamplification.

Manual operation: See "[Preamplifier](#)" on page 70

INPut:GAIN[:VALue] <Gain>

Selects the "gain" if the preamplifier is activated (INP:GAIN:STAT ON, see [INPut:GAIN:STATe](#) on page 241).

The command requires the additional preamplifier hardware option.

Parameters:

<Gain> For all FSW models except for FSW85, the following settings are available:
 15 dB and 30 dB
 All other values are rounded to the nearest of these two.
 For FSW85 models:
 FSW43 or higher:
 30 dB

Default unit: DB

Example: INP:GAIN:STAT ON
INP:GAIN:VAL 30
Switches on 30 dB preamplification.

Manual operation: See "Preamplifier" on page 70

[SENSe:]IQ:WBANd <State>

Selects the signal path for signal processing.

For details and restrictions, see "Signal Path" on page 73.

Parameters:

<State> ON | OFF | 0 | 1
OFF | 0
The narrowband signal path is used.
ON | 1
The wideband signal path is used.
*RST: 0

Example: SENS:IQ:WBAN ON

Manual operation: See "Signal Path" on page 73

5.6.6 Controlling a signal generator

When you configure the signal generator, make sure to synchronize with *OPC? or *WAI to make sure that the command was successfully applied on the generator before sending the next command.

CONFigure:DUT:STIMe.....	243
CONFigure:GENerator:CONTRol[:STATe].....	243
CONFigure:GENerator:DUT:INPut:MAXimum:POWer.....	243
CONFigure:GENerator:LEVel:DUTLimit.....	243
CONFigure:GENerator:DUT:INPut:MAXimum:POWer:LEDState?.....	244
CONFigure:GENerator:EXTernal:ROSCillator.....	244
CONFigure:GENerator:EXTernal:ROSCillator:LEDState?.....	244
CONFigure:GENerator:FREQuency:CENTer.....	245
CONFigure:GENerator:FREQuency:CENTer:LEDState?.....	245
CONFigure:GENerator:FREQuency:CENTer:SYNC[:STATe].....	245
CONFigure:GENerator:IPConnection:ADDRess.....	246
CONFigure:GENerator:CONNection:CState?.....	246
CONFigure:GENerator:POWer:LEVel.....	246
CONFigure:GENerator:POWer:LEVel:ATTenuation.....	247
CONFigure:GENerator:POWer:LEVel:ATTenuation:LEDState?.....	247
CONFigure:GENerator:POWer:LEVel:LEDState?.....	248
CONFigure:GENerator:POWer:LEVel:OFFSet.....	248
CONFigure:GENerator:POWer:LEVel:OFFSet:LEDState?.....	248
CONFigure:GENerator:RFOutput:LEDState?.....	249

CONFigure:GENerator:RFOutput[:STATe].....	249
CONFigure:GENerator:SEGMENT.....	249
CONFigure:GENerator:SEGMENT:LEDState?.....	250
CONFigure:GENerator:SETTings:UPDate.....	250
CONFigure:GENerator:TARGet:PATH:BB?.....	250
CONFigure:GENerator:TARGet:PATH:RF.....	251
CONFigure:SETTings.....	251
CONFigure:GENerator:RELAy:READ?.....	251
CONFigure:GENerator:RELAy:WRITe.....	251

CONFigure:DUT:STIME <Time>

This command defines the settling time between generator setting changes and the start of the next measurement.

Parameters:

<Time> <numeric value>
 *RST: 0
 Default unit: s

Example: //Define settling delay
 CONF:DUT:STIM 0.5

Manual operation: See "[Settling Delay](#)" on page 84

CONFigure:GENerator:CONTrol[:STATe] <State>

This command turns the generator control on and off.

Parameters:

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

Example: //Turn on generator control
 CONF:GEN:CONT ON

Manual operation: See "[Generator Control State](#)" on page 81

CONFigure:GENerator:DUT:INPut:MAXimum:POWer <Level>

This command defines the maximum generator output power.

Parameters:

<Level> Default unit: dBm

Example: //Define maximum output power
 CONF:GEN:DUT:INP:MAX:POW 0DBM

Manual operation: See "[Maximum DUT Input Level](#)" on page 82

CONFigure:GENerator:LEVel:DUTLimit <Value>

This command defines the output power RMS level of the generator.

Parameters:

<Value> <numeric value>
 Default unit: dB

CONFigure:GENerator:DUT:INPut:MAXimum:POWer:LEDState?

This command queries the maximum output level configuration state on the generator.

Return values:

<State> **GREen**
 Configuration was successful.

GREY
 Unknown configuration state.

RED
 Configuration to the reference was not successful.

Example:

```
CONF:GEN:DUT:INP:MAX:POW:LEDS?
would return, e.g.:
GRE
```

Usage: Query only

Manual operation: See "[Maximum DUT Input Level](#)" on page 82

CONFigure:GENerator:EXTernal:ROSCillator <Source>

This command selects the source of the generator reference frequency.

Make sure to synchronize with *OPC? or *WAI to make sure that the command was successfully applied on the generator before sending the next command.

Parameters:

<Source> **EXT**
 The generator uses an external reference frequency (for example that of the FSW).

INT
 The generator uses its own (internal) reference frequency.

Example:

```
//Select the reference frequency of the generator
CONF:GEN:EXT:ROSC INT;*WAI
```

Manual operation: See "[Reference Frequency](#)" on page 83

CONFigure:GENerator:EXTernal:ROSCillator:LEDState?

This command queries the connection status of the generator to its frequency reference.

Return values:

<State> **GREen**
 Connection to the reference was successful.

GREY

Unknown connection state.

RED

Connection to the reference was not successful.

Example:

```
CONF:GEN:EXT:ROSC:LEDS?
would return, e.g.:
RED
```

Usage:

Query only

Manual operation: See "[Reference Frequency](#)" on page 83**CONFigure:GENerator:FREQUENCY:CENTer** <Frequency>

This command defines the frequency of the generator.

Make sure to synchronize with *OPC? or *WAI to make sure that the command was successfully applied on the generator before sending the next command.

Parameters:

<Frequency> <numeric value>
 Default unit: Hz

Example:

```
//Define a generator frequency
CONF:GEN:FREQ:CENT 100000000;*WAI
```

Manual operation: See "[Center Frequency](#)" on page 83**CONFigure:GENerator:FREQUENCY:CENTer:LEDState?**

This command queries the status of frequency synchronization.

Return values:

<State> **GREen**
 Frequency synchronization was successful.
GREY
 Unknown frequency synchronization state.
RED
 Frequency synchronization was not successful.

Example:

```
CONF:GEN:FREQ:CENT:LEDS?
would return, e.g.:
GRE
```

Usage:

Query only

Manual operation: See "[Center Frequency](#)" on page 83**CONFigure:GENerator:FREQUENCY:CENTer:SYNC[:STATe]** <State>

This command turns synchronization of the analyzer and generator frequency on and off.

Make sure to synchronize with `*OPC?` or `*WAI` to make sure that the command was successfully applied on the generator before sending the next command.

Parameters:

<State> ON | OFF | 1 | 0

Example: //Match the generator frequency to the analyzer frequency when frequency on the FSW is changed
`CONF:GEN:FREQ:CENT:SYNC ON;*WAI`

Manual operation: See "[Attach to Analyzer Frequency](#)" on page 83

CONFigure:GENerator:IPConnection:ADDRESS <IPAddress>

This command defines the IP address of the connected signal generator.

Make sure to synchronize with `*OPC?` or `*WAI` to make sure that the command was successfully applied on the generator before sending the next command.

Parameters:

<IPAddress> String containing the IP address or computer name.

Example: //Connect to the generator with the stated IP address
`CONF:GEN:IPC:ADDR '192.0.2.0';*WAI`

Example: //Connect to the generator with a computer name
`CONF:GEN:IPC:ADDR 'MyGenerator';*WAI`

Manual operation: See "[IP Address](#)" on page 81

CONFigure:GENerator:CONNECTION:CState?

Queries the state of the connected signal generator.

Return values:

<ConnectionState> **UNKNown**
no signal generator connected
CONNected
connection established
NCONNected
connection could not be established, possibly due to an incompatible instrument or invalid IP address

Example: `CONFigure:GENerator:CONNECTION:CState?`

Usage: Query only

Manual operation: See "[IP Address](#)" on page 81

CONFigure:GENerator:POWER:LEVEL <Level>

This command defines the signal generator level.

Make sure to synchronize with `*OPC?` or `*WAI` to make sure that the command was successfully applied on the generator before sending the next command.

Parameters:

<Level> <numeric value>
 Default unit: dBm

Example:

```
//Define generator output level
CONF:GEN:POW:LEV 0;*WAI
```

Manual operation: See "[RMS Level](#)" on page 82

CONFigure:GENerator:POWer:LEVel:ATTenuation <Level>

This command defines digital attenuation that is applied to digitally modulated I/Q signals.

Make sure to synchronize with `*OPC?` or `*WAI` to make sure that the command was successfully applied on the generator before sending the next command.

Parameters:

<Level> <numeric value>
 *RST: 0
 Default unit: dB

Example:

```
//Attenuate the signal
CONF:GEN:POW:LEV:ATT 10;*WAI
```

Manual operation: See "[Digital Attenuation](#)" on page 83

CONFigure:GENerator:POWer:LEVel:ATTenuation:LEDState?

This command queries the configuration state of digital attenuation on the generator.

Return values:

<State> **GREEN**
 Digital attenuation configuration was successful.
 GREY
 Unknown digital attenuation configuration state.
 RED
 Digital attenuation configuration was not successful.

Example:

```
CONF:GEN:POW:LEV:ATT:LEDS?
would return, e.g.:
RED
```

Usage:

Query only

CONFigure:GENerator:POWer:LEVel:LEDState?

This command queries the level configuration state on the generator.

Return values:

<State> **GREen**
Level configuration was successful.

GREY
Unknown level configuration state.

RED
Level configuration was not successful.

Example:

```
CONF:GEN:POW:LEV:LEDS?
would return, e.g.:
GRE
```

Usage: Query only

Manual operation: See "[RMS Level](#)" on page 82

CONFigure:GENerator:POWer:LEVel:OFFSet <Level>

This command defines a mathematical level offset for the signal generator (for example to take external attenuation into account).

Make sure to synchronize with *OPC? or *WAI to make sure that the command was successfully applied on the generator before sending the next command.

Parameters:

<Level> <numeric value>
Default unit: dBm

Example:

```
//Define a level offset
CONF:GEN:POW:LEV:OFFS 10;*WAI
```

Manual operation: See "[RMS Level](#)" on page 82

CONFigure:GENerator:POWer:LEVel:OFFSet:LEDState?

This command queries the level offset configuration state on the generator.

Return values:

<State> **GREen**
Level offset configuration was successful.

GREY
Unknown level offset configuration state.

RED
Level offset configuration was not successful.

Example:

```
CONF:GEN:POW:LEV:LEDS?
would return, e.g.:
GRE
```


Usage: Query only
Manual operation: See "RMS Level" on page 82

CONFigure:GENerator:RFOutput:LEDState?

This command queries the RF output state on the generator.

Return values:

<State> **GREen**
Output configuration was successful.
GREY
Unknown output configuration state.
RED
Output configuration was not successful.

Example: CONF:GEN:RFO:LEDS?
would return, e.g.:
GRE

Usage: Query only
Manual operation: See "RF Output" on page 84

CONFigure:GENerator:RFOutput[:STATe] <State>

This command turns the RF output on the connected signal generator on and off.

Make sure to synchronize with *OPC? or *WAI to make sure that the command was successfully applied on the generator before sending the next command.

Parameters:

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

Example: //Turn off the RF output
CONF:GEN:RFO OFF; *WAI

Manual operation: See "RF Output" on page 84

CONFigure:GENerator:SEGment <Segment>

This command selects the segment in a multi-waveform file that should be selected on the signal generator.

Make sure to synchronize with *OPC? or *WAI to make sure that the command was successfully applied on the generator before sending the next command.

Parameters:

<Segment> <numeric value>: (integer only)
Range: Depends on the number of segments in the wave-
 form file.
*RST: 0

Example: //Select the 3rd segment of a waveform file
 CONF:GEN:SEGM 3;*WAI

Manual operation: See "[Segment](#)" on page 83

CONFigure:GENerator:SEGMENT:LEDState?

This command queries if the proper segment of a multi waveform has been selected.

Return values:

<State> **GREen**
 The desired segment has been selected.

GREY
 Unknown segment selection state.

RED
 The desired segment has not been selected.

Example: CONF:GEN:SEGM:LEDS?
 would return, e.g.
 RED

Usage: Query only

Manual operation: See "[Segment](#)" on page 83

CONFigure:GENerator:SETTings:UPDate

This command updates the generator settings as defined within the R&S FSW-K18.

Make sure to synchronize with *OPC? or *WAI to make sure that the command was successfully applied on the generator before sending the next command.

Example: //Update generator settings
 CONF:GEN:SETT:UPD;*WAI

Usage: Event

CONFigure:GENerator:TARGet:PATH:BB?

This command queries the signal path of the R&S SMW used for baseband signal generation.

Note that the baseband path is always the same as the RF path selected with [CONFigure:GENerator:TARGet:PATH:RF](#).

Return values:

<Path> A | B

Example: CONF:GEN:TARG:PATH:BB?
 would return, e.g.
 A

Usage: Query only

Manual operation: See "Path RF / BB" on page 83

CONFigure:GENerator:TARGet:PATH:RF <Path>

This command selects the signal path of the generator used for RF signal generation.

Make sure to synchronize with *OPC? or *WAI to make sure that the command was successfully applied on the generator before sending the next command.

Parameters:

<Path> A | B

Example: //Select RF path A to generate the signal
CONF:GEN:TARG:PATH:RF A;*WAI

Manual operation: See "Path RF / BB" on page 83

CONFigure:SETTings

This command transfers the current generator configuration into the amplifier application.

Make sure to synchronize with *OPC? or *WAI to make sure that the command was successfully applied on the generator before sending the next command.

Example: //Synchronize the generator configuration
CONF:SETT;*WAI

Usage: Event

CONFigure:GENerator:RELay:READ?

Provides functionality to read the answer if the command that was sent to the signal generator using [CONFigure:GENerator:RELay:WRITe](#) on page 251 contained a "?".

Return values:

<Response>

Example: CONF:GEN:REL:READ?

Usage: Query only
Asynchronous command

CONFigure:GENerator:RELay:WRITe <Command>

Provides functionality to configure the signal generator directly through the FSW-K18 application. It resends the string parameter as a SCPI command to the connected signal generator.

If the command contains a "?", use [CONFigure:GENerator:RELay:READ?](#) on page 251 to read the answer.

Setting parameters:

<Command>

Example: CONF:GEN:REL:WRIT "generator command"**Usage:** Setting only
Asynchronous command

5.6.7 Configuring the data capture

[SENSe:]BANDwidth[:RESolution].....	252
[SENSe:]BANDwidth[:RESolution]:AUTO.....	252
[SENSe:]REFSig:TIME?.....	253
[SENSe:]SWAPiq.....	253
[SENSe:]SWEep:LENGth.....	253
[SENSe:]SWEep:TIME.....	254
[SENSe:]SWEep:TIME:AUTO.....	254
TRACe:IQ:BWIDth.....	254
TRACe:IQ:SRATe.....	255
TRACe:IQ:SRATe:AUTO.....	255
TRACe:IQ:WBANd:MBWIDth.....	256
TRACe:IQ:WBANd[:STATe].....	256

[SENSe:]BANDwidth[:RESolution] <Bandwidth>

This command defines the resolution bandwidth applied to spectrum measurements.

Prerequisites for this command

- Turn off automatic selection of RBW ([SENSe:]BANDwidth[:RESolution]:AUTO).

Parameters:

<Bandwidth> <numeric value>
 Range: 1 Hz to 10 MHz
 *RST: RBW is selected automatically
 Default unit: Hz

Example: //Select resolution bandwidth
 BAND:AUTO OFF
 BAND 100KHZ

Manual operation: See "[Defining the resolution bandwidth for spectrum measurements](#)" on page 98

[SENSe:]BANDwidth[:RESolution]:AUTO <State>

This command turns automatic selection of the resolution bandwidth (RBW) for spectrum measurements on and off.

Parameters:

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

Example:

```
//Select manual resolution bandwidth
BAND:AUTO OFF
BAND 100KHZ
```

Manual operation: See ["Defining the resolution bandwidth for spectrum measurements"](#) on page 98

[SENSe:]REFSig:TIME?

This command queries the length of the reference signal as shown in the "Acquisition" dialog box.

Return values:

<Duration> <numeric value>
 Default unit: s

Example:

```
REFS:TIME?
would return, e.g.:
0.00125
```

Usage: Query only

Manual operation: See ["Automatic adjustment"](#) on page 97

[SENSe:]SWAPiq <State>

This command inverts the I and Q branches of the signal.

Parameters:

<State> ON | OFF | 1 | 0

Example:

```
//Inverts the I and Q channels
SWAP ON
```

Manual operation: See ["Inverting the I/Q branches"](#) on page 98

[SENSe:]SWEep:LENGth <Samples>

This command defines the capture length.

Prerequisites for this command

- Turn off automatic selection of the capture time (`[SENSe:]SWEep:TIME:AUTO`).

Effects of this command

- Changing the capture length automatically adjusts the capture time.

Parameters:

<Samples> <numeric value>: (integer only)
 Default unit: Samples

Example: //Define a capture length
 SWE:TIME:AUTO OFF
 SWE:LENG 1000000

Manual operation: See "[Manual definition](#)" on page 98

[SENSe:]SWEep:TIME <Time>

This command defines the capture time.

Prerequisites for this command

- Turn off automatic selection of the capture time ([SENSe:]SWEep:TIME:AUTO).

Effects of this command

- Changing the capture time automatically adjusts the capture length.

Parameters:

<Time> <numeric value>
 Default unit: s

Example: //Defines a sweep time
 SWE:TIME:AUTO OFF
 SWE:TIME 10MS

Manual operation: See "[Manual definition](#)" on page 98

[SENSe:]SWEep:TIME:AUTO <State>

This command turns automatic selection of an appropriate capture time on and off.

When you turn on this feature, the application calculates an appropriate capture time based on the reference signal and adjusts the other acquisition settings accordingly.

Parameters:

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

Example: //Select automatic adjustment of the capture time
 SWE:TIME:AUTO ON

Manual operation: See "[Automatic adjustment](#)" on page 97

TRACe:IQ:BWIDth <Bandwidth>

This command defines the analysis bandwidth with which the amplified signal is captured.

This command is available when TRACe:IQ:SRATe:AUTO has been turned off.

Note that when you change the analysis bandwidth, the sample rate and capture length are adjusted automatically to the new bandwidth.

Parameters:**<Bandwidth>** <numeric value>

Note that the application automatically adjusts the sample rate when you change the bandwidth manually.

Default unit: Hz

Example:

```
TRAC:IQ:SRAT:AUTO OFF
TRAC:IQ:BWID 50MHZ
```

Defines a bandwidth of 50 MHz. The sample rate is adjusted accordingly.

Manual operation: See "[Manual definition](#)" on page 97

TRACe:IQ:SRATe <SampleRate>

This command defines the sample rate with which the amplified signal is captured.

This command is available when [TRACe:IQ:SRATe:AUTO](#) has been turned off.

Note that when you change the sample rate, the analysis bandwidth and capture length are adjusted automatically to the new sample rate.

Parameters:**<SampleRate>** <numeric value>

Note that the application automatically adjusts the analysis bandwidth when you change the sample rate manually.

Default unit: Hz

Example:

```
TRAC:IQ:SRAT:AUTO OFF
TRAC:IQ:SRAT 20MHZ
```

Defines a sample rate of 20 MHz. The analysis bandwidth is adjusted accordingly.

Manual operation: See "[Manual definition](#)" on page 97

TRACe:IQ:SRATe:AUTO <State>

This command turns automatic selection of an appropriate (capture) sample rate on and off.

When you turn on this feature, the application calculates an appropriate sample rate based on the reference signal and adjusts the other data acquisition settings accordingly.

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

*RST: 1

Example:

```
TRAC:IQ:SRAT:AUTO ON
```

Selects automatic adjustment of the sample rate.

Manual operation: See "[Automatic adjustment](#)" on page 96

TRACe:IQ:WBANd:MBWidth <Bandwidth>

This command selects the largest possible bandwidth that can be applied for the wideband signal path.

The wideband signal path is available with the corresponding bandwidth extensions available for the FSW.

The command is available when you turn on `TRACe:IQ:WBANd[:STATe]`.

Parameters:

<Bandwidth>

80MHZ

Restricts the bandwidth to 80 MHz.

(The wideband signal path is not used in that case. `TRACe:IQ:WBANd[:STATe]` is turned off.)

160MHZ | 320MHZ | 500MHZ

Restricts the bandwidth to the corresponding value, even if you have installed a higher bandwidth extension.

Default unit: Hz

Example:

```
//Restrict the bandwidth to 160 MHz
TRAC:IQ:WBAN ON
TRAC:IQ:WBAN:MBW 160MHZ
```

Manual operation: See "[Maximum bandwidth](#)" on page 97

TRACe:IQ:WBANd[:STATe] <State>

This command turns the wideband signal path on and off.

The wideband signal path is available with the corresponding bandwidth extensions available for the FSW.

Parameters:

<State>

ON | 1

Turns on the wideband signal path.

By default, the application allows you to use the maximum available bandwidth ("Auto" mode in manual operation).

You have to turn on the wideband signal path when you want to use bandwidths greater than 80 MHz.

OFF | 0

Turns off the wideband signal path. The largest available bandwidth is 80 MHz.

Example:

```
//Turn off the wideband signal path
TRAC:IQ:WBAN OFF
```

Manual operation: See "[Maximum bandwidth](#)" on page 97

5.6.8 Sweep configuration

[SENSe:]SWEep:IQAVg:COUNT.....	257
[SENSe:]SWEep:IQAVg:COUNT:CURRENT?	257
[SENSe:]SWEep:IQAVg:MAverage[:STATe].....	257
[SENSe:]SWEep:IQAVg[:STATe].....	258
[SENSe:]SWEep:STATistics[:STATe].....	258
[SENSe:]SWEep:STATistics:COUNT.....	258
[SENSe:]SWEep:STATistics:CONTinuous[:STATe].....	258
[SENSe:]SWEep:STATistics:MODE.....	259
CONFigure:RESult:RANGe[:SELected].....	259

[SENSe:]SWEep:IQAVg:COUNT <Count>

Only available for backward compatibility.

Switches statistics state to "ON", sets trace mode to "IQ/Averaging" and counts to specified value.

Parameters:

<Count> <numeric value> (integer only)
 Range: 1 to 10000
 *RST: 1

Example: //Average over 10 data captures
 SWE:IQAV:COUN 10

Manual operation: See "[I/Q Averaging Sweep Count](#)" on page 125

[SENSe:]SWEep:IQAVg:COUNT:CURRENT?

Only available for backward compatibility.

Queries the current measurement out of a sequence of measurements that averages I/Q data.

Return values:

<Measurement> numeric value

Example: //Define number of measurements
 SWE:IQAV:COUN 10
 //Query process of measurement
 SWE:IQAV:COUN:CURR?
 would return, e.g.
 7 (out of 10)

Usage: Query only

[SENSe:]SWEep:IQAVg:MAverage[:STATe] <State>

Only available for backward compatibility.

Switches statistics state to "ON", sets trace mode to "IQ/Averaging" and switches continuous statistics "ON" or "OFF".

Parameters:

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

Example: SWE:IQAV:MAV ON

[SENSe:]SWEep:IQAVg[:STATe] <State>

Only available for backward compatibility.

Switches statistics state to "ON" and sets trace mode to "IQ/Averaging".

Parameters:

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

[SENSe:]SWEep:STATistics[:STATe] <State>

Sets and queries the sweep statistics setting.

Parameters:

<State> ON | OFF

Example: [SENSe]:SWEep:STATistics:STATe ON

Manual operation: See "[Statistics State](#)" on page 99

[SENSe:]SWEep:STATistics:COUNT <Count>

Sets and queries the sweep statistics count.

Parameters:

<Count> numeric value

Example: SENS:SWE:STAT:COUNT 10

Manual operation: See "[Statistics Count](#)" on page 100

[SENSe:]SWEep:STATistics:CONTinuous[:STATe] <State>

Sets and queries the continuous statistics setting.

Parameters:

<State> ON | OFF

Example: [SENSe]:SWEep:STATistics:CONT ON

Manual operation: See "[Continuous Statistics](#)" on page 100

[SENSe:]SWEep:STATistics:MODE <State>

Sets and queries the statistics mode.

Parameters:

<State> IQAveraging | TRACe

Example: [SENSe]:SWEep:STATistics:MODE TRACe

Manual operation: See "[Statistics Mode](#)" on page 99

CONFigure:RESult:RANGe[:SElected] <ResultRange>

Sets and queries the selected result range.

Parameters:

<ResultRange> <numeric value>

Example: CONFigure:RESult:RANGe

Manual operation: See "[Statistics Table](#)" on page 32
See "[Select Result Rng](#)" on page 100

5.6.9 Synchronizing measurement data

CONFigure:ESTimation:FULL.....	259
CONFigure:ESTimation:RANGe.....	260
CONFigure:ESTimation:START.....	260
CONFigure:ESTimation:STOP.....	260
CONFigure:SYNC:CONFidence.....	261
CONFigure:SYNC:SECond:STAT.....	261
CONFigure:SYNC:DOMain.....	261
CONFigure:SYNC:SOFail.....	262
CONFigure:SYNC:STAT.....	262
FEtCh[:SYNC]?.....	262
FEtCh:SYNC:FAIL?.....	263

CONFigure:ESTimation:FULL <State>

This command turns estimation over the complete reference signal on and off.

Parameters:

<State> ON | OFF | 1 | 0

When you turn estimation over the full reference signal off, you can define an estimation range with:

- CONFigure:ESTimation:START
- CONFigure:ESTimation:STOP

*RST: 1

Example: //Define a synchronization range over the first 20 µs of the capture buffer
 CONF:EST:FULL OFF
 CONF:EST:STAR 0s
 CONF:EST:STOP 20us

Manual operation: See ["Defining the estimation range"](#) on page 103

CONFigure:ESTimation:RANGe <Start>, <Stop>

This command defines start and stop values of the estimation range.

Alternatively, you can do that with

- [CONFigure:ESTimation:START](#) on page 260
- [CONFigure:ESTimation:STOP](#) on page 260

Setting parameters:

<Start> <numeric value>
 Start time of the estimation range (relative to the beginning of the reference signal).
 Default unit: s

<Stop> <numeric value>
 Stop time of the estimation range (relative to the beginning of the reference signal).
 Default unit: s

Example: //Define an estimation range over the first 20 µs of the reference signal
 CONF:EST:FULL OFF
 CONF:EST:RANG 0,20e-6

Usage: Setting only

CONFigure:ESTimation:STARt <Start>

This command defines the start value of the estimation range.

Parameters:

<Start> <numeric value>
 Default unit: s

Example: See [CONFigure:ESTimation:FULL](#).

Manual operation: See ["Defining the estimation range"](#) on page 103

CONFigure:ESTimation:STOP <Stop>

This command defines the end value of the estimation range.

Parameters:

<Stop> <numeric value>
Default unit: s

Example: See [CONFigure:ESTimation:FULL](#).

Manual operation: See ["Defining the estimation range"](#) on page 103

CONFigure:SYNC:CONFidence <Confidence>

This command defines the synchronization confidence level.

Parameters:

<Confidence> <numeric value>
Range: 0 to 100
Default unit: PCT

Example: //Define confidence level
CONF:SYNC:CONF 99

Manual operation: See ["Defining a synchronization confidence level"](#) on page 102

CONFigure:SYNC:SECond:STAT <State>

This command activates an additional synchronization algorithm (operating in frequency domain).

Parameters:

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

Example: //Turn on additional synchronization algorithm.
:CONF:SYNC:SEC:STAT ON

Manual operation: See ["2nd Stage Synchronization"](#) on page 103

CONFigure:SYNC:DOMain <Domain>

This command selects the synchronization method.

Parameters:

<Domain> **IQDirect**
I/Q data for the reference signal is directly correlated with the reference and measured signal.

IQPDiff
Correlation on the phase differentiated I/Q data.

MAGNitude
Correlation on the magnitude of the I/Q data with no regard for phase information.

TRIGger

It is assumed that the capture is triggered at the start of the reference waveform.

*RST: IQPDiff

Example: //Try to find a correlation in the raw I/Q data
CONF:SYNC:DOM IQD

Manual operation: See ["Selecting the synchronization method"](#) on page 102

CONFigure:SYNC:SOFail <State>

This command turns a measurement stop on and off, when synchronization of measured and reference signal fails.

This mostly has an effect on continuous measurements. Single measurements are not affected.

Parameters:

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

Example: //Stop the measurement when synchronization fails
CONF:SYNC:SOF ON

Manual operation: See ["Turning synchronization of reference and measured signal on and off"](#) on page 101

CONFigure:SYNC:STAT <State>

This command turns synchronization between reference and measured signal on and off.

Parameters:

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

Example: //Turn on synchronization between reference and measured signal
CONF:SYNC:STAT ON

Manual operation: See ["Turning synchronization of reference and measured signal on and off"](#) on page 101

FETCh[:SYNC]?

This command queries if synchronisation between reference and measured signal has been successful.

The command is available when you have turned on `CONFigure:SYNC:STAT`.

Return values:

<State> **ON | 1**
Synchronisation has been successful.
OFF | 0
Synchronisation has not been successful.

Example: `FETC?`
would return, e.g.
0

Usage: Query only

FETCh:SYNC:FAIL?

This command queries the synchronization status.

Return values:

<State> **1**
Synchronization was not successful.
0
Synchronization was successful.

Example: `FETC:SYNC:FAIL?`
would return, e.g.
0

Usage: Query only

5.6.10 Defining the evaluation range

<code>CONFigure:EVALuation:FULL</code>	263
<code>CONFigure:EVALuation:RANGe</code>	264
<code>CONFigure:EVALuation:START</code>	264
<code>CONFigure:EVALuation:STOP</code>	264

CONFigure:EVALuation:FULL <State>

This command turns result evaluation over the complete capture buffer on and off.

Parameters:

<State> **ON | OFF | 1 | 0**
When you turn calculation over the full capture buffer off, you can define an evaluation range with:
•`CONFigure:EVALuation:START`
•`CONFigure:EVALuation:STOP`
***RST: 1**

Example: //Define an evaluation range over 45 μ s of the capture buffer
 CONF:EVAL:FULL OFF
 CONF:EVAL:STAR 5us
 CONF:EVAL:STOP 50us

Manual operation: See ["Defining the evaluation range"](#) on page 104

CONFigure:EVALuation:RANGe <Start>, <Stop>

This command defines start and stop values of the evaluation range.

Alternatively, you can do that with

- [CONFigure:EVALuation:START](#) on page 264
- [CONFigure:EVALuation:STOP](#) on page 264

Setting parameters:

<Start> <numeric value>
 Start time of the evaluation range (relative to the beginning of the reference signal).
 Default unit: s

<Stop> <numeric value>
 Stop time of the evaluation range (relative to the beginning of the reference signal).
 Default unit: s

Example: //Define an evaluation range over 45 μ s of the reference signal, beginning at 5 μ s into the signal
 CONF:EVAL:FULL OFF
 CONF:EVAL:RANG 5e-6,50e-6

Usage: Setting only

Manual operation: See ["Defining the evaluation range"](#) on page 104

CONFigure:EVALuation:STARt <Start>

This command defines the start value of the evaluation range.

Parameters:

<Start> <numeric value>
 Default unit: s

Example: See [CONFigure:EVALuation:FULL](#).

Manual operation: See ["Defining the evaluation range"](#) on page 104

CONFigure:EVALuation:STOP <Stop>

This command defines the end value of the evaluation range.

Parameters:

<Stop> <numeric value>
 Default unit: s

Example: See `CONFigure:EVALuation:FULL`.

Manual operation: See "Defining the evaluation range" on page 104

5.6.11 Estimating and compensating signal errors

- [Error estimation and compensation](#)..... 265
- [Equalizer](#)..... 268

5.6.11.1 Error estimation and compensation

<code>CONFigure:SIGNal:ERRor:COMPensation:ADRoop[:STATe]</code>	265
<code>CONFigure:SIGNal:ERRor:COMPensation:FERRor[:STATe]</code>	265
<code>CONFigure:SIGNal:ERRor:COMPensation:IQImbalance[:STATe]</code>	266
<code>CONFigure:SIGNal:ERRor:COMPensation:IQOfset[:STATe]</code>	266
<code>CONFigure:SIGNal:ERRor:COMPensation:SRATe[:STATe]</code>	266
<code>CONFigure:SIGNal:ERRor:ESTimation:ADRoop[:STATe]</code>	267
<code>CONFigure:SIGNal:ERRor:ESTimation:FERRor[:STATe]</code>	267
<code>CONFigure:SIGNal:ERRor:ESTimation:IQImbalance[:STATe]</code>	267
<code>CONFigure:SIGNal:ERRor:ESTimation:IQOfset[:STATe]</code>	267
<code>CONFigure:SIGNal:ERRor:ESTimation:SRATe[:STATe]</code>	268

CONFigure:SIGNal:ERRor:COMPensation:ADRoop[:STATe] <State>

This command turns compensation of the amplitude droop on and off.

Prerequisites for this command

- Turn on estimation of sample rate (`CONFigure:SIGNal:ERRor:ESTimation:ADRoop[:STATe]`).

Parameters:

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

Example: //Turn on error compensation
`CONF:SIGN:ERR:COMP:ADR ON`

Manual operation: See "Amplitude Droop" on page 106

CONFigure:SIGNal:ERRor:COMPensation:FERRor[:STATe] <State>

This command turns compensation of the frequency error on and off.

Prerequisites for this command

- Turn on estimation of sample rate (`CONFigure:SIGNal:ERRor:ESTimation:FERRor[:STATe]`).

Parameters:

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

Example:

```
//Turn on error compensation
CONF:SIGN:ERR:COMP:FERR ON
```

Manual operation: See "[Frequency Error](#)" on page 106

CONFigure:SIGNal:ERRor:COMPensation:IQIMbalance[:STATe] <State>

This command turns compensation of the I/Q imbalance on and off.

Prerequisites for this command

- Turn on estimation of sample rate ([CONFigure:SIGNal:ERRor:ESTimation:IQIMbalance\[:STATe\]](#)).

Parameters:

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

Example:

```
//Turn on error compensation
CONF:SIGN:ERR:COMP:IQIM ON
```

Manual operation: See "[I/Q Imbalance](#)" on page 106

CONFigure:SIGNal:ERRor:COMPensation:IQOffset[:STATe] <State>

This command turns compensation of the I/Q offset on and off.

Prerequisites for this command

- Turn on estimation of sample rate ([CONFigure:SIGNal:ERRor:ESTimation:IQOffset\[:STATe\]](#)).

Parameters:

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

Example:

```
//Turn on error compensation
CONF:SIGN:ERR:COMP:IQOF ON
```

Manual operation: See "[I/Q Offset](#)" on page 106

CONFigure:SIGNal:ERRor:COMPensation:SRATe[:STATe] <State>

This command turns compensation of the sample rate error on and off.

Prerequisites for this command

- Turn on estimation of sample rate ([CONFigure:SIGNal:ERRor:ESTimation:SRATe\[:STATe\]](#)).

Parameters:

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

Example:

//Turn on error compensation
 CONF:SIGN:ERR:COMP:SRAT ON

Manual operation: See ["Sample Error Rate"](#) on page 106

CONFigure:SIGNal:ERRor:ESTimation:ADRoop[:STATe] <State>

This command turns estimation of the amplitude droop on and off.

Parameters:

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

Example:

//Turn on error estimation
 CONF:SIGN:ERR:EST:ADR ON

Manual operation: See ["Amplitude Droop"](#) on page 106

CONFigure:SIGNal:ERRor:ESTimation:FERRor[:STATe] <State>

This command turns estimation of the frequency error on and off.

Parameters:

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

Example:

//Turn on error estimation
 CONF:SIGN:ERR:EST:FERR ON

Manual operation: See ["Frequency Error"](#) on page 106

CONFigure:SIGNal:ERRor:ESTimation:IQIMbalance[:STATe] <State>

This command turns estimation of the I/Q imbalance on and off.

Parameters:

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

Example:

//Turn on error estimation
 CONF:SIGN:ERR:EST:IQIM ON

Manual operation: See ["I/Q Imbalance"](#) on page 106

CONFigure:SIGNal:ERRor:ESTimation:IQOFFset[:STATe] <State>

This command turns estimation of the I/Q offset on and off.

Parameters:

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

Example:

```
//Turn on error estimation.
CONF:SIGN:ERR:EST:IQOF ON
```

Manual operation: See "[I/Q Offset](#)" on page 106

CONFigure:SIGNal:ERRor:ESTimation:SRATe[:STATe] <State>

This command turns estimation of the sample rate error on and off.

Parameters:

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

Example:

```
//Turn on error estimation
CONF:SIGN:ERR:EST:SRAT ON
```

Manual operation: See "[Sample Error Rate](#)" on page 106

5.6.11.2 Equalizer

CONFigure:EQUalizer:FILTer:FILE:FORMat	268
CONFigure:EQUalizer:FILTer:LENGth	268
CONFigure:EQUalizer:FPARameters	269
CONFigure:EQUalizer[:STATe]	269
CONFigure:EQUalizer:TRAIIn	270
MMEMory:LOAD:EQUalizer:FILTer:COEFFicient	270
MMEMory:STORe<n>:EQUalizer:FILTer:COEFFicient	270

CONFigure:EQUalizer:FILTer:FILE:FORMat <Source>

This command selects the file format to which the equalizer filter is exported.

Parameters:

<Source> **CSV**
 Filter is written to a `csv` file.

FRES
 Filter is written to a `fres` file.

*RST: CSV

Example:

```
//Select file format for equalizer filter
CONF:EQU:FILT:FILE:FORM CSV
```

Manual operation: See "[Using the equalizer](#)" on page 107

CONFigure:EQUalizer:FILTer:LENGth <Length>

This command defines the length of the filter that the equalizer training is based on.

Parameters:

<Length> <numeric value> (integer only)

Example:

```
//Define equalizer filter length
CONF:EQU:FILT:LENG 25
```

Manual operation:

See ["Using the equalizer"](#) on page 107
See ["Equalizer Filter Length For Training"](#) on page 125

CONFigure:EQUalizer:FPARameters <Coefficient>...

This command defines the filter coefficients.

You can use this command to define the filter coefficients manually instead of training a filter.

Parameters:

<Coefficient> <numeric value> (integer only)

List of comma separated values.

Each coefficient consists of a real and an imaginary value.

```
<Coefficient_1_I>,<Coefficient_2_Q>,  
<Coefficient_2_I>,<Coefficient_2_Q>,...,  
<Coefficient_n_I>,<Coefficient_n_Q>
```

Example:

```
//Define a filter with a length of five, number of values therefore  
must be 10  
CONF:EQU:FPAR 5,8,5,10,10,12,5,2,2,1
```

Manual operation:

See ["Using the equalizer"](#) on page 107

CONFigure:EQUalizer[:STATe] <State>

This command turns the equalizer on and off.

Prerequisites for this command

- Load equalizer filter data (either by training or by restoring a file with equalizer information).
 - [CONFigure:EQUalizer:TRAI](#)n
 - [MMEMory:LOAD:EQUalizer:FILT:COEFFicient](#)

Parameters:

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

Example:

```
//Turn on equalizer  
MMEM:LOAD:EQU:FILT:COEF 'c:\filter.csv'  
CONF:EQU ON
```

Manual operation:

See ["Using the equalizer"](#) on page 107

CONFigure:EQUalizer:TRAIn

This command initiates a training sequence for the equalizer filter.

Note that you have to synchronize the measurement before you can initiate a training sequence.

Prerequisites for this command

- Define a filter length (`CONFigure:EQUalizer:FILTer:LENGTh`).

Usage: Event

Manual operation: See ["Using the equalizer"](#) on page 107

MMEMory:LOAD:EQUalizer:FILTer:COEFFicient <FileName>

This command restores an equalizer filter that you have previously saved.

Setting parameters:

<FileName> String containing the file name and location of the filter (csv file format).

Example: //Restore filter file
MMEM:LOAD:EQU:FILT:COEF 'C:\filter.csv'

Usage: Setting only

Manual operation: See ["Using the equalizer"](#) on page 107

MMEMory:STORe<n>:EQUalizer:FILTer:COEFFicient <FileName>

This command stores the equalizer filter that has been calculated.

Prerequisites for this command

- Train an equalizer filter (`CONFigure:EQUalizer:TRAI`n).

Suffix:

<n> 1..n

Setting parameters:

<FileName> String containing the file name and location of the filter (csv file format).

Example: //Store filter file
CONF:EQU:TRA
MMEM:STOR:EQU:FILT:COEF 'C:\filter.csv'

Usage: Setting only

Manual operation: See ["Using the equalizer"](#) on page 107

5.6.12 Applying a system model

CONFigure:MODeling:AMAM:ORDER.....	271
CONFigure:MODeling:AMPM:ORDER.....	271
CONFigure:MODeling:LRANge.....	272
CONFigure:MODeling:NPOints.....	272
CONFigure:MODeling:SCALE.....	272
CONFigure:MODeling:SEQuence.....	272
CONFigure:MODeling[:STATE].....	273

CONFigure:MODeling:AMAM:ORDER <Order>

This command defines the order (or degree) of the "AM/AM" model polynomials that are calculated by the application.

Parameters:

<Order> String containing the polynomials to be calculated.
 You can either select a range of polynomials (e.g. "1-7"), a selection of polynomials (e.g. "1;3;5") or a combination of both (e.g. "1;3-5").
 Range: 0 to 18
 *RST: "0-7"

Example: //Calculate the polynomials to the 1st, 2nd, 3rd, 4th and 5th degree
 CONF:MOD:AMAM:ORD "1-5"

Example: //Calculate the polynomials to the 1st, 3rd and 5th degree
 CONF:MOD:AMAM:ORD "1;3;5"

Manual operation: See ["Selecting the degree of the polynomial"](#) on page 109

CONFigure:MODeling:AMPM:ORDER <Order>

This command defines the order (or degree) of the "AM/PM" model polynomials that are calculated by the application.

Parameters:

<Order> String containing the polynomials to be calculated.
 You can either select a range of polynomials (e.g. "1-7"), a selection of polynomials (e.g. "1;3;5") or a combination of both (e.g. "1;3;5").
 Range: 0 to 18
 *RST: "1-7"

Example: //Calculate the polynomials to the 1st, 3rd, 4th and 5th degree
 CONF:MOD:AMPM:ORD "1;3-5"

Manual operation: See ["Selecting the degree of the polynomial"](#) on page 109

CONFigure:MODELing:LRANge <Level>

This command defines the modeling level range.

Parameters:

<Level> <numeric value>
Default unit: dB

Example: //Define a modeling level range
CONF:MOD:LRAN 30

Manual operation: See ["Defining the modeling range"](#) on page 110

CONFigure:MODELing:NPOints <Points>

This command defines the number of modeling points.

Parameters:

<Points> <numeric value>: (integer only)
*RST: 50
Default unit: ---

Example: //Calculate the model based on 50 points
CONF:MOD:NPO 50

Manual operation: See ["Defining the modeling range"](#) on page 110

CONFigure:MODELing:SCALE <State>

This command selects the method by which the input power range is split into smaller ranges for the calculation of the amplifier model.

Parameters:

<State> **LINear**
Input power range is split on a linear basis.
LOGarithmic
Input power range is split on a logarithmic basis.
*RST: LOGarithmic

Example: //Apply a linear scale for the model calculation
CONF:MOD:SCAL LIN

Manual operation: See ["Selecting the modeling scale"](#) on page 110

CONFigure:MODELing:SEQUence <State>

This command selects the sequence in which the models are calculated.

Parameters:

<State> **AMFirst**
Calculates the "AM/AM" model before calculating the "AM/PM" model.

PMFirst

Calculates the "AM/PM" model before calculating the "AM/AM" model.

*RST: AMFirst

Example: //Calculate "AM/AM" model first
CONF:MOD:SEQ AMF

Manual operation: See ["Turning system modeling on and off"](#) on page 109

CONFigure:MODEling[:STATe] <State>

This command turns system modeling on and off.

Parameters:

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

Example: //Turn on system modeling
CONF:MOD ON

Manual operation: See ["Turning system modeling on and off"](#) on page 109

5.6.13 Applying digital predistortion

- [Polynomial DPD](#)..... 273
- [Direct DPD](#)..... 281
- [Generalized memory polynomial](#).....286
- [Hammerstein model](#).....291

5.6.13.1 Polynomial DPD

CONFigure:DPD:AMAM:LEDState?	274
CONFigure:DPD:AMAM[:STATe]	274
CONFigure:DPD:AMPM:LEDState?	274
CONFigure:DPD:AMPM[:STATe]	275
CONFigure:DPD:AMXM[:STATe]	275
CONFigure:DPD:FILE:GENerate	275
CONFigure:DPD:FILE:GENerate:ALL	276
CONFigure:DPD:FNAME	276
CONFigure:DPD:METHod	276
CONFigure:DPD:SEQuence	277
CONFigure:DPD:SHAPing:MODE	278
CONFigure:DPD:TRADeoff	278
CONFigure:DPD:UPDate	278
CONFigure:DPD:UPDate:ALL	278
CONFigure:DPD:UPDate:LEDState?	279
MMEMory:STORe<n>:DPD	279
FETCh:DPD:POLYnomial?	280
FETCh:DPD:WAVeform:PATH?	280

CONFigure:DPD:AMAM:LEDState?

This command queries the state of the calculation of the "AM/AM" distortion curve.

Return values:

<State> **GREen**
 Calculation was successful.

GREY
 Unknown calculation state.

RED
 Calculation was not successful.

Example:

```
CONF:DPD:AMAM:LEDS?
would return, e.g.:
RED
```

Usage: Query only

CONFigure:DPD:AMAM[:STATe] <State>

This command turns "AM/AM" predistortion on and off.

Prerequisites for this command

- Turn on polynomial DPD ([CONFigure:DDPD\[:STATe\]](#)).

Parameters:

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

Example:

```
//Calculate "AM/AM" curve
CONF:DPD:AMAM ON
```

Manual operation: See ["Selecting the order of model calculation"](#) on page 114

CONFigure:DPD:AMPM:LEDState?

This command queries the state of the calculation of the "AM/PM" distortion curve.

Return values:

<State> **GREen**
 Calculation was successful.

GREY
 Unknown calculation state.

RED
 Calculation was not successful.

Example:

```
CONF:DPD:AMPM:LEDS?
would return, e.g.:
RED
```

Usage: Query only

CONFigure:DPD:AMPM[:STATe] <State>

This command turns "AM/PM" predistortion on and off.

Prerequisites for this command

- Turn on polynomial DPD ([CONFigure:DDPD\[:STATe\]](#)).

Parameters:

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

Example: //Calculate "AM/PM" curve
 CONF:DPD:AMPM ON

Manual operation: See ["Selecting the order of model calculation"](#) on page 114

CONFigure:DPD:AMXM[:STATe] <State>

This command turns "AM/AM" and "AM/PM" predistortion on and off (at the same time).

Alternatively, you can do that with:

- [CONFigure:DPD:AMAM\[:STATe\]](#)
and
- [CONFigure:DPD:AMPM\[:STATe\]](#)

However, using [CONFigure:DPD:AMXM\[:STATe\]](#) is the smoother way.

Prerequisites for this command

- Turn on polynomial DPD ([CONFigure:DDPD\[:STATe\]](#)).

Setting parameters:

<State> ON | OFF | 1 | 0

Example: //Calculate both "AM/AM" and "AM/PM" predistortion
 CONF:DPD:AMXM ON

Usage: Setting only

Manual operation: See ["Selecting the order of model calculation"](#) on page 114

CONFigure:DPD:FILE:GENERate

This command generates the waveform files containing predistortion information within the amplifier application.

All in all, the command generates three waveform files: "AM/AM" only, "AM/PM" only and "AM/AM" plus "AM/PM".

It also transfers these waveform files to the connected signal generator.

Prerequisites for this command

- Turn on polynomial DPD ([CONFigure:DDPD\[:STATe\]](#)).

Example: //Calculate DPD within the amplifier application and transfer the result to the signal generator
 CONF:DPD:METH WFIL
 CONF:DPD:FILE:GEN

Usage: Event

CONFigure:DPD:FILE:GENerate:ALL

This command generates the waveform files containing predistortion information within the amplifier application.

All in all, the command generates three waveform files: "AM/AM" only, "AM/PM" only and "AM/AM" plus "AM/PM".

It also transfers these waveform files to the connected signal generator and turns on the "AM/AM" and "AM/PM" DPDs.

Alternatively, you can do that with:

- [CONFigure:DPD:FILE:GENerate](#) and
- [CONFigure:DPD:AMXM\[:STATe\]](#) on page 275

Prerequisites for this command

- Turn on polynomial DPD ([CONFigure:DDPD\[:STATe\]](#)).

Example: //Calculate DPD within the amplifier application and transfer the result to the signal generator
 CONF:DPD:METH WFIL
 CONF:DPD:FILE:GEN

Usage: Event

CONFigure:DPD:FNAME <FileName>

This command defines a name for the DPD correction table.

Prerequisites for this command

- Turn on polynomial DPD ([CONFigure:DDPD\[:STATe\]](#)).

Parameters:

<FileName> String containing the DPD table file name.

Example: //Defines the DPD table name
 CONF:DPD:FNAME 'DPDTable'

Manual operation: See "[Selecting the DPD shaping method](#)" on page 113

CONFigure:DPD:METHod <Method>

This command selects the method with which the application determines the DPD.

Prerequisites for this command

- Turn on polynomial DPD (`CONFigure:DDPD[:STATe]`).

Parameters:

<Method>

GENerator

Signal generator applies the DPD parameters calculated by the amplifier application to the generated RF signal in real-time. Option R&S SMW-K541 is required on the generator for this method.

WFILE

Signal generator applies the DPD to the generated RF signal through a waveform file.

No additional equipment is required on the signal generator for this method.

Use `CONFigure:DPD:FILE:GENerate` to actually generate the DPD and transfer it to the generator.

*RST: GENerator

Example:

```
//Calculates the DPD within the amplifier application
CONF:DPD:METH WFILE
```

Manual operation: See ["Selecting the DPD method"](#) on page 112

CONFigure:DPD:SEQuence <State>

This command selects the order in which the "AM/AM" and "AM/PM" distortion are applied.

Available when both have been turned on.

Prerequisites for this command

- Turn on polynomial DPD (`CONFigure:DDPD[:STATe]`).
- Turn on both "AM/AM" and "AM/PM" calculation (`CONFigure:DPD:AMAM[:STATe]` / `CONFigure:DPD:AMPM[:STATe]`).

Parameters:

<State>

AMFirst

Calculates the "AM/AM" distortion first, then the "AM/PM" distortion.

PMFirst

Calculates the "AM/PM" distortion first, then the "AM/AM" distortion.

Example:

```
//Calculates the "AM/AM" curve first
CONF:DPD:SEQ AMF
```

Manual operation: See ["Selecting the order of model calculation"](#) on page 114

CONFigure:DPD:SHAPing:MODE <Method>

This command selects the method use to shape the DPD function.

Parameters:

<Method>

POLYnomial

DPD function based on the characteristics of the polynomial system model.

TABLE

DPD function based on the correction values kept in a table calculated by the R&S SMW.

*RST: TABLE

Example:

```
//Select DPD shaping method
CONF:DPD:SHAP:MODE TABL
```

Manual operation: See ["Selecting the DPD shaping method"](#) on page 113

CONFigure:DPD:TRADeoff <Power Linearity Tradeoff>

This command defines the power / linearity tradeoff for polynomial DPD calculation.

Prerequisites for this command

- Turn on polynomial DPD ([CONFigure:DDPD\[:STATe\]](#)).

Parameters:

<Power Linearity Tradeoff> <numeric value>
Default unit: PCT

Example:

```
//Define linearity tradeoff
CONF:DPD:TRAD 75
```

Manual operation: See ["Polynomial DPD Power / Linearity Tradeoff"](#) on page 113

CONFigure:DPD:UPDate

This command updates the DPD shaping tables on the R&S SMW when new measurement data is available.

Prerequisites for this command

- Turn on polynomial DPD ([CONFigure:DDPD\[:STATe\]](#)).

Example:

```
//Update the shaping table
CONF:DPD:UPD
```

Usage:

Event

CONFigure:DPD:UPDate:ALL

This command updates the DPD shaping tables on the R&S SMW when new measurement data is available.

In addition, this command also turns on the DPD ("AM/AM"and"AM/PM").

Using one command only to do those things has the advantage of a slightly shorter execution time.

Alternatively, you can do that with:

- `CONFigure:DPD:UPDate` on page 278 and
- `CONFigure:DPD:AMXM[:STATe]` on page 275

Prerequisites for this command

- Turn on polynomial DPD (`CONFigure:DDPD[:STATe]`).

Example: //Update the tables and turn on "AM/AM" and "AM/PM" predistortion
 CONF:DPD:UPD:ALL

Usage: Event

CONFigure:DPD:UPDate:LEDState?

This command queries the state of the DPD calculation.

The information of the return result depends on the DPD method:

- DPD calculated by the generator (with option K541): Query of the state of the update of the shaping table or the polynomial coefficients.
- DPD calculation by the Amplifier application: Query of the state of waveform file generation and its upload to the generator.

Prerequisites for this command

- Turn on polynomial DPD (`CONFigure:DDPD[:STATe]`).

Return values:

<State> **GREen**
 Transmission was successful.

GREY
 Unknown transmission state.

RED
 Transmission was not successful.

Example: //Query LED state
 CONF:DPD:UPD
 CONF:DPD:UPD:LEDS?
 would return, e.g.:
 GREY

Usage: Query only

MMEMory:STORe<n>:DPD <FileName>

This command generates and stores a waveform containing the DPD in a file you have specified.

Prerequisites for this command

- DPD method "Generate Predistorted Waveform File" has to be selected (`CONF:DPD:METHod = WFILE`)
- The DPD calculation has been initiated with `CONF:DPD:FILE:GENerate`.

Suffix:

<n> 1..n

Setting parameters:

<FileName> String containing the file name.

Example:

```
CONF:DPD:METH WFILE
CONF:DPD:FILE:GEN
MMEM:STOR:DPD 'DPD_WV'
```

Calculates the DPD within the Amplifier application, transfers the result to the signal generator and saves it in a file.

Usage: Setting only

FETCH:DPD:POLYnomial?

This command queries the polynomial factors of the correctional polynomial.

Prerequisites for this command

- Turn on polynomial DPD (`CONF:DDPD[:STATe]`).
- Run polynomial DPD (`CONF:DPD:FILE:GENerate`).

Return values:

<Values> List of numerical values.
The number of values depends on the DPD configuration.
The real and imaginary parts of the DPD coefficients are returned interleaved in the following order: real(a0), imag(a0), real(a1), imag(a1), ...

Example: //Query polynomial factors
`FETCH:DPD:POLY?`

Usage: Query only

FETCH:DPD:WAVeform:PATH?

Queries the path of the Polynomial DPD waveform.

Return values:

<FileName>

Example: `FETCH:DPD:WAV:PATH?`

Usage: Query only

5.6.13.2 Direct DPD

CONFigure:DDPD:ABORt.....	281
CONFigure:DDPD:APPLy[:STATe].....	281
CONFigure:DDPD:APPLy:WRAP[:STATe].....	282
CONFigure:DDPD:CONTinue.....	282
CONFigure:DDPD:COUnT.....	282
CONFigure:DDPD:COUnT:CURRent?.....	283
CONFigure:DDPD:FINish.....	283
CONFigure:DDPD:FNAME.....	283
CONFigure:DDPD:GEXpansion.....	284
CONFigure:DDPD:STARt.....	284
CONFigure:DDPD[:STATe].....	284
CONFigure:DDPD:RMS[:CURRent]?.....	284
CONFigure:DDPD:TRADeoff.....	285
CONFigure:DDPD:WINDow<n>:RESult.....	285
FETCh:DDPD:OPERation:STATus?.....	285
FETCh:DDPD:WAVEform:PATH?.....	286
MMEMory:STORe<n>:DDPD.....	286

CONFigure:DDPD:ABORt

This command stops a DPD sequence and discards the predistorted I/Q data that have been calculated.

Prerequisites for this command

- Turn on direct DPD ([CONFigure:DDPD\[:STATe\]](#) on page 284).
- Initiate a DPD sequence ([CONFigure:DDPD:STARt](#) on page 284).

Example: //Stop a DPD sequence
CONF:DDPD:ABOR

Usage: Event

CONFigure:DDPD:APPLy[:STATe] <State>

This command transfers the waveform file with the correction values to the signal generator and applies them to the input signal.

Prerequisites for this command

- Turn on direct DPD ([CONFigure:DDPD\[:STATe\]](#)).
- Run a DPD sequence ([CONFigure:DDPD:STARt](#)).

Parameters:

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

Example: //Run a DPD sequence and transfer the correction value to the generator
 CONF:DDPD ON
 CONF:DDPD:STAR
 CONF:DDPD:APP ON

Manual operation: See ["Automated direct DPD sequence"](#) on page 116

CONFigure:DDPD:APPLy:WRAP[:STATe] <State>

Smooths start- and tail-samples down to "0" in order to avoid phase discontinuities when the file is cyclically played from a signal source.

Parameters:

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

Example: CONFigure:DDPD:APPLy:WRAP ON

Manual operation: See ["Automated direct DPD sequence"](#) on page 116
 See ["Manual direct DPD sequence"](#) on page 117

CONFigure:DDPD:CONTinue

Continues direct DPD in manual mode.

Example: CONFigure:DDPD:CONTinue

Usage: Event

Manual operation: See ["Manual direct DPD sequence"](#) on page 117

CONFigure:DDPD:COUNT <Count>

This command defines the number of iterations in a direct DPD sequence.

Prerequisites for this command

- Turn on direct DPD ([CONFigure:DDPD\[:STATe\]](#)).

Parameters:

<Count> <numeric value> (integer only)
 Range: 1 to 1000
 *RST: 10

Example: //Define number of iterations
 CONF:DDPD:COUN 25

Manual operation: See ["Automated direct DPD sequence"](#) on page 116
 See ["Manual direct DPD sequence"](#) on page 117

CONFigure:DDPD:COUNt:CURRent?

This command queries the process of the direct DPD sequence (number of current iteration).

- Turn on direct DPD ([CONFigure:DDPD\[:STATe\]](#)).
- Start a DPD sequence ([CONFigure:DDPD:START](#)).

Return values:

<Iterations>

Example: //Define number of iterations
CONF:DDPD:COUN 10
//Query process of measurement
CONF:DDPD:COUN:CURR?
would return, e.g.
7 (out of 10)

Usage: Query only

Manual operation: See "[Manual direct DPD sequence](#)" on page 117

CONFigure:DDPD:FINish

This command stops a DPD sequence before all iterations are done and keeps the predistorted I/Q data that have been calculated.

Prerequisites for this command

- Turn on direct DPD ([CONFigure:DDPD\[:STATe\]](#)).
- Initiate a DPD sequence ([CONFigure:DDPD:START](#)).

Example: //Stop a DPD sequence
CONF:DDPD:FIN

Usage: Event

CONFigure:DDPD:FNAME <FileName>

This command defines a file name for the I/Q file that contains the predistorted I/Q data that was generated by the direct DPD.

Prerequisites for this command

- Turn on direct DPD ([CONFigure:DDPD\[:STATe\]](#)).

Parameters:

<FileName> String containing the file name (including file type .wav).

Example: //Define file name of direct DPD file
CONF:DDPD:FNAME 'DirectDPD.wav'

Manual operation: See "[Automated direct DPD sequence](#)" on page 116

CONFigure:DDPD:GEXPansion <GainExpansion>

This command sets the gain expansion for Direct DPD.

Parameters:

<GainExpansion> <numeric value>
Default unit: dB

Example: //Define gain expansion
CONFigure:DDPD:GEXPansion 2

Manual operation: See "[Automated direct DPD sequence](#)" on page 116
See "[Manual direct DPD sequence](#)" on page 117

CONFigure:DDPD:STARt

This command initiates a direct DPD sequence with the number of iterations you have defined.

You can define the number of iterations with [CONFigure:DDPD:COUNT](#).

Prerequisites for this command

- Turn on direct DPD ([CONFigure:DDPD\[:STATe\]](#) on page 284).

Example: //Initiate direct DPD sequence
CONF:DDPD:STAR

Usage: Event

Manual operation: See "[Automated direct DPD sequence](#)" on page 116
See "[Manual direct DPD sequence](#)" on page 117

CONFigure:DDPD[:STATe] <State>

This command selects the type of DPD.

Parameters:

<State> **ON | 1**
Selects direct DPD.
OFF | 0
Selects polynomial DPD.
*RST: OFF

Example: //Select direct DPD
CONF:DDPD ON

CONFigure:DDPD:RMS[:CURRent]?

Returns the current RMS power level in manual direct DPD mode.

Return values:

<Level> <numeric value>

Example: `CONFigure:DDPD:RMS:CURRENT`
Usage: Query only
Manual operation: See "[Manual direct DPD sequence](#)" on page 117

CONFigure:DDPD:TRADEoff <Power Linearity Tradeoff>

This command defines the power / linearity tradeoff for direct DPD calculation.

Prerequisites for this command

- Turn on direct DPD (`CONFigure:DDPD[:STATe]`).

Parameters:

<Power Linearity Tradeoff> <numeric value>
 Default unit: PCT

Example: `//Define linearity tradeoff`
 `CONF:DDPD:TRAD 75`

Manual operation: See "[Direct DPD Power / Linearity Tradeoff](#)" on page 118

CONFigure:DDPD:WINDow<n>:RESult <Result>

Configures the result type of the DDPD Results result display.

Suffix:

<n> [Window](#)

Parameters:

<Result> **EVM**
 Error Vector Magnitude
 ACL1
 ACIrlower1
 ACU1
 ACIrlUpper1
 ACB1
 ACIrlBalanced1

Example: `CONFigure:DDPD:WIND1:RESult EVM`

Manual operation: See "[DDPD Results \(FSW-K18D\)](#)" on page 18
 See "[Direct DPD Result Type](#)" on page 152

FETCH:DDPD:OPERation:STATus?

This command queries the state of a direct DPD operation.

Return values:

<State> ON | OFF | 1 | 0
 ON
 Direct DPD operation was successful.

OFF

Direct DPD operation was not successful.

Example: //Query direct DPD state
 FETC:DDPD:OPER:STAT?

Usage: Query only

FETCh:DDPD:WAVeform:PATH?

Queries the path of the Direct DPD waveform.

Return values:

<FileName>

Example: FETCh:DDPD:WAVE:PATH?

Usage: Query only

Manual operation: See "[Manual direct DPD sequence](#)" on page 117

MMEMy:STORe<n>:DDPD <FileName>

This command stores the direct DPD information in a file.

Prerequisites for this command

- Turn on direct DPD ([CONFigure:DDPD\[:STATe\]](#) on page 284).
- Run a DPD sequence ([CONFigure:DDPD:STARt](#) on page 284).

Suffix:

<n> 1..n

Setting parameters:

<FileName> String containing the file name and location of the file.

Example: //Run a DPD sequence and save the DPD
 CONF:DDPD ON
 CONF:DDPD:STAR
 MMEM:STOR:DDPD 'c:\directdpd.wv'

Usage: Setting only

Manual operation: See "[Automated direct DPD sequence](#)" on page 116

5.6.13.3 Generalized memory polynomial

CONFigure:GMP:LAG:ORDer:MEMory	287
CONFigure:GMP:LAG:ORDer:POLYnomial	287
CONFigure:GMP:LAG:ORDer:XTERm	287
CONFigure:GMP:LEAD:ORDer:MEMory	287
CONFigure:GMP:LEAD:ORDer:POLYnomial	288
CONFigure:GMP:LEAD:ORDer:XTERm	288
CONFigure:MDPD:COEFFicient:SElect	288
CONFigure:MDPD:APPLY:MODEl	288

CONFigure:MDPD[:STATe].....	289
CONFigure:MDPD:ITERation.....	289
CALCulate:MDPD:MODEl.....	289
CONFigure:MDPD:ORDer:POLYnomial.....	289
CONFigure:MDPD:ORDer:MEMory.....	289
CONFigure:MDPD:RMS[:CURRent]?.....	290
CONFigure:MDPD:WAVeform:SElect.....	290
CONFigure:MDPD:WAVeform:UPDate.....	290
FETCh:MDPD:COEFficients?.....	290
FETCh:MDPD:WAVeform:PATH?.....	291
MMEMory:STORe:MDPD:COEFficient.....	291
MMEMory:STORe:MDPD:WAVeform.....	291

CONFigure:GMP:LAG:ORDer:MEMory <Level>

Sets the lagging cross-terms memory order of the generalized memory polynomial.

Parameters:

<Level> *RST: 5

Example:

```
//Set lagging cross-terms memory order
CONF:GMP:LAG:ORD:MEM 5
```

CONFigure:GMP:LAG:ORDer:POLYnomial <Level>

Sets the lagging cross-terms polynomial order of the generalized memory polynomial.

Parameters:

<Level> *RST: 5

Example:

```
//Set lagging cross-terms polynomial order
CONF:GMP:LAG:ORD:POLY 5
```

CONFigure:GMP:LAG:ORDer:XTERm <Level>

Sets the lagging cross-term order of the generalized memory polynomial.

Parameters:

<Level> *RST: 0

Example:

```
//Set lagging cross-terms order
CONF:GMP:LAG:ORD:XTER 0
```

CONFigure:GMP:LEAD:ORDer:MEMory <Level>

Sets the leading cross-terms memory order of the generalized memory polynomial.

Parameters:

<Level> *RST: 5

Example:

```
//Set leading cross-terms memory order
CONF:GMP:LEAD:ORD:MEM 5
```

CONFigure:GMP:LEAD:ORDer:POLYnomial <Level>

Sets the leading cross-terms polynomial order of the generalized memory polynomial.

Parameters:

<Level> *RST: 5

Example: //Set leading cross-terms polynomial order
CONF:GMP:LEAD:ORD:POLY 5

CONFigure:GMP:LEAD:ORDer:XTERm <Level>

Sets the leading cross-term order of the generalized memory polynomial.

Parameters:

<Level> *RST: 0

Example: //Set leading cross-terms order
CONF:GMP:LEAD:ORD:XTER 0

CONFigure:MDPD:COEFFicient:SElect <Type>

Selects the source from which the coefficients are to be used.

Parameters:

<Type> FILE | MODeling

FILE

Uses the coefficients from a `csv` file.

MODeling

Uses the coefficients generated by the modelling.

*RST: FILE

Example: //Select source
CONFigure:MDPD:COEFFicient:SElect FILE

CONFigure:MDPD:APPLY:MODEl <Channel>

Selects the waveform to which the model should be applied.

Info: First select the source to execute this command: [CONFigure:MDPD:COEFFicient:SElect](#) on page 288.

Parameters:

<Channel>

Manual operation: See ["Running a Memory Polynomial DPD sequence"](#) on page 120

CONFigure:MDPD[:STATe] <State>

Switches the memory polynomial state on and off.

Parameters:

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

Example: CONFigure:MDPD:STATe ON

Manual operation: See ["Running a Memory Polynomial DPD sequence"](#)
on page 120

CONFigure:MDPD:ITERation <Level>

Configures the iteration step for memory polynomial DPD.

Parameters:

<Level> <numeric value>

Example: CONFigure:MDPD:ITERation 4

Manual operation: See ["Running a Memory Polynomial DPD sequence"](#)
on page 120

CALCulate:MDPD:MODEl

Calculates the memory polynomial model.

Example: CALCulate:MDPD:MODEl

Usage: Event

Manual operation: See ["Running a Memory Polynomial DPD sequence"](#)
on page 120

CONFigure:MDPD:ORDER:POLYnomial <Order>

Sets the polynomial order for memory polynomial DPD as a string.

Parameters:

<Order>

Example: CONFigure:MDPD:ORDER:POLY "1-7;9;11"

Manual operation: See ["Running a Memory Polynomial DPD sequence"](#)
on page 120

CONFigure:MDPD:ORDER:MEMory <Order>

Sets the memory order for memory polynomial DPD as a string.

Parameters:

<Order>

Example: `CONFigure:MDPD:ORDER:MEMory "1-7;9;11"`**Manual operation:** See ["Running a Memory Polynomial DPD sequence"](#) on page 120**CONFigure:MDPD:RMS[:CURRent]?**

Returns the current RMS power level of the memory polynomial waveform.

Return values:

<Level> <numeric value>

Example: `CONFigure:MDPD:RMS:CURRent`**Usage:** Query only**Manual operation:** See ["Manual direct DPD sequence"](#) on page 117**CONFigure:MDPD:WAVEform:SElect <Type>**

Selects the type of DPD waveform to be used.

Parameters:

<Type>

DDPD

Uses a direct DPD waveform.

MDPD

Uses a memory polynomial DPD waveform.

REF

Uses the reference signal.

Example: `CONFigure:MDPD:WAVEform:SElect MDPD`**Manual operation:** See ["Running a Memory Polynomial DPD sequence"](#) on page 120**CONFigure:MDPD:WAVEform:UPDate**

Sends the memory polynomial waveform to the signal generator.

Example: `CONFigure:MDPD:WAVEform:UPDate`**Usage:** Event**Manual operation:** See ["Running a Memory Polynomial DPD sequence"](#) on page 120**FETCh:MDPD:COEFFicients?**

Fetches the MDPD coefficient values.

Example: `FETCh:MDPD:COEFFicients?`

Usage: Query only

Manual operation: See ["Memory DPD Coefficients"](#) on page 23

FETCh:MDPD:WAVeform:PATH?

Queries the path of the Memory Polynomial DPD waveform.

Return values:

<FileName>

Example: FETCh:MDPD:WAV:PATH?

Usage: Query only

MMEMory:STORe:MDPD:COEFFicient <FileName>

Exports the memory DPD coefficients in a file in .csv format.

Setting parameters:

<FileName>

Example: MMEMory:STORe:MDPD:COEFFicient 'C:\MemoryPolyCoeff.csv'

Usage: Setting only

Manual operation: See ["Running a Memory Polynomial DPD sequence"](#) on page 120

MMEMory:STORe:MDPD:WAVeform <FileName>

Saves the memory polynomial waveform at a user selected path.

Only available when generator control is OFF.

Setting parameters:

<FileName>

Example: MMEMory:STORe:MDPD:WAVeform 'C:\MemoryPoly.wv'

Usage: Setting only

Manual operation: See ["Running a Memory Polynomial DPD sequence"](#) on page 120

5.6.13.4 Hammerstein model

CONFigure:HAMMerstein[:STATe]	292
CONFigure:HAMMerstein:ITERation	292
CONFigure:HAMMerstein:ORDer:POLYnomial	292
CONFigure:HAMMerstein:ORDer:MEMory	292
CONFigure:HAMMerstein:MUPGenerator	292

CONFigure:HAMMerstein:GENWaveform[:SElect].....	293
CONFigure:HAMMerstein:NONLinearity[:STATE].....	293
CONFigure:HAMMerstein:FILTer[:STATE].....	293

CONFigure:HAMMerstein[:STATE] <State>

Switches Hammerstein mode on and off.

Parameters:

<State> **ON | 1**
 OFF | 0

Example: CONF:HAMM ON

Manual operation: See ["Running a Hammerstein model sequence"](#) on page 123

CONFigure:HAMMerstein:ITERation <Level>

Configures the iteration step for the Hammerstein model.

Parameters:

<Level> <numeric value>

Example: CONFigure:HAMM:ITERation 4

Manual operation: See ["Running a Hammerstein model sequence"](#) on page 123

CONFigure:HAMMerstein:ORDer:POLYnomial <Order>

Sets the polynomial order for the Hammerstein model as a string.

Parameters:

<Order>

Example: CONFigure:HAMM:ORDer:POLY "1-7;9;11"

Manual operation: See ["Running a Hammerstein model sequence"](#) on page 123

CONFigure:HAMMerstein:ORDer:MEMory <Order>

Sets the memory order for the Hammerstein model as a string.

Parameters:

<Order>

Example: CONFigure:HAMMerstein:ORDer:MEMory "1-7;9;11"

Manual operation: See ["Running a Hammerstein model sequence"](#) on page 123

CONFigure:HAMMerstein:MUPGenerator

Starts the DSP and updates the generator.

Example: CONFigure:HAMMerstein:MUPGenerator

Usage: Event

Manual operation: See ["Running a Hammerstein model sequence"](#) on page 123

CONFigure:HAMMerstein:GENWaveform[:SELEct] <GeneratorWaveform>

Switches the generator waveform between reference and direct DPD.

Parameters:

<GeneratorWaveform>REFerence | DDPD

REFerence

Reference waveform

DDPD

DDPD waveform

Example: CONFigure:Hammerstein:GENWaveform REF

Manual operation: See ["Running a Hammerstein model sequence"](#) on page 123

CONFigure:HAMMerstein:NONLinearity[:STATe] <State>

Switches the non-linearity (SMx-K541) on and off.

Parameters:

<State> **ON | 1**

OFF | 0

Example: CONFigure:Hammerstein:NONLinearity ON

Manual operation: See ["Running a Hammerstein model sequence"](#) on page 123

CONFigure:HAMMerstein:FILTer[:STATe] <State>

Switches the filter (SMx-K544) on and off.

Parameters:

<State> **ON | 1**

OFF | 0

Example: CONFigure:Hammerstein:FILTer ON

Manual operation: See ["Running a Hammerstein model sequence"](#) on page 123

5.6.14 Detailed MSE

CALCulate:MSERror?	294
CALCulate:MSERror:CONFigure:EQUalizer:FILTer:LENGth	294
CALCulate:MSERror:IQAVg:COUNT	294

CALCulate:MSERror?

Calculates the detailed MSE and returns the result.

Example: CALC:MSER?

Usage: Query only

Manual operation: See "[Calculate Detailed MSE](#)" on page 125

CALCulate:MSERror:CONFigure:EQUalizer:FILTer:LENGth <Length>**Parameters:**

<Length>

CALCulate:MSERror:IQAVg:COUNT <Count>**Parameters:**

<Count>

5.6.15 Trigger

TRIGger[:SEquence]:CTPis	294
TRACe:IQ:TPISample?	295

TRIGger[:SEquence]:CTPis <State>

The trigger event is set to the actual trigger point within the sample (TPIS). See also [TRACe:IQ:TPISample?](#) on page 295.

This setting is available for all trigger sources except "Free Run".

This setting only becomes effective for the next new measurement.

TPIS correction is not supported if user frequency response correction (R&S FSW-K544) is active. If you activate frequency response correction, TPIS correction is automatically deactivated in all channels.

For details see frequency response correction in the FSW user manual.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

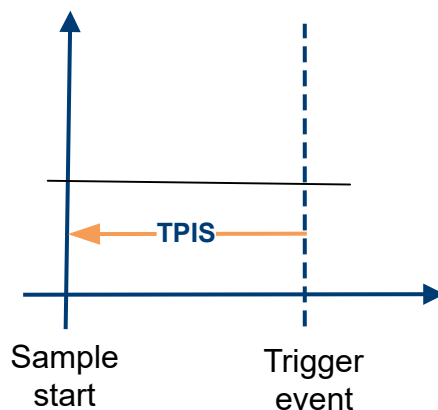
Example:

```
// Query the current trigger offset within the sample
TRAC:IQ:TPIS?
//Result: 0.000002
//Correct the trigger event
TRIG:CTP ON
//Start a new measurement
INIT:IMM; *WAI
//Query the trigger offset within the sample again
TRAC:IQ:TPIS?
//Result: 0.000000
```

Manual operation: See "[Correct TPIS](#)" on page 95

TRACe:IQ:TPISample?

Queries the time offset from the sample start to the trigger event (trigger point in sample = TPIS). Since the FSW usually samples with a much higher sample rate than the specific application actually requires, the trigger point determined internally is much more precise than the one determined from the (downsampled) data in the application. Thus, the TPIS indicates the offset from the sample start to the actual trigger event.



This value can only be determined in triggered measurements using external or IFPower triggers, otherwise the value is 0.

Is not available if the "Digital Baseband" interface (FSW-B17) is active.

Return values:

<TPIS> numeric value
 Default unit: s

Example: TRAC:IQ:TPIS?
 Result for a sample rate of 1 MHz: between 0 and 1/1 MHz, i.e. between 0 and 1 μ s (the duration of 1 sample).

Usage: Query only

5.6.16 Configuring envelope tracking

CONFigure:PAE:ICHannel:MULTIplier.....	296
CONFigure:PAE:ICHannel:OFFSet.....	296
CONFigure:PAE:ICHannel:RESistor.....	296
CONFigure:PAE:PCONsumption[:PARAmeter]:A.....	296
CONFigure:PAE:PCONsumption[:PARAmeter]:B.....	297
CONFigure:PAE:QCHannel:MULTIplier.....	297
CONFigure:PAE:QCHannel:OFFSet.....	297

CONFigure:PAE:ICHannel:MULTIplier <Multiplier>

This command defines a multiplier to take into account various effects resulting from the measurement equipment connected to the I channel.

Parameters:

<Multiplier> <numeric value>

Example:

```
//Defines a multiplier of 0.75
CONF:PAE:ICH:MULT 0.75
```

CONFigure:PAE:ICHannel:OFFSet <Offset>

This command defines an offset for the I channel.

Parameters:

<Offset> <numeric value>
 Default unit: No unit

Example:

```
//Define an offset of 1
CONF:PAE:ICH:EOFF 1
```

CONFigure:PAE:ICHannel:RESistor <Resistance>

This command defines the characteristics of the shunt resistor used in the test setup.

Parameters:

<Resistance> <numeric value>
 Resistance in Ohm.

Example:

```
//Defines a resistance of 1.5 Ω
CONF:PAE:ICH:RES 1.5
```

CONFigure:PAE:PCONsumption[:PARAmeter]:A <Value>

Parameters:

<Value>

CONFigure:PAE:PCONsumption[:PARAmeter]:B <Value>

Parameters:

<Value>

CONFigure:PAE:QCHannel:MULTiplier <Multiplier>

This command defines a multiplier to take into account various effects resulting from the measurement equipment connected to the Q channel.

Parameters:

<Multiplier> <numeric value>

Example:

```
//Define a multiplier of 1.2
CONF:PAE:QCH:MULT 1.2
```

CONFigure:PAE:QCHannel:OFFSet <Offset>

This command defines an offset for the Q channel.

Parameters:

<Offset> <numeric value>

Default unit: No unit

Example:

```
//Defines an offset of 1
CONF:PAE:QCH:OFFS 1
```

5.6.17 Configuring ACLR measurements

CALCulate<n>:MARKer<m>:FUNction:POWer:RESult?.....	298
[SENSe:]POWer:ACHannel:ACPairs.....	298
[SENSe:]POWer:ACHannel:AABW.....	298
[SENSe:]POWer:ACHannel:BANDwidth:ACHannel.....	298
[SENSe:]POWer:ACHannel:BANDwidth:ALTerNate<ch>.....	299
[SENSe:]POWer:ACHannel:BANDwidth[:CHANnel<ch>].....	299
[SENSe:]POWer:ACHannel:FILTer:ALPHa:ACHannel.....	299
[SENSe:]POWer:ACHannel:FILTer:ALPHa:ALTerNate<ch>.....	300
[SENSe:]POWer:ACHannel:FILTer:ALPHa:CHANnel<ch>.....	300
[SENSe:]POWer:ACHannel:FILTer[:STATe]:ACHannel.....	300
[SENSe:]POWer:ACHannel:FILTer[:STATe]:ALTerNate<ch>.....	300
[SENSe:]POWer:ACHannel:FILTer[:STATe]:CHANnel<ch>.....	301
[SENSe:]POWer:ACHannel:REFerence:TXCHannel:AUTO.....	301
[SENSe:]POWer:ACHannel:REFerence:TXCHannel:MANual.....	301
[SENSe:]POWer:ACHannel:SPACing:CHANnel<ch>.....	301
[SENSe:]POWer:ACHannel:SPACing[:ACHannel].....	302
[SENSe:]POWer:ACHannel:SPACing:ALTerNate<ch>.....	302
[SENSe:]POWer:ACHannel:TXCHannel:COUnT.....	302

CALCulate<n>:MARKer<m>:FUNCTION:POWer:RESult? <Item>

This command queries the (numerical) results of the ACLR measurement.

Suffix:

<n> [Window](#)

<m> irrelevant

Query parameters:

<Item> **ACP**
Queries the results of the ACLR measurement.
Returns the power for every active transmission and adjacent channel. The order is:

- power of the transmission channels
- power of adjacent channel (lower, upper)

Example:

```
CALC:MARK:FUNC:POW:RES?
would return, e.g.
-21.76, 3.21, 2.57
```

Usage: Query only

Manual operation: See "[Adjacent Channel Leakage Error \(ACLR\)](#)" on page 13

[SENSe:]POWer:ACHannel:ACPairs <ChannelPairs>

Defines the number of pairs of adjacent and alternate channels.

Parameters:

<ChannelPairs> Range: 0 to 12
*RST: 1

Manual operation: See "[Number of channels: Tx, Adj](#)" on page 129

[SENSe:]POWer:ACHannel:AABW <State>

This command turns automatic selection of the measurement bandwidth for ACLR measurements on and off.

When you turn this on, the application selects a measurement bandwidth that is large enough to capture all channels evaluated by the ACLR measurement.

Parameters:

<State> ON | OFF | 1 | 0

Example:

```
//Turn on automatic selection of the measurement bandwidth
POW:ACH:AABW ON
```

Manual operation: See "[Selecting the measurement bandwidth](#)" on page 129

[SENSe:]POWer:ACHannel:BANDwidth:ACHannel <Bandwidth>

Defines the channel bandwidth of the adjacent channels.

The adjacent channels are the first channels to the left and right of the transmission channels. If you set the channel bandwidth for these channels, the FSW sets the bandwidth of the alternate channels to the same value (not for MSR signals).

Parameters:

<Bandwidth> Range: 100 Hz to 1000 MHz
 *RST: 14 kHz
 Default unit: Hz

Manual operation: See "[Channel Bandwidth](#)" on page 130

[SENSe:]POWer:ACHannel:BANDwidth:ALTErnate<ch> <Bandwidth>

Defines the channel bandwidth of the alternate channels.

Suffix:

<ch> 1..n
 Alternate channel number

Parameters:

<Bandwidth> Range: 100 Hz to 1000 MHz
 *RST: 14 kHz
 Default unit: Hz

Manual operation: See "[Channel Bandwidth](#)" on page 130

[SENSe:]POWer:ACHannel:BANDwidth[:CHANnel<ch>] <Bandwidth>

Defines the channel bandwidth of the transmission channels.

Suffix:

<ch> 1..n
 Tx channel number

Parameters:

<Bandwidth> Range: 100 Hz to 1000 MHz
 *RST: 14 kHz
 Default unit: Hz

Manual operation: See "[Channel Bandwidth](#)" on page 130

[SENSe:]POWer:ACHannel:FILTEr:ALPHa:ACHannel <Alpha>

Defines the roll-off factor for the adjacent channel weighting filter.

Parameters:

<Alpha> Roll-off factor
 Range: 0 to 1
 *RST: 0.22

Manual operation: See "[Weighting Filters](#)" on page 131

[SENSe:]POWer:ACHannel:FILTer:ALPHa:ALTerNate<ch> <Alpha>

Defines the roll-off factor for the alternate channel weighting filter.

Suffix:

<ch> 1..n
Alternate channel number

Parameters:

<Alpha> Roll-off factor
Range: 0 to 1
*RST: 0.22

Manual operation: See "[Weighting Filters](#)" on page 131

[SENSe:]POWer:ACHannel:FILTer:ALPHa:CHANnel<ch> <Alpha>

Defines the roll-off factor for the transmission channel weighting filter.

Suffix:

<ch> 1..n
Tx channel number

Parameters:

<Alpha> Roll-off factor
Range: 0 to 1
*RST: 0.22

Manual operation: See "[Weighting Filters](#)" on page 131

[SENSe:]POWer:ACHannel:FILTer[:STATe]:ACHannel <State>

Turns the weighting filter for the adjacent channel on and off.

Parameters:

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

Manual operation: See "[Weighting Filters](#)" on page 131

[SENSe:]POWer:ACHannel:FILTer[:STATe]:ALTerNate<ch> <State>

Turns the weighting filter for an alternate channel on and off.

Suffix:

<ch> 1..n
Alternate channel number

Parameters:

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

Manual operation: See "[Weighting Filters](#)" on page 131

[SENSe:]POWer:ACHannel:FiLTer[:STATe]:CHANnel<ch> <State>

Turns the weighting filter for a transmission channel on and off.

Suffix:

<ch> 1..n
Tx channel number

Parameters:

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

Manual operation: See "[Weighting Filters](#)" on page 131

[SENSe:]POWer:ACHannel:REFErence:TXCHannel:AUTO <RefChannel>

Selects the reference channel for relative measurements.

You need at least one channel for the command to work.

Parameters:

<RefChannel> MINimum | MAXimum | LHIGhest
MINimum
Transmission channel with the lowest power
MAXimum
Transmission channel with the highest power
LHIGhest
Lowest transmission channel for lower adjacent channels and
highest transmission channel for upper adjacent channels

Example:

POW:ACH:REF:TXCH:AUTO MAX
Selects the channel with the peak power as reference channel.

Manual operation: See "[Reference Channel](#)" on page 130

[SENSe:]POWer:ACHannel:REFErence:TXCHannel:MANual <ChannelNumber>

Defines a reference channel for relative ACLR measurements.

You need at least one channel for the command to work.

Parameters:

<ChannelNumber> Range: 1 to 18
*RST: 1

Manual operation: See "[Reference Channel](#)" on page 130

[SENSe:]POWer:ACHannel:SPACing:CHANnel<ch> <Spacing>

Defines the distance between transmission channels.

If you set the channel spacing for a transmission channel, the FSW sets the spacing of the lower transmission channels to the same value, but not the other way round. The command works hierarchically: to set a distance between the 2nd and 3rd and 3rd and 4th channel, you have to set the spacing between the 2nd and 3rd channel first.

Suffix:

<ch> 1..n
Tx channel number

Parameters:

<Spacing> Range: 14 kHz to 2000 MHz
 *RST: 20 kHz
 Default unit: Hz

Manual operation: See "[Channel Spacings](#)" on page 130

[SENSe:]POWer:ACHannel:SPACing[:ACHannel] <Spacing>

Defines the distance from transmission channel to adjacent channel.

A change of the adjacent channel spacing causes a change in the spacing of all alternate channels below the adjacent channel.

Parameters:

<Spacing> Range: 100 Hz to 2000 MHz
 *RST: 14 kHz
 Default unit: Hz

Manual operation: See "[Channel Spacings](#)" on page 130

[SENSe:]POWer:ACHannel:SPACing:ALTErnate<ch> <Spacing>

Defines the distance from transmission channel to alternate channels.

Suffix:

<ch> 1..n
Alternate channel number

Parameters:

<Spacing> Range: 100 Hz to 2000 MHz
 *RST: 40 kHz (ALT1), 60 kHz (ALT2), 80 kHz (ALT3), ...
 Default unit: Hz

Manual operation: See "[Channel Spacings](#)" on page 130

[SENSe:]POWer:ACHannel:TXCHannel:COUnT <Number>

Defines the number of transmission channels.

The command works for measurements in the frequency domain.

Parameters:

<Number> Range: 1 to 18
 *RST: 1

Manual operation: See "Number of channels: Tx, Adj" on page 129

5.6.18 Configuring power measurements

CONFigure:POWer:RESult:P3DB:REFerence.....	303
CONFigure:POWer:RESult:P3DB[:STATe].....	303

CONFigure:POWer:RESult:P3DB:REFerence <RefPower>

This command defines the input power corresponding to the gain reference required to calculate the compression points.

Prerequisites for this command

- Turn off automatic calculation of the reference point (CONFigure:POWer:RESult:P3DB[:STATe]).

Parameters:

<RefPower> <numeric value>
 Default unit: dBm

Example: //Reference point is the gain measured at an input power of 3 dBm

```
CONF:POW:RES:P3DB OFF
CONF:POW:RES:P3DB:REF 3
```

Manual operation: See "Configuring compression point calculation" on page 128

CONFigure:POWer:RESult:P3DB[:STATe] <State>

This command turns automatic calculation of the reference point required to determine the compression points (1 dB, 2 dB and 3 dB) on and off.

Parameters:

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

Example: //Automatically determine the reference point

```
CONF:POW:RES:P3DB ON
```

Manual operation: See "Configuring compression point calculation" on page 128

5.6.19 Configuring parameter sweeps

CONFigure:PSweep:ADJust:LEVel[:STATe].....	304
CONFigure:PSweep:EXPEcted:GAIN.....	304
CONFigure:PSweep[:STATe].....	304
CONFigure:PSweep:X:SETTING.....	305
CONFigure:PSweep:X:START.....	305
CONFigure:PSweep:X:STEP.....	305
CONFigure:PSweep:X:STOP.....	306

CONFigure:PSweep:Y:SETTing.....	306
CONFigure:PSweep:Y:STARt.....	306
CONFigure:PSweep:Y:STATe.....	307
CONFigure:PSweep:Y:STEP.....	307
CONFigure:PSweep:Y:STOP.....	307

CONFigure:PSweep:ADJust:LEVel[:STATe] <State>

This command turns synchronization of the generator output level and the analyzer reference level on and off.

When you synchronize the levels, it is recommended to also define the expected gain of the DUT with `CONFigure:PSweep:EXpected:GAIN`.

Prerequisites for this command

- Select "Generator Power" as one of the parameters.

Parameters:

<State> ON | OFF | 1 | 0

Example: //Synchronize the generator output level and the analyzer reference level
`CONF:PSW:ADJ:LEV ON`

Manual operation: See "[Synchronizing the levels of signal generator and analyzer](#)" on page 134

CONFigure:PSweep:EXpected:GAIN <Gain>

This command defines the expected gain of the DUT.

This is necessary when you synchronize the generator output level and the reference level of the analyzer `CONFigure:PSweep:ADJust:LEVel[:STATe] = ON`.

Prerequisites for this command

- Select "Generator Power" as one of the parameters.

Parameters:

<Gain> <numeric value>
 Default unit: dB

Example: //Define expected gain
`CONF:PSW:ADJ:LEV ON`
`CONF:PSW:EXP:GAIN 5`

Manual operation: See "[Synchronizing the levels of signal generator and analyzer](#)" on page 134

CONFigure:PSweep[:STATe] <State>

This command turns the parameter sweep on and off.

Parameters:

<State> ON | OFF | 1 | 0

Example: //Turn on parameter sweep
CONF:PSW ON

Manual operation: See "Turning the parameter sweep on and off" on page 133

CONFigure:PSWeep:X:SETTing <Setting>

This command selects the parameter type for the first parameter controlled by the parameter sweep.

Parameters:

<Setting>

BIAS

Controls the envelope bias.

DELay

Controls the delay between envelope and RF signal.

FREQuency

Controls the frequency.

POWeR

Controls the output level.

Example: See [CONFigure:PSWeep:Y:SETTing](#).

CONFigure:PSWeep:X:STARt <Start>

This command defines the start value for the first parameter controlled by the parameter sweep.

Parameters:

<Start>

<numeric value> whose unit depends on the parameter type you have selected with [CONFigure:PSWeep:Y:SETTing](#):

- Hz in case of the center frequency
- dBm in case of the output level
- s in case of the delay between envelope and RF signal
- V in case of the envelope bias

Example: See [CONFigure:PSWeep:Y:SETTing](#).

CONFigure:PSWeep:X:STEP <Step>

This command defines the stepsize for the first parameter controlled by the parameter sweep.

Parameters:

<Step>

<numeric value> whose unit depends on the parameter type you have selected with [CONFigure:PSWeep:Y:SETTing](#):

- Hz in case of the center frequency
- dB in case of the output level
- s in case of the delay between envelope and RF signal
- V in case of the envelope bias

Example: See [CONFigure:PSWeep:Y:SETTing](#).

CONFigure:PSweep:X:STOP <Stop>

This command defines the stop value for the first parameter controlled by the parameter sweep.

Parameters:

<Stop> <numeric value> whose unit depends on the parameter type you have selected with [CONFigure:PSweep:Y:SETting](#):

- Hz in case of the center frequency
- dBm in case of the output level
- s in case of the delay between envelope and RF signal
- V in case of the envelope bias

Example: See [CONFigure:PSweep:Y:SETting](#).

CONFigure:PSweep:Y:SETting <Setting>

This command selects the parameter type for the second parameter controlled by the parameter sweep.

Parameters:

<Setting>

BIAS
Controls the envelope bias.

DELay
Controls the delay between envelope and RF signal.

FREQUENCY
Controls the frequency.

POWer
Controls the output level.

Example: //Configure the second parameter with start, stop and stepsize values

```
CONF:PSW:Y:STAT ON
CONF:PSW:Y:SETT FREQ
CONF:PSW:Y:STAR 10MHZ
CONF:PSW:Y:STOP 100MHZ
CONF:PSW:Y:STEP 1MHZ
```

CONFigure:PSweep:Y:START <Start>

This command defines the start value for the second parameter controlled by the parameter sweep.

Parameters:

<Start> <numeric value> whose unit depends on the parameter type you have selected with [CONFigure:PSweep:Y:SETting](#):

- Hz in case of the center frequency
- dBm in case of the output level
- s in case of the delay between envelope and RF signal
- V in case of the envelope bias

Example: See [CONFigure:PSweep:Y:SETting](#).

CONFigure:PSweep:Y:STATe <State>

This command turns the second parameter controlled by the parameter sweep on and off.

Parameters:

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

Example: See [CONFigure:PSweep:Y:SETting](#).

CONFigure:PSweep:Y:STEP <Step>

This command defines the stepsize for the second parameter controlled by the parameter sweep.

Parameters:

<Step> <numeric value> whose unit depends on the parameter type you have selected with [CONFigure:PSweep:Y:SETting](#):

- Hz in case of the center frequency
- dB in case of the output level
- s in case of the delay between envelope and RF signal
- V in case of the envelope bias

Example: See [CONFigure:PSweep:Y:SETting](#).

CONFigure:PSweep:Y:STOP <Stop>

This command defines the stop value for the second parameter controlled by the parameter sweep.

Parameters:

<Stop> <numeric value> whose unit depends on the parameter type you have selected with [CONFigure:PSweep:Y:SETting](#):

- Hz in case of the center frequency
- dBm in case of the output level
- s in case of the delay between envelope and RF signal
- V in case of the envelope bias

Example: See [CONFigure:PSweep:Y:SETting](#).

5.6.20 Configuring power servoing

Note that as long as you have selected automatic definition of the data acquisition values in the Power Servoing measurement, the application takes the same values as those that have been defined for the basic amplifier measurement (this is also the case when the basic data acquisition parameters are selected automatically).

If you want to define values specific to the Power Servoing measurement, you have to turn off automatic definition of the data acquisition value. If you turn automatic definition back on, the values are synchronized to those of the basic amplifier measurement again.

[SENSe:]PSErvoing:STATe.....	308
[SENSe:]PSErvoing:TARGeT:PARAmeter.....	308
[SENSe:]PSErvoing:TARGeT:VALue.....	309
[SENSe:]PSErvoing:TARGeT:TOLerance.....	309
[SENSe:]PSErvoing:MAX:ITERation.....	309
[SENSe:]PSErvoing:GLC].....	309
[SENSe:]PSErvoing:INPut:STEP.....	309
[SENSe:]PSErvoing:START.....	310
FETCh:PSErvoing:OPERation:STATus?.....	310

[SENSe:]PSErvoing:STATe <State>

Sets and queries the power servoing state.

Parameters:

<State> ON | OFF | 1 | 0

Example: PSEr:STAT ON

Manual operation: See "[Power Servoing sequence](#)" on page 135

[SENSe:]PSErvoing:TARGeT:PARAmeter <Target>

Sets the power servoing target parameter.

Parameters:

<Target> POUT | EVM | LADJ | UADJ | LALT | UALT

POUT

Power Out

EVM

EVM

LADJ

ACLR Adjacent Lower

UADJ

ACLR Adjacent Upper

LALT

ACLR Alternate Lower

UALT

ACLR Alternate Upper

Example: PSEr:TARG:PAR POUT

Manual operation: See "[Power Servoing sequence](#)" on page 135

[SENSe:]PSERvoing:TARGet:VALue <TargetValue>

Sets and queries the power servoing target value. The unit depends on the selected target parameter.

Parameters:

<TargetValue> <numeric value>

Example: PSER:TARG:VAL 3

Manual operation: See ["Power Servoing sequence"](#) on page 135

[SENSe:]PSERvoing:TARGet:TOLerance <TargetValue>

Sets and queries the power servoing target tolerance. The unit depends on the selected target parameter.

Parameters:

<TargetValue> <numeric value>

Example: PSER:TARG:TOL 0.2

Manual operation: See ["Power Servoing sequence"](#) on page 135

[SENSe:]PSERvoing:MAX:ITERation <MaxIterations>

Sets and queries the maximum number of iterations during the power servoing sequence.

Parameters:

<MaxIterations> <numeric value>

Example: PSER:MAX:ITER 5

Manual operation: See ["Power Servoing sequence"](#) on page 135

[SENSe:]PSERvoing[:GLC] <GenLevelControl>

Selects if the generator level is modified using input power or digital attenuation.

Parameters:

<GenLevelControl> RFL | DATT

RFL

Input power

DATT

Digital attenuation

Example: PSER:GLC RFL

Manual operation: See ["Power Servoing sequence"](#) on page 135

[SENSe:]PSERvoing:INPut:STEP <InputPowerStep>

Defines the input power step size.

Parameters:`<InputPowerStep>` <numeric value>**Manual operation:** See ["Power Servoing sequence"](#) on page 135**[SENSe:]PSErvoing:STARt**

Starts the power servoing sequence.

Example: `PSEr:STAR`**Usage:** Event**Manual operation:** See ["Power Servoing sequence"](#) on page 135**FETCh:PSErvoing:OPERation:STATus?**

Queries the status of the power servoing operation.

Return values:`<State>` ON | OFF | 1 | 0**Example:** `FETCh:PSErvoing:OPERation:STATus?`**Usage:** Query only**Manual operation:** See ["Power Servoing sequence"](#) on page 135

5.6.21 Frequency domain measurements

CONFigure:FDOMain:FFTLengTh	310
CONFigure:FDOMain:SQUelch	311
CONFigure:FDOMain:WFUNction	311
CONFigure:FDOMain:WLFRatio	311
CONFigure:FDOMain:WOVerlap	311

CONFigure:FDOMain:FFTLengTh <FFT Length>

Defines the number of frequency points determined by each FFT calculation. The more points are used, the higher the resolution in the spectrum becomes, but the longer the calculation takes.

Parameters:

`<FFT Length>` Range: 1k to 32k
 *RST: 2k
 Default unit: -

Example: `CONF:FDOM:FFTL 2048`**Manual operation:** See ["FFT Length"](#) on page 136

CONFigure:FDOMain:SQUelch <SquelchLevel>

For group delay results, defines a level threshold below which the group delay is set to 0. If the group delay does not exceed the threshold, it is ignored altogether.

Parameters:

<SquelchLevel> Range: -200 to +200
 Increment: 0.1
 *RST: -150.0
 Default unit: dBm

Example: CONF:FDOM:SQU 20

Manual operation: See ["Use Squelch for Group Delay"](#) on page 137

CONFigure:FDOMain:WFUNction <Method>

Defines the FFT window type.

Parameters:

<Method> FLATtop | GAUSSian | RECTangular | P5 | BLACKharris
 *RST: FLATtop

Example: CONF:FDOM:WFUN GIAN

Manual operation: See ["Window Function"](#) on page 136

CONFigure:FDOMain:WLFRatio <WLength Ratio>

Defines the window length as a percentage of the FFT length (see [CONFigure:FDOMain:FFTLength](#) on page 310).

Parameters:

<WLength Ratio> Range: 0.1 to 100
 Increment: 0.1
 *RST: 25
 Default unit: percent

Example: CONF:FDOM:WLFR 25

Manual operation: See ["Window Length to FFT Ratio"](#) on page 137

CONFigure:FDOMain:WOVerlap <Window Overlap>

Defines the part of a single FFT window that is re-calculated by the next FFT calculation when using multiple FFT windows.

Parameters:

<Window Overlap> Range: 0 to 99.9
 Increment: 0.1
 *RST: 25
 Default unit: percent

Example: CONF:FDOM:WOV 25

Manual operation: See "Window Overlap" on page 136

5.7 Analyzing results

- [Configuring traces](#)..... 312
- [Using markers](#)..... 317
- [Configuring numerical result displays](#)..... 328
- [Configuring the statistics table](#)..... 332
- [Configuring result display characteristics](#)..... 333
- [Scaling the diagram axes](#)..... 339

5.7.1 Configuring traces

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:MODE	312
FORMat:DEXPort:DSEParator	313
FORMat:DEXPort:HEADer	313
FORMat:DEXPort:TRACes	314
MMEMory:STORe<n>:TRACe	314
[SENSe:]DETEctor<t>:DEFault[:FUNCTion]	314
[SENSe:]DETEctor<t>:TRACe[:POINT]	315
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:RESult	315
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:PRESet	315
[SENSe:][WINDow<n>:]DETEctor<t>[:FUNCTion]	316
TRACe:IQ:DATA?	316
TRACe:IQ:DATA:FORMat	316
TRACe:IQ:DDPD[:DATA]?	316
TRACe:IQ:RELENgth?	317
TRACe:IQ:SYNC:RELENgth?	317
TRACe:IQ:TPIS?	317

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:MODE <Trace>

This command selects the traces to be displayed in the graphical result displays.

Suffix:

<n>	Window
<w>	irrelevant
<t>	Trace

Parameters:

<Trace> Available traces depend on the result display.

AVERage

The average is formed over several measurements.

BLANK

Removes the selected trace from the display.

MAXHold

The maximum value is determined over several measurements and displayed. The FSW saves each trace point in the trace memory only if the new value is greater than the previous one.

MINHold

The minimum value is determined from several measurements and displayed. The FSW saves each trace point in the trace memory only if the new value is lower than the previous one.

VIEW

The current contents of the trace memory are frozen and displayed.

WRITE

Overwrite mode (default): the trace is overwritten by each measurement.

Example: `DISP:WIND1:TRAC1:MODE WRIT`

Manual operation: See ["Trace Mode"](#) on page 139

FORMat:DEXPort:DSEParator <Separator>

Selects the decimal separator for data exported in ASCII format.

Parameters:

<Separator> POINT | COMMa

COMMa

Uses a comma as decimal separator, e.g. *4,05*.

POINT

Uses a point as decimal separator, e.g. *4.05*.

*RST: *RST has no effect on the decimal separator.
Default is POINT.

Example: `FORM:DEXP:DSEP POIN`

Sets the decimal point as separator.

Manual operation: See ["Decimal Separator"](#) on page 141

FORMat:DEXPort:HEADer <State>

If enabled, additional instrument and measurement settings are included in the header of the export file for result data. If disabled, only the pure result data from the selected traces and tables is exported.

Parameters:

<State> ON | OFF | 0 | 1

*RST: 1

Manual operation: See ["Include Instrument & Measurement Settings"](#) on page 141

FORMat:DEXPort:TRACes <TracesToExport>

This command selects the data to be included in a data export file.

Setting parameters:

<TracesToExport> **SINGLE**
Exports a a single trace only.

ALL
Exports all traces in all windows in the current application.

*RST: SINGLE

Example: //Export all traces
FORM:DEXP:TRAC ALL

MMEMory:STORe<n>:TRACe <Trace>, <FileName>

This command exports trace data to a file.

Suffix:

<n> 1..n
[Window](#)

Setting parameters:

<Trace> Number of the trace you want to save.
Note that the available number of traces depends on the selected result display. The value "0" exports all traces in a window.
To export all traces in all windows, turn on the feature to export all traces and all results first ([FORMat:DEXPort:TRACes](#)). The suffix at `STORe<n>` and the trace id, <Trace>, are ignored in that case.

Range: 0 to 6

<FileName> String containing the path and file name.

Example: //Export all traces in all windows to the specified file.
FORM:DEXP:TRAC ALL
MMEM:STOR:TRAC 0, 'C:\TraceResults'
//Export all traces in window 2 to the specified file.
FORM:DEXP:TRAC SING
MMEM:STOR2:TRAC 0, 'C:\TraceResults'
//Export the second trace in window 2 to the specified file.
MMEM:STOR2:TRAC 2, 'C:\TraceResults'

Usage: Setting only

Manual operation: See ["Selecting data to export"](#) on page 141
See ["Export Trace"](#) on page 142

[SENSe:]DETEctor<t>:DEFault[:FUNCTion] <State>

Selects the default detector for result displays.

Suffix:<t> [Trace](#)**Parameters:**

<State> AVERage | OFF

Manual operation: See "[Default Detector](#)" on page 142**[SENSe:]DETEctor<t>:TRACe[:POINT] <Points>**

Sets the maximum number of trace points to be used by detectors.

Suffix:<t> [Trace](#)**Parameters:**

<Points> numeric value

Manual operation: See "[Max. Trace Points](#)" on page 142**DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:RESult <Trace>**

Sets and queries the trace result type for the selected result display.

Suffix:<n> [Window](#)

<w> irrelevant

<t> [Trace](#)**Parameters:**

<Trace> BBI | BBPower | BBQ | RF | MEAS | MODel | REFerence

Info: The parameter "REFerence" also refers to "IdealLine".**Example:** `DISP:WIND:TRAC:RES MEAS`**Manual operation:** See "[Result Type](#)" on page 140**DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:PRESet <ResultType>**

Applies predefined, commonly required trace settings to the selected window.

Suffix:<n> 1..n
[Window](#)<w> 1..n
subwindow<t> 1..n
[Trace](#)**Parameters:**<ResultType> **ALL**
Preset All Traces

MAM

Max | Avg | Min

MCM

Max | ClrWrite | Min

Example:

DISP:WIND3:TRAC:PRES MCM

In window 3, the traces are set to the following modes:

Trace 1: Max Hold

Trace 2: Clear Write

Trace 3: Min Hold

Manual operation: See ["Predefined Trace Settings - Quick Config"](#) on page 140**[SENSe:][WINDow<n>:]DETEctor<t>[:FUNCTion] <Detector>**

Sets and queries the detector for the selected result display.

Suffix:<n> [Window](#)<t> [Trace](#)**Parameters:**

<Detector> NEGative | POSitive | NONE | AVERage

Manual operation: See ["Detector"](#) on page 140**TRACe:IQ:DATA?**

Sweeps and transfers raw I/Q data.

Example: TRACe1:IQ:DATA?**Usage:** Query only**TRACe:IQ:DATA:FORMat <Slope>**

Defines the I/Q data format.

Parameters:

<Slope> COMPatible | IQBLock | IQPair

Example: TRACe1:IQ:DATA:FORMat IQP**TRACe:IQ:DDPD[:DATA]?**

Queries the I/Q values of the current direct DPD iteration (only for unencrypted files).

Example: TRACe1:IQ:DDPD[:DATA]?**Usage:** Query only**Manual operation:** See ["Automated direct DPD sequence"](#) on page 116See ["Manual direct DPD sequence"](#) on page 117

TRACe:IQ:RLENgth?

Returns the sweep length or capture length.

Return values:

<Samples> numeric value

Example: TRACe:IQ:RLENgth?

Usage: Query only

TRACe:IQ:SYNC:RLENgth?

Returns the sweep length or capture length at the current sample rate.

Return values:

<Samples> numeric value

Example: TRACe:IQ:SYNC:RLENgth?

Usage: Query only

TRACe:IQ:TPIS?**Return values:**

<time> Default unit: HZ

Usage: Query only

5.7.2 Using markers

- [General marker settings](#).....317
- [Configuring individual markers](#).....319
- [Positioning markers](#).....324

5.7.2.1 General marker settings

[CALCulate<n>:MARKer<m>:LINK](#)..... 317

[DISPlay\[:WINDow<n>\]:MINFo\[:STATe\]](#)..... 318

[DISPlay\[:WINDow<n>\]:MTABLE](#)..... 318

CALCulate<n>:MARKer<m>:LINK <State>

This command turns marker coupling across result displays on and off.

Suffix:

<n> irrelevant

<m> irrelevant

Parameters:

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

Example:

//Couple markers
 CALC:MARK:LINK ON

Manual operation: See "[Link Markers Across Windows](#)" on page 144

DISPlay[:WINDow<n>]:MINFo[:STATe] <State>

Turns the marker information in all diagrams on and off.

Suffix:

<n> irrelevant

Parameters:

<State> **ON | 1**
 Displays the marker information in the diagrams.
OFF | 0
 Hides the marker information in the diagrams.
 *RST: 1

Example:

DISP:MINF OFF
 Hides the marker information.

Manual operation: See "[Marker Info](#)" on page 143

DISPlay[:WINDow<n>]:MTABle <DisplayMode>

Turns the marker table on and off.

Suffix:

<n> irrelevant

Parameters:

<DisplayMode> **ON | 1**
 Turns on the marker table.
OFF | 0
 Turns off the marker table.
AUTO
 Turns on the marker table if 3 or more markers are active.
 *RST: AUTO

Example:

DISP:MTAB ON
 Activates the marker table.

Manual operation: See "[Marker Table Display](#)" on page 143

5.7.2.2 Configuring individual markers

CALCulate<n>:DELTamarker<m>:AOFF.....	319
CALCulate<n>:DELTamarker<m>:LINK.....	319
CALCulate<n>:DELTamarker<ms>:LINK:TO:MARKer<md>.....	320
CALCulate<n>:DELTamarker<m>:MREFerence.....	320
CALCulate<n>:DELTamarker<m>[:STATe].....	320
CALCulate<n>:DELTamarker<m>:TRACe.....	321
CALCulate<n>:DELTamarker<m>:X.....	321
CALCulate<n>:DELTamarker<m>:Y?.....	322
CALCulate<n>:MARKer<m>:AOFF.....	322
CALCulate<n>:MARKer<ms>:LINK:TO:MARKer<md>.....	322
CALCulate<n>:MARKer<m>[:STATe].....	323
CALCulate<n>:MARKer<m>:TRACe.....	323
CALCulate<n>:MARKer<m>:X.....	323
CALCulate<n>:MARKer<m>:Y?.....	324

CALCulate<n>:DELTamarker<m>:AOFF

Turns off *all* delta markers.

Suffix:

<n> [Window](#)

<m> irrelevant

Example:

CALC:DELT:AOFF

Turns off all delta markers.

CALCulate<n>:DELTamarker<m>:LINK <State>

Links delta marker <m> to marker 1.

If you change the horizontal position (x-value) of marker 1, delta marker <m> changes its horizontal position to the same value.

Suffix:

<n> [Window](#)

<m> [Marker](#)

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0

Switches the function off

ON | 1

Switches the function on

Example:

CALC:DELT2:LINK ON

Manual operation: See "[Linking to Another Marker](#)" on page 145

CALCulate<n>:DELTamarker<ms>:LINK:TO:MARKer<md> <State>

Links the delta source marker <ms> to any active destination marker <md> (normal or delta marker).

Suffix:

<n> [Window](#)

<ms> source marker, see [Marker](#)

<md> destination marker, see [Marker](#)

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0

Switches the function off

ON | 1

Switches the function on

Example:

CALC:DELT4:LINK:TO:MARK2 ON

Links the delta marker 4 to the marker 2.

Manual operation: See "[Linking to Another Marker](#)" on page 145

CALCulate<n>:DELTamarker<m>:MREFerence <Reference>

Selects a reference marker for a delta marker other than marker 1.

Suffix:

<n> [Window](#)

<m> [Marker](#)

Parameters:

<Reference>

Example:

CALC:DELT3:MREF 2

Specifies that the values of delta marker 3 are relative to marker 2.

Manual operation: See "[Reference Marker](#)" on page 145

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

Turns delta markers on and off.

If necessary, the command activates the delta marker first.

No suffix at DELTmarker turns on delta marker 1.

Suffix:

<n> [Window](#)

<m> [Marker](#)

Parameters:

<State> ON | OFF | 0 | 1
OFF | 0
 Switches the function off
ON | 1
 Switches the function on

Example: CALC:DELT2 ON
 Turns on delta marker 2.

Manual operation: See "[Marker State](#)" on page 144
 See "[Marker Type](#)" on page 145

CALCulate<n>:DELTaMarker<m>:TRACe <Trace>

Selects the trace a delta marker is positioned on.

Note that the corresponding trace must have a trace mode other than "Blank".

If necessary, the command activates the marker first.

Suffix:

<n> [Window](#)

<m> [Marker](#)

Parameters:

<Trace> Trace number the marker is assigned to.

Example: CALC:DELT2:TRAC 2
 Positions delta marker 2 on trace 2.

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

Moves a delta marker to a particular coordinate on the x-axis.

If necessary, the command activates the delta marker and positions a reference marker to the peak power.

Suffix:

<n> [Window](#)

<m> [Marker](#)

Parameters:

<Position> Numeric value that defines the marker position on the x-axis.
 Range: The value range and unit depend on the measurement and scale of the x-axis.

Example: CALC:DELT:X?
 Outputs the absolute x-value of delta marker 1.

Manual operation: See "[Marker Position X-value](#)" on page 145

CALCulate<n>:DELTaMarker<m>:Y?

Queries the result at the position of the specified delta marker.

Suffix:

<n> 1..n

<m> 1..n

Return values:

<Result> Result at the position of the delta marker.
The unit is variable and depends on the one you have currently set.

Default unit: DBM

Usage: Query only

CALCulate<n>:MARKer<m>:AOFF

Turns off all markers.

Suffix:

<n> [Window](#)

<m> [Marker](#)

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

Manual operation: See "[All Markers Off](#)" on page 146

CALCulate<n>:MARKer<ms>:LINK:TO:MARKer<md> <State>

Links the normal source marker <ms> to any active destination marker <md> (normal or delta marker).

If you change the horizontal position of marker <md>, marker <ms> changes its horizontal position to the same value.

Suffix:

<n> [Window](#)

<ms> source marker, see [Marker](#)

<md> destination marker, see [Marker](#)

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0

Switches the function off

ON | 1

Switches the function on

Example: CALC:MARK4:LINK:TO:MARK2 ON
Links marker 4 to marker 2.

Manual operation: See ["Linking to Another Marker"](#) on page 145

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

Turns markers on and off. If the corresponding marker number is currently active as a delta marker, it is turned into a normal marker.

Suffix:

<n> [Window](#)

<m> [Marker](#)

Parameters:

<State> ON | OFF | 0 | 1
OFF | 0
 Switches the function off
ON | 1
 Switches the function on

Example: CALC:MARK3 ON
 Switches on marker 3.

Manual operation: See ["Marker State"](#) on page 144
 See ["Marker Type"](#) on page 145

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

Selects the trace the marker is positioned on.

Note that the corresponding trace must have a trace mode other than "Blank".

If necessary, the command activates the marker first.

Suffix:

<n> [Window](#)

<m> [Marker](#)

Parameters:

<Trace> **1 to 4**
 Trace number the marker is assigned to.

Example: //Assign marker to trace 1
 CALC:MARK3:TRAC 2

Manual operation: See ["Assigning the Marker to a Trace"](#) on page 146

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

Moves a marker to a specific coordinate on the x-axis.

If necessary, the command activates the marker.

If the marker has been used as a delta marker, the command turns it into a normal marker.

Suffix:

<n> Window

<m> Marker

Parameters:<Position> Numeric value that defines the marker position on the x-axis.
The unit depends on the result display.Range: The range depends on the current x-axis range.
Default unit: Hz**Example:**

CALC:MARK2:X 1.7MHz

Positions marker 2 to frequency 1.7 MHz.

Manual operation: See "[Marker Position X-value](#)" on page 145

CALCulate<n>:MARKer<m>:Y?

Queries the result at the position of the specified marker.

Suffix:

<n> 1..n

<m> 1..n

Return values:

<Result> Default unit: DBM

Usage: Query only**5.7.2.3 Positioning markers**

CALCulate<n>:DELTaMarker<m>:MAXimum:LEFT.....	324
CALCulate<n>:DELTaMarker<m>:MAXimum:NEXT.....	325
CALCulate<n>:DELTaMarker<m>:MAXimum[:PEAK].....	325
CALCulate<n>:DELTaMarker<m>:MAXimum:RIGHT.....	325
CALCulate<n>:DELTaMarker<m>:MINimum:LEFT.....	325
CALCulate<n>:DELTaMarker<m>:MINimum:NEXT.....	326
CALCulate<n>:DELTaMarker<m>:MINimum[:PEAK].....	326
CALCulate<n>:DELTaMarker<m>:MINimum:RIGHT.....	326
CALCulate<n>:MARKer<m>:MAXimum:LEFT.....	326
CALCulate<n>:MARKer<m>:MAXimum:NEXT.....	327
CALCulate<n>:MARKer<m>:MAXimum[:PEAK].....	327
CALCulate<n>:MARKer<m>:MAXimum:RIGHT.....	327
CALCulate<n>:MARKer<m>:MINimum:LEFT.....	327
CALCulate<n>:MARKer<m>:MINimum:NEXT.....	328
CALCulate<n>:MARKer<m>:MINimum[:PEAK].....	328
CALCulate<n>:MARKer<m>:MINimum:RIGHT.....	328

CALCulate<n>:DELTaMarker<m>:MAXimum:LEFT

Moves a delta marker to the next positive peak value.

The search includes only measurement values to the left of the current marker position.

Suffix:

<n> [Window](#)

<m> [Marker](#)

Manual operation: See ["Search Next Peak"](#) on page 147

CALCulate<n>:DELTamarker<m>:MAXimum:NEXT

Moves a marker to the next positive peak value.

Suffix:

<n> 1..n
[Window](#)

<m> 1..n
[Marker](#)

Manual operation: See ["Search Next Peak"](#) on page 147

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

Moves a delta marker to the highest level.

If the marker is not yet active, the command first activates the marker.

Suffix:

<n> [Window](#)

<m> [Marker](#)

Manual operation: See ["Peak Search"](#) on page 146

CALCulate<n>:DELTamarker<m>:MAXimum:RIGHT

Moves a delta marker to the next positive peak value on the trace.

The search includes only measurement values to the right of the current marker position.

Suffix:

<n> [Window](#)

<m> [Marker](#)

Manual operation: See ["Search Next Peak"](#) on page 147

CALCulate<n>:DELTamarker<m>:MINimum:LEFT

Moves a delta marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

Suffix:

<n> [Window](#)

<m> [Marker](#)

Manual operation: See ["Search Next Minimum"](#) on page 147

CALCulate<n>:DELTaMarker<m>:MINimum:NEXT

Moves a marker to the next minimum peak value.

Suffix:

<n> [Window](#)

<m> [Marker](#)

Manual operation: See ["Search Next Minimum"](#) on page 147

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

Moves a delta marker to the minimum level.

If the marker is not yet active, the command first activates the marker.

Suffix:

<n> [Window](#)

<m> [Marker](#)

Manual operation: See ["Search Minimum"](#) on page 147

CALCulate<n>:DELTaMarker<m>:MINimum:RIGHT

Moves a delta marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

Suffix:

<n> [Window](#)

<m> [Marker](#)

Manual operation: See ["Search Next Minimum"](#) on page 147

CALCulate<n>:MARKer<m>:MAXimum:LEFT

Moves a marker to the next positive peak.

The search includes only measurement values to the left of the current marker position.

Suffix:<n> [Window](#)<m> [Marker](#)**Manual operation:** See "[Search Next Peak](#)" on page 147

CALCulate<n>:MARKer<m>:MAXimum:NEXT

Moves a marker to the next positive peak.

Suffix:<n> [Window](#)<m> [Marker](#)**Manual operation:** See "[Search Next Peak](#)" on page 147

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

Moves a marker to the highest level.

If the marker is not yet active, the command first activates the marker.

Suffix:<n> [Window](#)<m> [Marker](#)**Manual operation:** See "[Peak Search](#)" on page 146

CALCulate<n>:MARKer<m>:MAXimum:RIGHT

Moves a marker to the next positive peak.

The search includes only measurement values to the right of the current marker position.

Suffix:<n> [Window](#)<m> [Marker](#)**Manual operation:** See "[Search Next Peak](#)" on page 147

CALCulate<n>:MARKer<m>:MINimum:LEFT

Moves a marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

Suffix:<n> [Window](#)<m> [Marker](#)

Manual operation: See ["Search Next Minimum"](#) on page 147

CALCulate<n>:MARKer<m>:MINimum:NEXT

Moves a marker to the next minimum peak value.

Suffix:

<n> [Window](#)

<m> [Marker](#)

Manual operation: See ["Search Next Minimum"](#) on page 147

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

Moves a marker to the minimum level.

If the marker is not yet active, the command first activates the marker.

Suffix:

<n> [Window](#)

<m> [Marker](#)

Manual operation: See ["Search Minimum"](#) on page 147

CALCulate<n>:MARKer<m>:MINimum:RIGHT

Moves a marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

Suffix:

<n> [Window](#)

<m> [Marker](#)

Manual operation: See ["Search Next Minimum"](#) on page 147

5.7.3 Configuring numerical result displays

DISPlay[:WINDow<n>]:PTABLE:ITEM.....	328
DISPlay[:WINDow<n>]:PTABLE:ITEM:ALL.....	329
DISPlay[:WINDow<n>]:TABLE:ITEM.....	329
DISPlay[:WINDow<n>]:TABLE:ITEM:MACCuracy:ALL.....	331
DISPlay[:WINDow<n>]:TABLE:ITEM:POWer:ALL.....	331
DISPlay[:WINDow<n>]:TABLE:ITEM:VCURrent:ALL.....	331

DISPlay[:WINDow<n>]:PTABLE:ITEM <Item>, <State>

DISPlay[:WINDow<n>]:PTABLE:ITEM? <Item>

This command adds and removes results from the "Parameter Sweep" Table.

Suffix:

<n> 1..n
[Window](#)

Note that you have to include the `WINDOW` syntax element if the "Parameter Sweep" Table is in a window other than window 1.

Parameters:

<State> ON | OFF | 1 | 0
 *RST: All results are 1.

Parameters for setting and query:

<Item> Selects the result.
 See the table at [CONFIGure:PSweep:Z<n>:RESult](#) for a list of available parameters.

Example:

```
DISP:PTAB:ITEM RMS,OFF
```

Removes the RMS Power result from the "Parameter Sweep" Table.

DISPlay[:WINDow<n>]:PTABLE:ITEM:ALL <State>

This command adds and removes all parameter sweep results from the parameter sweep table.

Suffix:

<n> [Window](#)

Setting parameters:

<State> ON | OFF | 1 | 0

Example:

```
//Display all parameter sweep results
DISP:PTAB:ITEM:ALL ON
```

Usage:

Setting only

DISPlay[:WINDow<n>]:TABLE:ITEM <Item>, <State>**DISPlay[:WINDow<n>]:TABLE:ITEM? <Item>**

This command adds and removes results from the result summary.

Suffix:

<n> [Window](#)

Note that you have to include the `WINDOW` syntax element if the result summary is in a window other than window 1.

Parameters:

<State> ON | OFF | 1 | 0
 *RST: All results are 1.

Parameters for setting and query:

<Item> Selects the result.
 See the table below for a list of available parameters.

Example: //Removes the gain imbalance result from the result summary.
 DISP:TABLE:ITEM GIMB,OFF
 //Query if frequency error result is calculated
 DISP:WIND2:TABLE:ITEM? FERR
 would return, e.g.
 1

SCPI parameter	Result
AMWidth	AM curve width
APAE	Average PAE
BBIVoltage	Baseband I input voltage
BBPower	Baseband power
BBQVoltage	Baseband Q input voltage
CFIN	Crest factor in
CFOU	Crest factor out
FERRor	Frequency error
GAIN	Gain
GIMBalance	Gain Imbalance
ICC	Current
IQIMbalance	I/Q imbalance
IQOFset	I/Q offset
MERRor	Magnitude error
OUTP1db	1 dB output compression point
OUTP2db	2 dB output compression point
OUTP3db	3 dB output compression point
P1DB	1 dB compression point
P2DB	2 dB compression point
P3DB	3 dB compression point
PC	Average power consumption
PCPA	PC based average PAE
PERRor	Phase error
PINPut	Power in
PMWidth	PM curve width
POUTput	Power out
QERRor	Quadrature error
REVM	"Raw EVM"
RMEVm	Raw model EVM

SCPI parameter	Result
SRError	Sample rate error
VCC	Voltage

DISPlay[:WINDow<n>]:TABLe:ITEM:MACCuracy:ALL <State>

This command adds and removes all modulation accuracy results from the result summary.

Suffix:

<n> [Window](#)

Setting parameters:

<State> ON | OFF | 1 | 0

Example:

```
//Display all modulation accuracy results
DISP:TABL:ITEM:MACC:ALL ON
```

Usage:

Setting only

DISPlay[:WINDow<n>]:TABLe:ITEM:POWer:ALL <State>

This command adds and removes all power results from the result summary.

Suffix:

<n> [Window](#)

Setting parameters:

<State> ON | OFF | 1 | 0

Example:

```
//Display all power result
DISP:TABL:ITEM:POW:ALL ON
```

Usage:

Setting only

DISPlay[:WINDow<n>]:TABLe:ITEM:VCURrent:ALL <State>

This command adds and removes all voltage / current results from the result summary.

Prerequisites for this command

- Select a baseband measurement.

Suffix:

<n> [Window](#)

Setting parameters:

<State> ON | OFF | 1 | 0

Example:

```
//Displays all voltage and current results
DISP:TABL:ITEM:VCUR:ACC:ALL ON
```

Usage:

Setting only

5.7.4 Configuring the statistics table

DISPlay[:WINDow<n>]:STABle:ITEM.....	332
DISPlay[:WINDow<n>]:STABle:ITEM:MACCuracy:ALL.....	332
DISPlay[:WINDow<n>]:STABle:ITEM:POWer:ALL.....	332
DISPlay[:WINDow<n>]:STABle:ITEM:VCURrent:ALL.....	333

DISPlay[:WINDow<n>]:STABle:ITEM <Item>, <State>

DISPlay[:WINDow<n>]:STABle:ITEM? <Item>

This command adds and removes results from the statistics table.

Suffix:

<n>

[Window](#)

Note that you have to include the `WINDow` syntax element if the statistics table is in a window other than window 1.

Parameters:

<State>

ON | OFF | 1 | 0

*RST: All results are 1.

Parameters for setting and query:

<Item>

Selects the result.

See the table in the description of [DISPlay\[:WINDow<n>\]:TABLE:ITEM](#) on page 329 for a list of available parameters.

Example:

//Removes the gain imbalance result from the statistics table.

DISP:STAB:ITEM GIMB,OFF

//Query if frequency error result is calculated

DISP:WIND2:STAB:ITEM? FERR

would return, e.g.

1

DISPlay[:WINDow<n>]:STABle:ITEM:MACCuracy:ALL <State>

This command adds and removes all modulation accuracy results from the statistics table.

Suffix:

<n>

[Window](#)

Setting parameters:

<State>

ON | OFF | 1 | 0

Example:

//Display all modulation accuracy results

DISP:STAB:ITEM:MACC:ALL ON

Usage:

Setting only

DISPlay[:WINDow<n>]:STABle:ITEM:POWer:ALL <State>

This command adds and removes all power results from the statistics table.

Suffix:	
<n>	Window
Setting parameters:	
<State>	ON OFF 1 0
Example:	//Display all power result DISP:STAB:ITEM:POW:ALL ON
Usage:	Setting only

DISPlay[:WINDow<n>]:STABle:ITEM:VCURrent:ALL <State>

This command adds and removes all voltage / current results from the statistics table.

Prerequisites for this command

- Select a baseband measurement.

Suffix:	
<n>	Window
Setting parameters:	
<State>	ON OFF 1 0
Example:	//Displays all voltage and current results DISP:STAB:ITEM:VCUR:ACC:ALL ON
Usage:	Setting only

5.7.5 Configuring result display characteristics

CALCulate<n>:AMPM:DEFinition.....	333
CALCulate<n>:PREFerence:X.....	334
CALCulate<n>:UNIT:ANGLE.....	334
CONFigure:FRSPan.....	335
CONFigure:FRSPan:AUTO.....	335
CONFigure:POWER:UNIT.....	335
CONFigure:PSWeep:Z<n>:RESult.....	335
DISPlay[:WINDow<n>]:TDOMain:X[:SCALE]:DURation.....	336
DISPlay[:WINDow<n>]:TDOMain:X[:SCALE]:MODE.....	337
DISPlay[:WINDow<n>]:TDOMain:X[:SCALE]:OFFSet.....	337
DISPlay[:WINDow<n>]:TDOMain:Y[:SCALE]:NORMalise[:STATE].....	338
CONFigure:AMPM:CWIDTH:REFerence.....	338
CONFigure:AMPM:CWIDTH:REFerence:AUTO.....	338

CALCulate<n>:AMPM:DEFinition <ResultType>

This command selects the way the "AM/PM" results are calculated.

Suffix:

<n> irrelevant

Parameters:

<ResultType>

MREF

Subtracts the reference trace from the measurement trace. This is the inverse of the default REAFMeas method.

REFMeas

Subtracts the measurement trace from the reference trace.

*RST: REFMeas

Example:

CALC:AMP:DEF?
would return, e.g.
REFM

Manual operation: See ["AM/PM Definition"](#) on page 150

CALCulate<n>:PREference:X <ResultType>

This command selects the type of information displayed on x-axis in the following result displays.

- "EVM vs Power"
- "AM/PM"
- "Gain Compression"

Suffix:

<n> [Window](#)

Parameters:

<ResultType>

PINPut

Shows the corresponding result against the input level.

POUTput

Shows the corresponding result against the output level.

Example:

//Displays the result (for example "AM/PM") against the input level.
CALC:GAIN:X PINP

Manual operation: See ["Reference for AM/PM, EVM and Gain Compression"](#) on page 152

CALCulate<n>:UNIT:ANGLE <Unit>

This command selects the unit for results that display the phase.

Suffix:

<n> [Window](#)

Parameters:

<Unit>

DEG

Phase displayed in degrees.

RAD

Phase displayed in radians.

Example: //Show the phase results in degrees
CALC:UNIT:ANGL DEG

Manual operation: See "[Unit](#)" on page 150

CONFigure:FRSPan <Time>

Sets or queries the the frequency response span for FSW-K18F result displays.

Parameters:

<Time> Range: 1 Hz to 100 GHz
Default unit: HZ

Example: CONF:FRSP:AUTO OFF
CONF:FRSP 2000

Manual operation: See "[Frequency Response](#)" on page 150

CONFigure:FRSPan:AUTO <State>

Defines how the span is determined that the frequency response is applied to for FSW-K18F result displays.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0

Defines the span manually using [CONFigure:FRSPan](#) on page 335.

ON | 1

Defines the span automatically according to the calculated OBW of the reference file.

*RST: 0

Manual operation: See "[Frequency Response](#)" on page 150

CONFigure:POWer:UNIT <Result>

Switches the unit for power results from dBm (default) to Watts.

Parameters:

<Result> DBM | WATT

Manual operation: See "[Power Unit](#)" on page 150

CONFigure:PSWeep:Z<n>:RESult <Result>

This command selects the result type displayed on the z-axis of the parameter sweep diagram.

Suffix:

<n> 1..n
[Window](#)

Parameters:

<Result> See table below for supported result types.

Example:

CONF:PSW:Z:RES EVM
 Displays the EVM against two parameters in the "Parameter Sweep" result display.

Manual operation: See "[Parameter sweep diagram](#)" on page 151

ACBM	Balanced ACLR Magnitude
ACB1	ACLR Adj 1 Balanced
ACB2	ACLR Alt 1 Balanced
ACB3	ACLR Alt 2 Balanced
ACL1	ACLR Adjacent 1 Lower
ACP	Adjacent Channel Power
ACU1	ACLR Adjacent 1 Upper
AMWidth	"AM/AM" Curve Width
CFACtor	Crest Factor
EVM	EVM
GAIN	Gain
ICC	Current (I _{cc})
PAE	PAE
PMWidth	"AM/PM" Curve Width
POUT	Power Out
P1DB	Compression Point 1 dB
P2DB	Compression Point 2 dB
P3DB	Compression Point 3 dB
RMS	RMS Power
VCC	Voltage (V _{cc})
VICC	Power (V _{cc} * I _{cc})

DISPlay[:WINDow<n>]:TDOMain:X[:SCALE]:DURATION <Time>

This command defines the amount of data displayed on the x-axis of the time domain result display.

Prerequisites for this command

- Turn off automatic scaling (`DISPlay[:WINDow<n>]:TDOMain:X[:SCALe]:MODE`).

Suffix:

<n> [Window](#)

Parameters:

<Time> <numeric value>

Time that is displayed on the x-axis, beginning at the offset defined with `DISPlay[:WINDow<n>]:TDOMain:X[:SCALe]:OFFSet`.

Default unit: s

Example:

```
//Scale the x-axis in the time domain result display
DISP:TDOM:X:MODE OFF
DISP:TDOM:X:DUR 12us
```

Manual operation: See "[Duration](#)" on page 151

DISPlay[:WINDow<n>]:TDOMain:X[:SCALe]:MODE <State>

This command turns automatic scaling of the x-axis in the time domain result display on and off.

Suffix:

<n> [Window](#)

Parameters:

<State> **ON | 1**

Turns on automatic scaling of the x-axis.

OFF | 0

Turns on manual scaling of the x-axis.

Example:

```
//Turn on manual scaling of the x-axis
DISP:TDOM:X:MODE OFF
```

Manual operation: See "[Position](#)" on page 151

DISPlay[:WINDow<n>]:TDOMain:X[:SCALe]:OFFSet <Time>

This command defines the origin of the x-axis in the time domain result display.

Prerequisites for this command

- Turn off automatic scaling (`DISPlay[:WINDow<n>]:TDOMain:X[:SCALe]:MODE`).

Suffix:

<n> [Window](#)

Parameters:

<Time> <numeric value>
 Time offset relative to the first recorded sample (when synchronization has failed) or the first sample of the synchronized data (when synchronization was successful).
 Default unit: s

Example:

Defines an offset
 DISP:TDOM:X:MODE OFF
 DISP:TDOM:X:OFFS 12us

Manual operation: See "[Offset](#)" on page 151

DISPlay[:WINDow<n>]:TDOMain:Y[:SCALE]:NORMalise[:STATE] <State>

This command turns normalization of the results in the time domain result display on and off.

Suffix:

<n> [Window](#)

Parameters:

<State> ON | OFF | 1 | 0

Example:

//Normalize the results in the time domain result display to 1
 DISP:TDOM:Y:NORM ON

Manual operation: See "[Normalize to 1](#)" on page 151

CONFigure:AMPM:CWIDTH:REFerence <CurveWidthReference>

Sets and queries the curve width computation reference point

Parameters:

<CurveWidthReference> <numeric value>
 Default unit: dB

Example:

CONF:AMPM:CWID:REF 3DB

Manual operation: See "[AM/AM and AM/PM Curve Width Reference Point](#)" on page 150

CONFigure:AMPM:CWIDTH:REFerence:AUTO <State>

Sets and queries the curve width computation reference point mode.

Parameters:

<State> **ON | 1**
 Automatic mode
OFF | 0
 Manual mode

Example:

CONFigure:AMPM:CWIDTH:REFerence:AUTO ON

Manual operation: See ["AM/AM and AM/PM Curve Width Reference Point"](#) on page 150

5.7.6 Scaling the diagram axes

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALe]:AUTO.....	339
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALe]:MAXimum.....	339
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALe]:MINimum.....	340
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALe]:PDIVision.....	340
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALe]:UNIT?.....	341
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:AUTO.....	341
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MAXimum.....	342
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MINimum.....	342
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:PDIVision.....	343
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RPOSition.....	343
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RVALue.....	344
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:UNIT?.....	344

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALe]:AUTO <State>

This command turns automatic scaling of the x-axis in graphical result displays on and off.

Suffix:

<n>	Window
<w>	irrelevant
<t>	irrelevant

Parameters:

<State>	OFF 0 Selects manual scaling of the diagram.
	ON 1 Automatically scales the diagram when new results are available.
	ONCE Automatically scales the diagram once whenever required.
	*RST: ON

Example: //Scale the axis each time new results are available
DISP:TRAC:X:AUTO ON

Manual operation: See ["Scaling the x-axis automatically"](#) on page 153

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALe]:MAXimum <Value>

This command defines the value at the top of the x-axis.

Suffix:

<n>	Window
<w>	irrelevant
<t>	irrelevant

Parameters:

<Value>	<numeric value>
	Default unit: Depends on the result display.

Example:

```
//Define x-axis level range
DISP:TRAC:x:AUTO OFF
DISP:TRAC:x:MIN -10DBM
DISP:TRAC:x:MAX -110DBM
```

Manual operation: See ["Scaling the x-axis manually"](#) on page 153

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALe]:MINimum
<Value>

This command defines the value at the bottom of the y-axis.

Suffix:

<n>	Window
<w>	irrelevant
<t>	irrelevant

Parameters:

<Value>	<numeric value>
	Default unit: Depends on the result display.

Example:

```
//Define x-axis level range
DISP:TRAC:X:AUTO OFF
DISP:TRAC:X:MIN -10DBM
DISP:TRAC:X:MAX -110DBM
```

Manual operation: See ["Scaling the x-axis manually"](#) on page 153

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALe]:PDIVision
<Distance>

This command defines the distance between the horizontal grid lines in graphical result displays.

Prerequisites for this command

- Turn off automatic scaling (`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALe]:AUTO`).

Suffix:

<n>	Window
<w>	irrelevant

<t> irrelevant

Parameters:

<Distance> <numeric value>
Default unit: Depends on the result display.

Example: //Define a distance of 5 dBm between the grid lines
DISP:TRAC:X:SCAL:AUTO OFF
DISP:TRAC:X:PDIV 5DBM

Manual operation: See "[Scaling the x-axis manually](#)" on page 153

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALe]:UNIT?

This command queries the unit of the x-axis

Suffix:

<n> [Window](#)

<w> irrelevant

<t> irrelevant

Return values:

<Unit> Unit of the x-axis in the selected window.

Example: DISP:WIND4:TRAC:X:UNIT?
would return, e.g.
SEC

Usage: Query only

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

This command turns automatic scaling of the y-axis in graphical result displays on and off.

Suffix:

<n> [Window](#)

<w> irrelevant

<t> irrelevant

Parameters:

<State> **OFF**
Selects manual scaling of the diagram.

ON
Automatically scales the diagram when new results are available.

ONCE
Automatically scales the diagram once whenever required.

*RST: ON

Example: //Scale the axis each time new results are available
 DISP:TRAC:Y:AUTO ON

Manual operation: See ["Scaling the y-axis automatically"](#) on page 155

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MAXimum
 <Value>

This command defines the value at the top of the y-axis.

Suffix:

<n> [Window](#)
 <w> irrelevant
 <t> irrelevant

Parameters:

<Value> <numeric value>
 Default unit: Depends on the result display.

Example: //Define y-axis level range
 DISP:TRAC:Y:AUTO OFF
 DISP:TRAC:Y:MIN -10DBM
 DISP:TRAC:Y:MAX -110DBM

Manual operation: See ["Scaling the y-axis manually"](#) on page 155

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MINimum
 <Value>

This command defines the value at the bottom of the y-axis.

Suffix:

<n> [Window](#)
 <w> irrelevant
 <t> irrelevant

Parameters:

<Value> <numeric value>
 Default unit: Depends on the result display.

Example: //Define y-axis level range
 DISP:TRAC:Y:AUTO OFF
 DISP:TRAC:Y:MIN -10DBM
 DISP:TRAC:Y:MAX -110DBM

Manual operation: See ["Scaling the y-axis manually"](#) on page 155

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:PDIVision
<Distance>

This command defines the distance between the grid lines in graphical result displays.

Prerequisites for this command

- Turn off automatic scaling (`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:AUTO`).

Suffix:

<n> [Window](#)
 <w> irrelevant
 <t> irrelevant

Parameters:

<Distance> <numeric value>
 Default unit: Depends on the result display.

Example: //Define a distance of 5 dBm between the grid lines
`DISP:TRAC:Y:SCAL:AUTO OFF`
`DISP:TRAC:Y:PDIV 5DBM`

Manual operation: See "[Scaling the y-axis manually](#)" on page 155

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RPOsition
<Position>

This command defines the position of the reference value.

You can define the reference value with `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RVALue`.

Suffix:

<n> [Window](#)
 <w> irrelevant
 <t> irrelevant

Parameters:

<Position> <numeric value>
 Default unit: %

Example: //Position the reference value at the 80 % mark of the y-axis
`DISP:TRAC:Y:AUTO OFF`
`DISP:TRAC:Y:RVAL 0DBM`
`DISP:TRAC:Y:RPOS 80`

Manual operation: See "[Scaling the y-axis manually](#)" on page 155

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RVALue
<Reference>

This command defines the reference value of a result display.

Prerequisites for this command

- Turn off automatic scaling (`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:AUTO`).

Suffix:

<n> [Window](#)
 <w> irrelevant
 <t> irrelevant

Parameters:

<Reference> <numeric value>
 Default unit: The unit depends on the result display.

Example: //Define a reference value of 10 dB
 DISP:TRAC:Y:AUTO OFF
 DISP:TRAC:Y:RVAL 10DB

Manual operation: See "[Scaling the y-axis manually](#)" on page 155

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:UNIT?

This command queries the unit of the y-axis

Suffix:

<n> [Window](#)
 <w> irrelevant
 <t> irrelevant

Return values:

<Unit> Unit of the y-axis in the selected window.

Example: DISP:WIND3:TRAC:Y:UNIT?
 would return, e.g.
 DBM

Usage: Query only

5.8 Retrieving results

The following remote commands are required to retrieve the results from an amplifier measurement in a remote environment.

- [Retrieving graphical measurement results](#).....345
- [Retrieving numeric results](#).....347
- [Retrieving I/Q data](#).....403

5.8.1 Retrieving graphical measurement results

FORMat[:DATA].....	345
TRACe<n>[:DATA]?.....	345
TRACe<n>[:DATA]:X?.....	346
TRACe<n>[:DATA]:Y?.....	347

FORMat[:DATA] <Format>[, <BitLength>]

Selects the data format that is used for transmission of trace data from the FSW to the controlling computer.

Note that the command has no effect for data that you send to the FSW. The FSW automatically recognizes the data it receives, regardless of the format.

Parameters:

<Format>

ASCII

ASCII format, separated by commas.

This format is almost always suitable, regardless of the actual data format. However, the data is not as compact as other formats can be.

REAL

Floating-point numbers (according to IEEE 754) in the "definite length block format".

In the Spectrum application, the format setting `REAL` is used for the binary transmission of trace data.

<BitLength>

Length in bits for floating-point results

16

16-bit floating-point numbers.

Compared to `REAL, 32` format, half as many numbers are returned.

32

32-bit floating-point numbers

For I/Q data, 8 bytes per sample are returned for this format setting.

64

64-bit floating-point numbers

Compared to `REAL, 32` format, twice as many numbers are returned.

Example:

FORM REAL, 32

TRACe<n>[:DATA]? <Trace>

This command queries the measurement results in the graphical result displays. Usually, the measurement results are either displayed on the y-axis (two-dimensional diagrams) or the z-axis (three-dimensional diagrams).

Suffix:

<n> 1..n
[Window](#)

Query parameters:

<Trace> TRACE1 | ... | TRACE6
 Selects the trace to be queried.
 Note that the available number of traces depends on the result display.
 For example, the "Magnitude Capture" result display only supports TRACE1, while the "Time Domain" result display supports TRACE1 to TRACE6.

Return values:

<Result> <numeric value>
 Values of the captured samples in chronological order.

Example:

TRAC:DATA TRACE1
 Queries the results displayed on trace 1.

Usage:

Query only

Manual operation:

See ["AM/AM"](#) on page 14
 See ["AM/PM"](#) on page 15
 See ["Channel Response Magnitude / Channel Response Phase / Group Delay \(FSW-K18F\)"](#) on page 16
 See ["DDPD Results \(FSW-K18D\)"](#) on page 18
 See ["EVM vs Power"](#) on page 19
 See ["Error Vector Spectrum"](#) on page 19
 See ["Gain Compression"](#) on page 20
 See ["Gain Deviation vs Time"](#) on page 21
 See ["Vcc vs Icc"](#) on page 22
 See ["Magnitude Capture"](#) on page 22
 See ["PAE vs Input Power / PAE vs Output Power"](#) on page 23
 See ["PAE vs Time"](#) on page 24
 See ["Parameter Sweep: Diagram"](#) on page 26
 See ["Phase Deviation vs Time"](#) on page 26
 See ["Power vs Time"](#) on page 27
 See ["Raw EVM"](#) on page 27
 See ["Spectrum FFT"](#) on page 29
 See ["Time Domain"](#) on page 30
 See ["Vcc vs Power / Icc vs Power"](#) on page 32

TRACe<n>[:DATA]:X? <Trace>

This command queries the measurement results as displayed on the x-axis in the graphical result displays.

Suffix:

<n> 1..n
[Window](#)

Query parameters:

<Trace> TRACE1 | ... | TRACE6
 Selects the trace to be queried.
 Note that the available number of traces depends on the result display.
 For example, the "Magnitude Capture" result display only supports TRACE1, while the "Time Domain" result display supports TRACE1 to TRACE6.

Return values:

<Result> <numeric value>
 X-axis values of the captured samples in chronological order.

Example:

TRAC:DATA TRACE1
 Queries the results displayed on trace 1.

Usage:

Query only

TRACe<n>[:DATA]:Y? <Trace>

This command queries the measurement results as displayed on the y-axis in result displays with three axes.

Suffix:

<n> 1..n
[Window](#)

Query parameters:

<Trace> TRACE1 | ... | TRACE6
 Selects the trace to be queried.
 Note that the available number of traces depends on the result display.

Example:

TRAC:DATA TRACE1
 Queries the results displayed on trace 1.

Usage:

Query only

5.8.2 Retrieving numeric results

The following commands are required to retrieve the calculated numeric results.

- [Retrieving general numeric results](#).....347
- [Retrieving results of the result summary](#).....348
- [Retrieving results of the parameter sweep table](#).....364
- [Retrieving results of the statistics table](#).....371

5.8.2.1 Retrieving general numeric results

[FETCh:TTF:CURRent\[:RESult\]?](#).....348
[FETCh:TTS:CURRent\[:RESult\]?](#).....348

FETCH:TTF:CURREnt[:RESult]?

This command queries the Trigger to Frame result as displayed in the channel bar.

Return values:

<Time> <numeric value>
Default unit: s

Example: FETCH:TTF:CURREnt?
would return, e.g.
0.00015700958

Usage: Query only

FETCH:TTS:CURREnt[:RESult]?

This command queries the trigger to sync result.

This is the time from start of capture (i.e. including pre-trigger samples) to the start of the sync range, which is not necessarily the beginning of the reference waveform.

Return values:

<Time> <numeric value>
Default unit: s

Example: FETCH:TTS:CURREnt[:RESult]?

Usage: Query only

5.8.2.2 Retrieving results of the result summary

- [Retrieving all results](#)..... 348
- [Retrieving the modulation accuracy](#)..... 349
- [Retrieving power results](#)..... 354
- [Retrieving baseband characteristics](#)..... 361

Retrieving all results

- [FETCH:MACCuracy\[:RESult\]:ALL?](#)..... 348
- [FETCH:POWer\[:RESult\]:ALL?](#)..... 349

FETCH:MACCuracy[:RESult]:ALL?

This command queries all numerical results shown in the Result Summary.

Return values:

<Results> <numerical value>: Results as a comma separated list.
The order of results is the same as in the result summary:
<RawEVMMin>, <RawEVMCurrent>, <RawEVMMax>,
<RawModelEVMMin>, <RawModelEVMCurrent>,
<RawModelEVMMax>, ...
The unit depends on the result.
If a result hasn't been calculated, the command returns NAN.

Example: `FETC:MACC:ALL?`
 would return, e.g.
 `0.277,0.277,0.277,0.002,0.245,0.922,...`

Usage: Query only

FETCh:POWer[:RESult]:ALL?

This command queries all power related numerical results as shown in the result summary.

Return values:

<Results> <numerical value>: Results as a comma separated list.
 The order of results is the same as in the result summary:
 The unit depends on the result.
 If a result hasn't been calculated, the command returns `NAN`.

Example: `FETC:POW:ALL?`
 would return, e.g.

Usage: Query only

Retrieving the modulation accuracy

<code>FETCh:MACCuracy:ADRoop:MAXimum[:RESult]?</code>	350
<code>FETCh:MACCuracy:ADRoop:MINimum[:RESult]?</code>	350
<code>FETCh:MACCuracy:ADRoop:CURRent[:RESult]?</code>	350
<code>FETCh:MACCuracy:FERRor:MAXimum[:RESult]?</code>	350
<code>FETCh:MACCuracy:FERRor:MINimum[:RESult]?</code>	350
<code>FETCh:MACCuracy:FERRor:CURRent[:RESult]?</code>	350
<code>FETCh:MACCuracy:GIMBalance:MAXimum[:RESult]?</code>	350
<code>FETCh:MACCuracy:GIMBalance:MINimum[:RESult]?</code>	350
<code>FETCh:MACCuracy:GIMBalance:CURRent[:RESult]?</code>	350
<code>FETCh:MACCuracy:IQIMbalance:MAXimum[:RESult]?</code>	351
<code>FETCh:MACCuracy:IQIMbalance:MINimum[:RESult]?</code>	351
<code>FETCh:MACCuracy:IQIMbalance:CURRent[:RESult]?</code>	351
<code>FETCh:MACCuracy:IQOFset:MAXimum[:RESult]?</code>	351
<code>FETCh:MACCuracy:IQOFset:MINimum[:RESult]?</code>	351
<code>FETCh:MACCuracy:IQOFset:CURRent[:RESult]?</code>	351
<code>FETCh:MACCuracy:MERRor:MAXimum[:RESult]?</code>	351
<code>FETCh:MACCuracy:MERRor:MINimum[:RESult]?</code>	351
<code>FETCh:MACCuracy:MERRor:CURRent[:RESult]?</code>	351
<code>FETCh:MACCuracy:PERRor:MAXimum[:RESult]?</code>	352
<code>FETCh:MACCuracy:PERRor:MINimum[:RESult]?</code>	352
<code>FETCh:MACCuracy:PERRor:CURRent[:RESult]?</code>	352
<code>FETCh:MACCuracy:POFFset[:RESult]?</code>	352
<code>FETCh:MACCuracy:QERRor:MAXimum[:RESult]?</code>	353
<code>FETCh:MACCuracy:QERRor:MINimum[:RESult]?</code>	353
<code>FETCh:MACCuracy:QERRor:CURRent[:RESult]?</code>	353
<code>FETCh:MACCuracy:REVM:MAXimum[:RESult]?</code>	353
<code>FETCh:MACCuracy:REVM:MINimum[:RESult]?</code>	353

FETCh:MACCuracy:REVM:CURRent[:RESult]?	353
FETCh:MACCuracy:RMEV:MAXimum[:RESult]?	353
FETCh:MACCuracy:RMEV:MINimum[:RESult]?	353
FETCh:MACCuracy:RMEV:CURRent[:RESult]?	353
FETCh:MACCuracy:SRERror:MAXimum[:RESult]?	354
FETCh:MACCuracy:SRERror:MINimum[:RESult]?	354
FETCh:MACCuracy:SRERror:CURRent[:RESult]?	354

FETCh:MACCuracy:ADRoop:MAXimum[:RESult]?

FETCh:MACCuracy:ADRoop:MINimum[:RESult]?

FETCh:MACCuracy:ADRoop:CURRent[:RESult]?

Return values:

<ADRoop>

Usage: Query only

Manual operation: See "[Amplitude Droop](#)" on page 34

FETCh:MACCuracy:FERRor:MAXimum[:RESult]?

FETCh:MACCuracy:FERRor:MINimum[:RESult]?

FETCh:MACCuracy:FERRor:CURRent[:RESult]?

This command queries the Frequency Error as shown in the Result Summary.

Return values:

<FrequencyError> <numeric value>

Minimum, maximum or current Frequency Error, depending on the command syntax.

Default unit: Hz

Example:

FETC:MACC:FERR:MAX?

would return, e.g.

1.2879

Usage: Query only

Manual operation: See "[Frequency Error](#)" on page 34

FETCh:MACCuracy:GIMBalance:MAXimum[:RESult]?

FETCh:MACCuracy:GIMBalance:MINimum[:RESult]?

FETCh:MACCuracy:GIMBalance:CURRent[:RESult]?

This command queries the Gain Imbalance as shown in the Result Summary.

Return values:

<GainImbalance> <numeric value>

Minimum, maximum or current Gain Imbalance, depending on the command syntax.

Default unit: dB

Example: FETC:MACC:GIMB:MIN?
would return, e.g.
0.887

Usage: Query only

Manual operation: See "[Gain Imbalance](#)" on page 34

FETCh:MACCuracy:IQIMbalance:MAXimum[:RESult]?
FETCh:MACCuracy:IQIMbalance:MINimum[:RESult]?
FETCh:MACCuracy:IQIMbalance:CURREnt[:RESult]?

This command queries the I/Q Imbalance as shown in the Result Summary.

Return values:

<IQImbalance> <numeric value>
Minimum, maximum or current I/Q Imbalance, depending on the command syntax.
Default unit: dB

Example: FETC:MACC:IQIM:CURRE?
would return, e.g.
0.02

Usage: Query only

Manual operation: See "[I/Q Imbalance](#)" on page 34

FETCh:MACCuracy:IQOOffset:MAXimum[:RESult]?
FETCh:MACCuracy:IQOOffset:MINimum[:RESult]?
FETCh:MACCuracy:IQOOffset:CURREnt[:RESult]?

This command queries the I/Q Offset as shown in the Result Summary.

Return values:

<IQOffset> <numeric value>
Minimum, maximum or current I/Q Offset, depending on the command syntax.
Default unit: dB

Example: FETC:MACC:IQOF:MIN?
would return, e.g.
0.001

Usage: Query only

Manual operation: See "[I/Q Offset](#)" on page 35

FETCh:MACCuracy:MERRor:MAXimum[:RESult]?
FETCh:MACCuracy:MERRor:MINimum[:RESult]?
FETCh:MACCuracy:MERRor:CURREnt[:RESult]?

This command queries the Magnitude Error as shown in the Result Summary.

Return values:

<Magnitude> <numeric value>

Minimum, maximum or current Magnitude Error, depending on the command syntax.

Default unit: %

Example:

FETC:MACC:MERR:MAX?

would return, e.g.

1.12

Usage:

Query only

Manual operation: See "[Magnitude Error](#)" on page 35

FETCh:MACCuracy:PERRor:MAXimum[:RESult]?

FETCh:MACCuracy:PERRor:MINimum[:RESult]?

FETCh:MACCuracy:PERRor:CURRent[:RESult]?

This command queries the Phase Error as shown in the Result Summary.

Return values:

<PhaseError> <numeric value>

Minimum, maximum or current Phase Error, depending on the command syntax.

Default unit: degree

Example:

FETC:MACC:PERR:CURR?

would return, e.g.

1.84

Usage:

Query only

Manual operation: See "[Phase Error](#)" on page 35

FETCh:MACCuracy:POFFset[:RESult]?

Queries the absolute phase value between reference signal and measured signal.

Note that the absolute phase is not relevant for FSW-K18 measurements.

However, it can be used to track the absolute phase stability between generator and analyzer (including their local oscillators).

Return values:

<Phase Offset> Numeric value

Default unit: radian

Example:

FETC:MACC:POFF:RES?

Returns the phase offset in radians.

Usage:

Query only

FETCh:MACCuracy:QERRor:MAXimum[:RESult]?

FETCh:MACCuracy:QERRor:MINimum[:RESult]?

FETCh:MACCuracy:QERRor:CURRent[:RESult]?

This command queries the Quadrature Error as shown in the Result Summary.

Return values:

<QuadratureError> <numeric value>
 Minimum, maximum or current Quadrature Error, depending on the command syntax.
 Default unit: degree

Example: FETC:MACC:QERR:MAX?
 would return, e.g.
 2.76

Usage: Query only

Manual operation: See "[Quadrature Error](#)" on page 36

FETCh:MACCuracy:REVM:MAXimum[:RESult]?

FETCh:MACCuracy:REVM:MINimum[:RESult]?

FETCh:MACCuracy:REVM:CURRent[:RESult]?

This command queries the "Raw EVM" as shown in the Result Summary.

Return values:

<EVM> <numeric value>
 Minimum, maximum or current "Raw EVM", depending on the command syntax.
 Default unit: %

Example: FETC:MACC:REVM:MAX?
 would return, e.g.
 3.606

Usage: Query only

Manual operation: See "[Raw EVM](#)" on page 37

FETCh:MACCuracy:RMEV:MAXimum[:RESult]?

FETCh:MACCuracy:RMEV:MINimum[:RESult]?

FETCh:MACCuracy:RMEV:CURRent[:RESult]?

This command queries the Raw Model EVM as shown in the Result Summary.

Return values:

<EVM> <numeric value>
 Minimum, maximum or current Raw Model EVM, depending on the command syntax.
 Default unit: %

Example: FETC:MACC:RMEV:CURR?
would return, e.g.
0.879

Usage: Query only

Manual operation: See "[Raw Model EVM](#)" on page 37

FETCh:MACCuracy:SRERror:MAXimum[:RESult]?

FETCh:MACCuracy:SRERror:MINimum[:RESult]?

FETCh:MACCuracy:SRERror:CURRent[:RESult]?

This command queries the Sample Rate Error as shown in the Result Summary.

Return values:

<SampleRateError> <numeric value>

Minimum, maximum or current SampleRateError, depending on the command syntax.

Default unit: Hz

Example: FETC:MACC:SRER:CURR?
would return, e.g.
-0.023

Usage: Query only

Manual operation: See "[Sample Rate Error](#)" on page 37

Retrieving power results

FETCh:AMAM:CWIDth:MAXimum[:RESult]?	355
FETCh:AMAM:CWIDth:MINimum[:RESult]?	355
FETCh:AMAM:CWIDth:CURRent[:RESult]?	355
FETCh:AMPM:CWIDth:MAXimum[:RESult]?	356
FETCh:AMPM:CWIDth:MINimum[:RESult]?	356
FETCh:AMPM:CWIDth:CURRent[:RESult]?	356
FETCh:AMPM:PEAK:CWIDth:MAXimum[:RESult]?	356
FETCh:AMPM:PEAK:CWIDth:MINimum[:RESult]?	356
FETCh:AMPM:PEAK:CWIDth:CURRent[:RESult]?	356
FETCh:AMAM:PEAK:CWIDth:MAXimum[:RESult]?	357
FETCh:AMAM:PEAK:CWIDth:MINimum[:RESult]?	357
FETCh:AMAM:PEAK:CWIDth:CURRent[:RESult]?	357
FETCh:PC:CURRent[:RESult]?	357
FETCh:PCPA:CURRent[:RESult]?	357
FETCh:POWer:CFACtor:IN:MAXimum[:RESult]?	357
FETCh:POWer:CFACtor:IN:MINimum[:RESult]?	357
FETCh:POWer:CFACtor:IN:CURRent[:RESult]?	357
FETCh:POWer:CFACtor:OUT:MAXimum[:RESult]?	358
FETCh:POWer:CFACtor:OUT:MINimum[:RESult]?	358
FETCh:POWer:CFACtor:OUT:CURRent[:RESult]?	358
FETCh:POWer:GAIN:MAXimum[:RESult]?	358
FETCh:POWer:GAIN:MINimum[:RESult]?	358

FETCh:POWer:GAIN:CURRent[:RESult]?	358
FETCh:POWer:INPut:MAXimum[:RESult]?	358
FETCh:POWer:INPut:MINimum[:RESult]?	358
FETCh:POWer:INPut:CURRent[:RESult]?	358
FETCh:POWer:OBW:MAXimum[:RESult]?	359
FETCh:POWer:OBW:MINimum[:RESult]?	359
FETCh:POWer:OBW:CURRent[:RESult]?	359
FETCh:POWer:OUTPut:MAXimum[:RESult]?	359
FETCh:POWer:OUTPut:MINimum[:RESult]?	359
FETCh:POWer:OUTPut:CURRent[:RESult]?	359
FETCh:POWer:OUTPut:P1DB:MAXimum[:RESult]?	359
FETCh:POWer:OUTPut:P1DB:MINimum[:RESult]?	359
FETCh:POWer:OUTPut:P2DB:MAXimum[:RESult]?	359
FETCh:POWer:OUTPut:P2DB:MINimum[:RESult]?	359
FETCh:POWer:OUTPut:P3DB:MAXimum[:RESult]?	360
FETCh:POWer:OUTPut:P3DB:MINimum[:RESult]?	360
FETCh:POWer:P1DB:MAXimum[:RESult]?	360
FETCh:POWer:P1DB:MINimum[:RESult]?	360
FETCh:POWer:P1DB:CURRent[:RESult]?	360
FETCh:POWer:P2DB:MAXimum[:RESult]?	360
FETCh:POWer:P2DB:MINimum[:RESult]?	360
FETCh:POWer:P2DB:CURRent[:RESult]?	360
FETCh:POWer:P3DB:MAXimum[:RESult]?	360
FETCh:POWer:P3DB:MINimum[:RESult]?	360
FETCh:POWer:P3DB:CURRent[:RESult]?	360
FETCh:POWer:P1DB:OUT:MAXimum[:RESult]?	360
FETCh:POWer:P1DB:OUT:MINimum[:RESult]?	360
FETCh:POWer:P1DB:OUT:CURRent[:RESult]?	360
FETCh:POWer:P2DB:OUT:MAXimum[:RESult]?	360
FETCh:POWer:P2DB:OUT:MINimum[:RESult]?	360
FETCh:POWer:P2DB:OUT:CURRent[:RESult]?	360
FETCh:POWer:P3DB:OUT:MAXimum[:RESult]?	360
FETCh:POWer:P3DB:OUT:MINimum[:RESult]?	360
FETCh:POWer:P3DB:OUT:CURRent[:RESult]?	360
FETCh:POWer:SENSor:IN:MAXimum[:RESult]?	361
FETCh:POWer:SENSor:IN:MINimum[:RESult]?	361
FETCh:POWer:SENSor:IN:CURRent[:RESult]?	361
FETCh:POWer:SENSor:OUT:MAXimum[:RESult]?	361
FETCh:POWer:SENSor:OUT:MINimum[:RESult]?	361
FETCh:POWer:SENSor:OUT:CURRent[:RESult]?	361

FETCh:AMAM:CWIDth:MAXimum[:RESult]?

FETCh:AMAM:CWIDth:MINimum[:RESult]?

FETCh:AMAM:CWIDth:CURRent[:RESult]?

This command queries the "AM/AM" Curve Width as shown in the Result Summary.

Return values:

<CurveWidth> <numeric value>
 Current "AM/AM" Curve Width.
 Default unit: V

Example:

FETC:AMAM:CWID:CURR?
 would return, e.g.
 0.69

Usage: Query only

Manual operation: See ["AM/AM Curve Width"](#) on page 38

FETCh:AMPM:CWIDth:MAXimum[:RESult]?

FETCh:AMPM:CWIDth:MINimum[:RESult]?

FETCh:AMPM:CWIDth:CURRent[:RESult]?

This command queries the "AM/PM" Curve Width as shown in the Result Summary.

Return values:

<CurveWidth> <numeric value>
 Current "AM/PM" Curve Width.
 Default unit: degree

Example:

FETC:AMPM:CWID:CURR?
 would return, e.g.
 1.441

Usage: Query only

Manual operation: See ["AM/PM Curve Width"](#) on page 39

FETCh:AMPM:PEAK:CWIDth:MAXimum[:RESult]?

FETCh:AMPM:PEAK:CWIDth:MINimum[:RESult]?

FETCh:AMPM:PEAK:CWIDth:CURRent[:RESult]?

This command queries the "AM/PM" peak curve width as shown in the result summary.

Return values:

<CurveWidth> <numeric value>
 Current "AM/PM" peak curve width.
 Default unit: °

Example:

FETC:AMPM:PEAK:CWID:CURR:RES?

Usage: Query only

Manual operation: See ["AM/PM Curve Width \(Pk-Pk\)"](#) on page 40

FETCh:AMAM:PEAK:CWIDTH:MAXimum[:RESult]?
FETCh:AMAM:PEAK:CWIDTH:MINimum[:RESult]?
FETCh:AMAM:PEAK:CWIDTH:CURRent[:RESult]?

This command queries the "AM/AM" peak curve width as shown in the result summary.

Return values:

<CurveWidth> <numeric value>
 Current "AM/AM" peak curve width.
 Default unit: dB

Example: FETC:AMAM:PEAK:CWID:CURR:RES?

Usage: Query only

Manual operation: See "[AM/AM Curve Width \(Pk-Pk\)](#)" on page 39

FETCh:PC:CURRent[:RESult]?
Return values:

<Current>

Usage: Query only

FETCh:PCPA:CURRent[:RESult]?
Return values:

<Current>

Usage: Query only

FETCh:POWER:CFACTOR:IN:MAXimum[:RESult]?
FETCh:POWER:CFACTOR:IN:MINimum[:RESult]?
FETCh:POWER:CFACTOR:IN:CURRent[:RESult]?

This command queries the Crest Factor at the DUT input as shown in the Result Summary.

Return values:

<CrestFactor> <numeric value>
 Current Crest Factor.
 Default unit: dB

Example: FETC:POW:CFAC:IN:CURR?
 would return, e.g.
 10.34

Usage: Query only

Manual operation: See "[Crest Factor In](#)" on page 41

FETCh:POWer:CFACtor:OUT:MAXimum[:RESult]?**FETCh:POWer:CFACtor:OUT:MINimum[:RESult]?****FETCh:POWer:CFACtor:OUT:CURRent[:RESult]?**

This command queries the Crest Factor at the DUT output as shown in the Result Summary.

Return values:

<CrestFactor> <numeric value>
Current Crest Factor.
Default unit: dB

Example: FETC:POW:CFAC:CURR?
would return, e.g.
8.72

Usage: Query only

Manual operation: See "[Crest Factor Out](#)" on page 41

FETCh:POWer:GAIN:MAXimum[:RESult]?**FETCh:POWer:GAIN:MINimum[:RESult]?****FETCh:POWer:GAIN:CURRent[:RESult]?**

This command queries the signal gain as shown in the Result Summary.

Return values:

<Gain> <numeric value>
Minimum, maximum or current gain, depending on the command syntax.
Default unit: dB

Example: FETC:POW:GAIN:MAX?
would return, e.g.
21.37

Usage: Query only

Manual operation: See "[Gain](#)" on page 41

FETCh:POWer:INPut:MAXimum[:RESult]?**FETCh:POWer:INPut:MINimum[:RESult]?****FETCh:POWer:INPut:CURRent[:RESult]?**

This command queries the power at the DUT input as shown in the Result Summary.

Return values:

<Power> <numeric value>
Minimum, maximum or current power, depending on the command syntax.
Default unit: dBm

Example: FETC:POW:INP:MIN?
would return, e.g.
9.39

Usage: Query only

Manual operation: See "Power In" on page 42

FETCh:POWer:OBW:MAXimum[:RESult]?

FETCh:POWer:OBW:MINimum[:RESult]?

FETCh:POWer:OBW:CURRent[:RESult]?

Return values:

<Level>

Usage: Query only

Manual operation: See "Occupied Bandwidth" on page 42

FETCh:POWer:OUTPut:MAXimum[:RESult]?

FETCh:POWer:OUTPut:MINimum[:RESult]?

FETCh:POWer:OUTPut:CURRent[:RESult]?

This command queries the signal power at the DUT output as shown in the Result Summary.

Return values:

<Power> <numeric value>

Minimum, maximum or current power, depending on the command syntax.

Default unit: dBm

Example: FETC:POW:OUTP:MIN?
would return, e.g.
7.198

Usage: Query only

Manual operation: See "Power Out" on page 42

FETCh:POWer:OUTPut:P1DB:MAXimum[:RESult]?

FETCh:POWer:OUTPut:P1DB:MINimum[:RESult]?

Return values:

<Level>

Usage: Query only

FETCh:POWer:OUTPut:P2DB:MAXimum[:RESult]?

FETCh:POWer:OUTPut:P2DB:MINimum[:RESult]?

Return values:

<Level>

Usage: Query only

FETCh:POWer:OUTPut:P3DB:MAXimum[:RESult]?

FETCh:POWer:OUTPut:P3DB:MINimum[:RESult]?

Return values:

<Level>

Usage: Query only

FETCh:POWer:P1DB:MAXimum[:RESult]?

FETCh:POWer:P1DB:MINimum[:RESult]?

FETCh:POWer:P1DB:CURRent[:RESult]?

FETCh:POWer:P2DB:MAXimum[:RESult]?

FETCh:POWer:P2DB:MINimum[:RESult]?

FETCh:POWer:P2DB:CURRent[:RESult]?

FETCh:POWer:P3DB:MAXimum[:RESult]?

FETCh:POWer:P3DB:MINimum[:RESult]?

FETCh:POWer:P3DB:CURRent[:RESult]?

This command queries the 3 dB Compression Point as shown in the Result Summary.

Return values:

<Level> <numeric value>

Current 3 dB Compression Point.

Default unit: dBm

Example: FETC:POW:P3DB:CURR?
would return, e.g.
2.551

Usage: Query only

Manual operation: See "[Compression Point \(1 dB / 2 dB / 3 dB\)](#)" on page 40

FETCh:POWer:P1DB:OUT:MAXimum[:RESult]?

FETCh:POWer:P1DB:OUT:MINimum[:RESult]?

FETCh:POWer:P1DB:OUT:CURRent[:RESult]?

FETCh:POWer:P2DB:OUT:MAXimum[:RESult]?

FETCh:POWer:P2DB:OUT:MINimum[:RESult]?

FETCh:POWer:P2DB:OUT:CURRent[:RESult]?

FETCh:POWer:P3DB:OUT:MAXimum[:RESult]?

FETCh:POWer:P3DB:OUT:MINimum[:RESult]?

FETCh:POWer:P3DB:OUT:CURRent[:RESult]?

This command queries the output 3 dB Compression Point as shown in the Result Summary.

Return values:

<Level> <numeric value>
 Current output 3 dB Compression Point.
 Default unit: dBm

Example:

FETC:POW:OUTP:P3DB:CURR?
 would return, e.g.
 -5.782

Usage: Query only

Manual operation: See "Output Compression Point (1 dB / 2 dB / 3 dB)" on page 42

FETCh:POWer:SENSor:IN:MAXimum[:RESult]?

FETCh:POWer:SENSor:IN:MINimum[:RESult]?

FETCh:POWer:SENSor:IN:CURRent[:RESult]?

Fetches the signal power at the input power sensor.

Return values:

<Power> <numeric value>

Example:

FETC:POW:SENS:IN:CURR:RES?

Usage: Query only

FETCh:POWer:SENSor:OUT:MAXimum[:RESult]?

FETCh:POWer:SENSor:OUT:MINimum[:RESult]?

FETCh:POWer:SENSor:OUT:CURRent[:RESult]?

Fetches the signal power at the output power sensor.

Return values:

<Power> <numeric value>

Example:

FETC:POW:SENS:OUT:CURR:RES?

Usage: Query only

Manual operation: See "Power Out (Sensor)" on page 42

Retrieving baseband characteristics

FETCh:APAE:MAXimum[:RESult]?	362
FETCh:APAE:MINimum[:RESult]?	362
FETCh:APAE:CURRent[:RESult]?	362
FETCh:BBPower:MAXimum[:RESult]?	362
FETCh:BBPower:MINimum[:RESult]?	362
FETCh:BBPower:CURRent[:RESult]?	362
FETCh:ICC:MAXimum[:RESult]?	363
FETCh:ICC:MINimum[:RESult]?	363
FETCh:ICC:CURRent[:RESult]?	363
FETCh:IVOLtage:PURE:MAXimum[:RESult]?	363
FETCh:IVOLtage:PURE:MINimum[:RESult]?	363

FETCh:IVOLtage:PURE:CURRent[:RESult]?	363
FETCh:QVOLtage:PURE:MAXimum[:RESult]?	363
FETCh:QVOLtage:PURE:MINimum[:RESult]?	363
FETCh:QVOLtage:PURE:CURRent[:RESult]?	363
FETCh:VCC:MAXimum[:RESult]?	364
FETCh:VCC:MINimum[:RESult]?	364
FETCh:VCC:CURRent[:RESult]?	364

FETCh:APAE:MAXimum[:RESult]?**FETCh:APAE:MINimum[:RESult]?****FETCh:APAE:CURRent[:RESult]?**

This command queries the Average PAE (Power Added Efficiency) as shown in the Result Summary.

Return values:

<PAE> <numeric value>
 Minimum, maximum or current Average PAE, depending on the command syntax.
 Default unit: %

Example: FETCh:APAE:CURR?
 would return, e.g.
 1.231

Usage: Query only

Manual operation: See "[Average PAE](#)" on page 44

FETCh:BBPower:MAXimum[:RESult]?**FETCh:BBPower:MINimum[:RESult]?****FETCh:BBPower:CURRent[:RESult]?**

This command queries the measured baseband power ($I_{cc} * V_{cc}$) as shown in the Result Summary.

Return values:

<Power> <numeric value>
 Minimum, maximum or current power, depending on the command syntax.
 Default unit: W

Example: FETCh:BBP:CURR?
 would return, e.g.
 0.75

Usage: Query only

Manual operation: See "[Power](#)" on page 44

FETCh:ICc:MAXimum[:RESult]?
FETCh:ICc:MINimum[:RESult]?
FETCh:ICc:CURRent[:RESult]?

This command queries the measured baseband current (I_{cc}) as shown in the Result Summary.

Return values:

<Current> Minimum, maximum or current I_{cc} , depending on the command syntax.

Default unit: A

Example:

FETC:ICc:MAX?

would return, e.g.

2.63

Usage:

Query only

Manual operation: See "[Current](#)" on page 44

FETCh:IVOLtage:PURE:MAXimum[:RESult]?
FETCh:IVOLtage:PURE:MINimum[:RESult]?
FETCh:IVOLtage:PURE:CURRent[:RESult]?

This command queries the voltage measured at the baseband input I as shown in the Result Summary.

The returned value is a "pure" voltage that does not contain any correction factors.

Return values:

<Voltage> <numeric value>

Minimum, maximum or current voltage, depending on the command syntax.

Default unit: V

Example:

FETC:IVOL:PURE:CURR?

would return, e.g.

1.4

Usage:

Query only

Manual operation: See "[Baseband Input Voltage I](#)" on page 43

FETCh:QVOLTage:PURE:MAXimum[:RESult]?
FETCh:QVOLTage:PURE:MINimum[:RESult]?
FETCh:QVOLTage:PURE:CURRent[:RESult]?

This command queries the measured at the baseband input Q as shown in the Result Summary.

The returned value is a "pure" voltage that does not contain any correction factors.

Return values:

<Voltage> <numeric value>
 Minimum, maximum or current voltage, depending on the command syntax.
 Default unit: V

Example:

FETC:IVOL:PURE:CURREN?
 would return, e.g.
 1.42

Usage:

Query only

Manual operation: See "[Baseband Input Voltage Q](#)" on page 43

FETCh:VCC:MAXimum[:RESult]?

FETCh:VCC:MINimum[:RESult]?

FETCh:VCC:CURRENt[:RESult]?

This command queries the measured baseband voltage (V_{cc}) as shown in the Result Summary.

Return values:

<Current> Minimum, maximum or current voltage, depending on the command syntax.
 Default unit: V

Example:

FETC:VCC:CURREN?
 would return, e.g.
 0.4

Usage:

Query only

Manual operation: See "[Voltage](#)" on page 43

5.8.2.3 Retrieving results of the parameter sweep table

Retrieving the results in the "Parameter Sweep" table requires six commands for every result type.

Example command set to query the EVM results:

- FETCh:PTABLE:EVM:MAXimum[:RESult] queries the highest EVM that has been measured.
- FETCh:PTABLE:EVM:MAXimum:X[:RESult] queries the location on the x-axis where the highest EVM has been measured.
- FETCh:PTABLE:EVM:MAXimum:Y[:RESult] queries the location on the y-axis where the highest EVM has been measured.
- FETCh:PTABLE:EVM:MINimum[:RESult] queries the lowest EVM that has been measured.
- FETCh:PTABLE:EVM:MINimum:X[:RESult] queries the location on the x-axis where the lowest EVM has been measured.

- `FETCh:PTABle:EVM:MINimum:Y[:RESult]` queries the location on the y-axis where the lowest EVM has been measured.

The type and unit of the value queried on the x- and y-axes depends on the selected parameter.

<code>FETCh:PTABle[:RESult]:ALL?</code>	367
<code>FETCh:PTABle:ACP:ACHannel<ch>:BALanced:MAXimum:X[:RESult]?</code>	367
<code>FETCh:PTABle:ACP:ACHannel<ch>:BALanced:MAXimum:X[:RESult]?</code>	367
<code>FETCh:PTABle:ACP:MAXimum:X[:RESult]?</code>	367
<code>FETCh:PTABle:ACP:ACHannel<ch>:LOWer:MAXimum:X[:RESult]?</code>	367
<code>FETCh:PTABle:ACP:ACHannel<ch>:UPPer:MAXimum:X[:RESult]?</code>	367
<code>FETCh:PTABle:AMAM:CWIDth:MAXimum:X[:RESult]?</code>	367
<code>FETCh:PTABle:AMPM:CWIDth:MAXimum:X[:RESult]?</code>	367
<code>FETCh:PTABle:BBPower:MAXimum:X[:RESult]?</code>	367
<code>FETCh:PTABle:CFACtor:MAXimum:X[:RESult]?</code>	367
<code>FETCh:PTABle:EVM:MAXimum:X[:RESult]?</code>	367
<code>FETCh:PTABle:ICC:MAXimum:X[:RESult]?</code>	368
<code>FETCh:PTABle:GAIN:MAXimum:X[:RESult]?</code>	368
<code>FETCh:PTABle:PAE:MAXimum:X[:RESult]?</code>	368
<code>FETCh:PTABle:P1DB:MAXimum:X[:RESult]?</code>	368
<code>FETCh:PTABle:P2DB:MAXimum:X[:RESult]?</code>	368
<code>FETCh:PTABle:P3DB:MAXimum:X[:RESult]?</code>	368
<code>FETCh:PTABle:POUT:MAXimum:X[:RESult]?</code>	368
<code>FETCh:PTABle:RMS:MAXimum:X[:RESult]?</code>	368
<code>FETCh:PTABle:VCC:MAXimum:X[:RESult]?</code>	368
<code>FETCh:PTABle:ACP:ACHannel<ch>:BALanced:MAXimum:Y[:RESult]?</code>	368
<code>FETCh:PTABle:ACP:ACHannel<ch>:BALanced:MAXimum:Y[:RESult]?</code>	368
<code>FETCh:PTABle:ACP:MAXimum:Y[:RESult]?</code>	368
<code>FETCh:PTABle:ACP:ACHannel<ch>:LOWer:MAXimum:Y[:RESult]?</code>	368
<code>FETCh:PTABle:ACP:ACHannel<ch>:UPPer:MAXimum:Y[:RESult]?</code>	368
<code>FETCh:PTABle:AMAM:CWIDth:MAXimum:Y[:RESult]?</code>	368
<code>FETCh:PTABle:AMPM:CWIDth:MAXimum:Y[:RESult]?</code>	368
<code>FETCh:PTABle:BBPower:MAXimum:Y[:RESult]?</code>	368
<code>FETCh:PTABle:CFACtor:MAXimum:Y[:RESult]?</code>	368
<code>FETCh:PTABle:EVM:MAXimum:Y[:RESult]?</code>	368
<code>FETCh:PTABle:ICC:MAXimum:Y[:RESult]?</code>	368
<code>FETCh:PTABle:GAIN:MAXimum:Y[:RESult]?</code>	368
<code>FETCh:PTABle:PAE:MAXimum:Y[:RESult]?</code>	368
<code>FETCh:PTABle:P1DB:MAXimum:Y[:RESult]?</code>	368
<code>FETCh:PTABle:P2DB:MAXimum:Y[:RESult]?</code>	368
<code>FETCh:PTABle:P3DB:MAXimum:Y[:RESult]?</code>	368
<code>FETCh:PTABle:POUT:MAXimum:Y[:RESult]?</code>	368
<code>FETCh:PTABle:RMS:MAXimum:Y[:RESult]?</code>	368
<code>FETCh:PTABle:VCC:MAXimum:Y[:RESult]?</code>	368
<code>FETCh:PTABle:ACP:ACHannel<ch>:BALanced:MAXimum[:RESult]?</code>	369
<code>FETCh:PTABle:ACP:ACHannel<ch>:BALanced:MAXimum[:RESult]?</code>	369
<code>FETCh:PTABle:ACP:MAXimum[:RESult]?</code>	369
<code>FETCh:PTABle:ACP:ACHannel<ch>:LOWer:MAXimum[:RESult]?</code>	369
<code>FETCh:PTABle:ACP:ACHannel<ch>:UPPer:MAXimum[:RESult]?</code>	369
<code>FETCh:PTABle:AMAM:CWIDth:MAXimum[:RESult]?</code>	369

FETCh:PTABle:AMPM:CWIDth:MAXimum[:RESult]?	369
FETCh:PTABle:BBPower:MAXimum[:RESult]?	369
FETCh:PTABle:CFACtor:MAXimum[:RESult]?	369
FETCh:PTABle:EVM:MAXimum[:RESult]?	369
FETCh:PTABle:GAIN:MAXimum[:RESult]?	369
FETCh:PTABle:ICC:MAXimum[:RESult]?	369
FETCh:PTABle:PAE:MAXimum[:RESult]?	369
FETCh:PTABle:P1DB:MAXimum[:RESult]?	369
FETCh:PTABle:P2DB:MAXimum[:RESult]?	369
FETCh:PTABle:P3DB:MAXimum[:RESult]?	369
FETCh:PTABle:POUT:MAXimum[:RESult]?	369
FETCh:PTABle:RMS:MAXimum[:RESult]?	369
FETCh:PTABle:VCC:MAXimum[:RESult]?	369
FETCh:PTABle:ACP:ACHannel<ch>:BALanced:MINimum:X[:RESult]?	369
FETCh:PTABle:ACP:ACHannel<ch>:LOWer:MINimum:X[:RESult]?	369
FETCh:PTABle:ACP:ACHannel<ch>:UPPer:MINimum:X[:RESult]?	369
FETCh:PTABle:ACP:BALanced:MINimum:X[:RESult]?	369
FETCh:PTABle:ACP:MINimum:X[:RESult]?	369
FETCh:PTABle:AMAM:CWIDth:MINimum:X[:RESult]?	369
FETCh:PTABle:AMPM:CWIDth:MINimum:X[:RESult]?	369
FETCh:PTABle:BBPower:MINimum:X[:RESult]?	369
FETCh:PTABle:CFACtor:MINimum:X[:RESult]?	369
FETCh:PTABle:EVM:MINimum:X[:RESult]?	369
FETCh:PTABle:GAIN:MINimum:X[:RESult]?	369
FETCh:PTABle:ICC:MINimum:X[:RESult]?	369
FETCh:PTABle:PAE:MINimum:X[:RESult]?	369
FETCh:PTABle:P1DB:MINimum:X[:RESult]?	369
FETCh:PTABle:P2DB:MINimum:X[:RESult]?	370
FETCh:PTABle:P3DB:MINimum:X[:RESult]?	370
FETCh:PTABle:POUT:MINimum:X[:RESult]?	370
FETCh:PTABle:RMS:MINimum:X[:RESult]?	370
FETCh:PTABle:VCC:MINimum:X[:RESult]?	370
FETCh:PTABle:ACP:ACHannel<ch>:BALanced:MINimum:Y[:RESult]?	370
FETCh:PTABle:ACP:ACHannel<ch>:LOWer:MINimum:Y[:RESult]?	370
FETCh:PTABle:ACP:ACHannel<ch>:UPPer:MINimum:Y[:RESult]?	370
FETCh:PTABle:ACP:BALanced:MINimum:Y[:RESult]?	370
FETCh:PTABle:ACP:MINimum:Y[:RESult]?	370
FETCh:PTABle:AMAM:CWIDth:MINimum:Y[:RESult]?	370
FETCh:PTABle:AMPM:CWIDth:MINimum:Y[:RESult]?	370
FETCh:PTABle:BBPower:MINimum:Y[:RESult]?	370
FETCh:PTABle:CFACtor:MINimum:Y[:RESult]?	370
FETCh:PTABle:EVM:MINimum:Y[:RESult]?	370
FETCh:PTABle:GAIN:MINimum:Y[:RESult]?	370
FETCh:PTABle:ICC:MINimum:Y[:RESult]?	370
FETCh:PTABle:PAE:MINimum:Y[:RESult]?	370
FETCh:PTABle:P1DB:MINimum:Y[:RESult]?	370
FETCh:PTABle:P2DB:MINimum:Y[:RESult]?	370
FETCh:PTABle:P3DB:MINimum:Y[:RESult]?	370
FETCh:PTABle:POUT:MINimum:Y[:RESult]?	370
FETCh:PTABle:RMS:MINimum:Y[:RESult]?	370

FETCh:PTABle:VCC:MINimum:Y[:RESult]?	370
FETCh:PTABle:ACP:ACHannel<ch>:BALanced:MINimum[:RESult]?	371
FETCh:PTABle:ACP:ACHannel<ch>:LOWer:MINimum[:RESult]?	371
FETCh:PTABle:ACP:ACHannel<ch>:UPPer:MINimum[:RESult]?	371
FETCh:PTABle:ACP:BALanced:MINimum[:RESult]?	371
FETCh:PTABle:ACP:MINimum[:RESult]?	371
FETCh:PTABle:AMAM:CWIDth:MINimum[:RESult]?	371
FETCh:PTABle:AMPM:CWIDth:MINimum[:RESult]?	371
FETCh:PTABle:BBPower:MINimum[:RESult]?	371
FETCh:PTABle:CFACtor:MINimum[:RESult]?	371
FETCh:PTABle:EVM:MINimum[:RESult]?	371
FETCh:PTABle:GAIN:MINimum[:RESult]?	371
FETCh:PTABle:ICC:MINimum[:RESult]?	371
FETCh:PTABle:PAE:MINimum[:RESult]?	371
FETCh:PTABle:P1DB:MINimum[:RESult]?	371
FETCh:PTABle:P2DB:MINimum[:RESult]?	371
FETCh:PTABle:P3DB:MINimum[:RESult]?	371
FETCh:PTABle:POUT:MINimum[:RESult]?	371
FETCh:PTABle:RMS:MINimum[:RESult]?	371
FETCh:PTABle:VCC:MINimum[:RESult]?	371

FETCh:PTABle[:RESult]:ALL?

This command queries all numerical results shown in the "Parameter Sweep" Table.

Return values:

<Results> <numeric value>: Results as a comma separated list.
 <EVMMinValue>, <EVMMinX>, <EVMMinY>,
 <ACPMInCalue>, <ACPMInX>, <ACPMInY>, ...
 The unit depends on the result and parameters assigned to the
 x- and y-axis.
 If a result hasn't been calculated, the command returns NAN.

Example:

```
FETC:PTAB:ALL?
//Result:
0.244445,1e+007,-30,0.246109,2e+007,-30,
-21.9096,...
```

Usage: Query only

```
FETCh:PTABle:ACP:ACHannel<ch>:BALanced:MAXimum:X[:RESult]?
FETCh:PTABle:ACP:BALanced:MAXimum:X[:RESult]?
FETCh:PTABle:ACP:MAXimum:X[:RESult]?
FETCh:PTABle:ACP:ACHannel<ch>:LOWer:MAXimum:X[:RESult]?
FETCh:PTABle:ACP:ACHannel<ch>:UPPer:MAXimum:X[:RESult]?
FETCh:PTABle:AMAM:CWIDth:MAXimum:X[:RESult]?
FETCh:PTABle:AMPM:CWIDth:MAXimum:X[:RESult]?
FETCh:PTABle:BBPower:MAXimum:X[:RESult]?
FETCh:PTABle:CFACtor:MAXimum:X[:RESult]?
FETCh:PTABle:EVM:MAXimum:X[:RESult]?
```

FETCh:PTABle:ICC:MAXimum:X[:RESult]?
 FETCh:PTABle:GAIN:MAXimum:X[:RESult]?
 FETCh:PTABle:PAE:MAXimum:X[:RESult]?
 FETCh:PTABle:P1DB:MAXimum:X[:RESult]?
 FETCh:PTABle:P2DB:MAXimum:X[:RESult]?
 FETCh:PTABle:P3DB:MAXimum:X[:RESult]?
 FETCh:PTABle:POUT:MAXimum:X[:RESult]?
 FETCh:PTABle:RMS:MAXimum:X[:RESult]?
 FETCh:PTABle:VCC:MAXimum:X[:RESult]?

These commands query the x-axis value at which the maximum result value for the parameter was determined, as shown in the "Parameter Sweep" table.

For details on the parameters, see [Chapter 2.2, "Amplifier parameters"](#), on page 33.

Return values:

<Results> <numeric value>
 The value depends on the parameter selected for the x-axis (see [CONFigure:PSweep:X:SETTing](#) on page 305).

Example: FETC:PTAB:VCC:MAX:X:RES?

Usage: Query only

FETCh:PTABle:ACP:ACHannel<ch>:BALanced:MAXimum:Y[:RESult]?
 FETCh:PTABle:ACP:BALanced:MAXimum:Y[:RESult]?
 FETCh:PTABle:ACP:MAXimum:Y[:RESult]?
 FETCh:PTABle:ACP:ACHannel<ch>:LOWer:MAXimum:Y[:RESult]?
 FETCh:PTABle:ACP:ACHannel<ch>:UPPer:MAXimum:Y[:RESult]?
 FETCh:PTABle:AMAM:CWIDth:MAXimum:Y[:RESult]?
 FETCh:PTABle:AMPM:CWIDth:MAXimum:Y[:RESult]?
 FETCh:PTABle:BBPower:MAXimum:Y[:RESult]?
 FETCh:PTABle:CFACTOR:MAXimum:Y[:RESult]?
 FETCh:PTABle:EVM:MAXimum:Y[:RESult]?
 FETCh:PTABle:ICC:MAXimum:Y[:RESult]?
 FETCh:PTABle:GAIN:MAXimum:Y[:RESult]?
 FETCh:PTABle:PAE:MAXimum:Y[:RESult]?
 FETCh:PTABle:P1DB:MAXimum:Y[:RESult]?
 FETCh:PTABle:P2DB:MAXimum:Y[:RESult]?
 FETCh:PTABle:P3DB:MAXimum:Y[:RESult]?
 FETCh:PTABle:POUT:MAXimum:Y[:RESult]?
 FETCh:PTABle:RMS:MAXimum:Y[:RESult]?
 FETCh:PTABle:VCC:MAXimum:Y[:RESult]?

These commands query the y-axis value at which the maximum result value for the parameter was determined, as shown in the "Parameter Sweep" table.

For details on the parameters, see [Chapter 2.2, "Amplifier parameters"](#), on page 33.

Return values:

<Results> <numeric value>
 The value depends on the parameter selected for the y-axis (see [CONFigure:PSweep:Y:SETTing](#) on page 306).

Example: `FETC:PTAB:VCC:MAX:Y:RES?`

Usage: Query only

FETCh:PTABle:ACP:ACHannel<ch>:BALanced:MAXimum[:RESult]?
FETCh:PTABle:ACP:ACHannel<ch>:LOWer:MAXimum[:RESult]?
FETCh:PTABle:ACP:ACHannel<ch>:UPPer:MAXimum[:RESult]?
FETCh:PTABle:ACP:MAXimum[:RESult]?
FETCh:PTABle:AMAM:CWIDth:MAXimum[:RESult]?
FETCh:PTABle:AMPM:CWIDth:MAXimum[:RESult]?
FETCh:PTABle:BBPower:MAXimum[:RESult]?
FETCh:PTABle:CFActor:MAXimum[:RESult]?
FETCh:PTABle:EVM:MAXimum[:RESult]?
FETCh:PTABle:GAIN:MAXimum[:RESult]?
FETCh:PTABle:ICC:MAXimum[:RESult]?
FETCh:PTABle:PAE:MAXimum[:RESult]?
FETCh:PTABle:P1DB:MAXimum[:RESult]?
FETCh:PTABle:P2DB:MAXimum[:RESult]?
FETCh:PTABle:P3DB:MAXimum[:RESult]?
FETCh:PTABle:POUT:MAXimum[:RESult]?
FETCh:PTABle:RMS:MAXimum[:RESult]?
FETCh:PTABle:VCC:MAXimum[:RESult]?

These commands query the maximum result values for the parameter as shown in the "Parameter Sweep" table.

For details on the parameters, see [Chapter 2.2, "Amplifier parameters"](#), on page 33.

Return values:

<Results> <numeric value>

Example: `FETC:PTAB:VCC:MIN:X?`
 //Result: 10000000

Usage: Query only

FETCh:PTABle:ACP:ACHannel<ch>:BALanced:MINimum:X[:RESult]?
FETCh:PTABle:ACP:ACHannel<ch>:LOWer:MINimum:X[:RESult]?
FETCh:PTABle:ACP:ACHannel<ch>:UPPer:MINimum:X[:RESult]?
FETCh:PTABle:ACP:MINimum:X[:RESult]?
FETCh:PTABle:AMAM:CWIDth:MINimum:X[:RESult]?
FETCh:PTABle:AMPM:CWIDth:MINimum:X[:RESult]?
FETCh:PTABle:BBPower:MINimum:X[:RESult]?
FETCh:PTABle:CFActor:MINimum:X[:RESult]?
FETCh:PTABle:EVM:MINimum:X[:RESult]?
FETCh:PTABle:GAIN:MINimum:X[:RESult]?
FETCh:PTABle:ICC:MINimum:X[:RESult]?
FETCh:PTABle:PAE:MINimum:X[:RESult]?
FETCh:PTABle:P1DB:MINimum:X[:RESult]?

FETCh:PTABle:P2DB:MINimum:X[:RESult]?
FETCh:PTABle:P3DB:MINimum:X[:RESult]?
FETCh:PTABle:POUT:MINimum:X[:RESult]?
FETCh:PTABle:RMS:MINimum:X[:RESult]?
FETCh:PTABle:VCC:MINimum:X[:RESult]?

These commands query the x-axis value at which the minimum result value for the parameter was determined, as shown in the "Parameter Sweep" table.

For details on the parameters, see [Chapter 2.2, "Amplifier parameters"](#), on page 33.

Return values:

<Results> <numeric value>

The value depends on the parameter selected for the x-axis (see [CONFigure:PSweep:X:SETting](#) on page 305).

Example: FETC:PTAB:VCC:MIN:X:RES?

Usage: Query only

FETCh:PTABle:ACP:ACHannel<ch>:BALanced:MINimum:Y[:RESult]?
FETCh:PTABle:ACP:ACHannel<ch>:LOWer:MINimum:Y[:RESult]?
FETCh:PTABle:ACP:ACHannel<ch>:UPPer:MINimum:Y[:RESult]?
FETCh:PTABle:ACP:BALanced:MINimum:Y[:RESult]?
FETCh:PTABle:ACP:MINimum:Y[:RESult]?
FETCh:PTABle:AMAM:CWIDTH:MINimum:Y[:RESult]?
FETCh:PTABle:AMPM:CWIDTH:MINimum:Y[:RESult]?
FETCh:PTABle:BBPower:MINimum:Y[:RESult]?
FETCh:PTABle:CFACTOR:MINimum:Y[:RESult]?
FETCh:PTABle:EVM:MINimum:Y[:RESult]?
FETCh:PTABle:GAIN:MINimum:Y[:RESult]?
FETCh:PTABle:ICC:MINimum:Y[:RESult]?
FETCh:PTABle:PAE:MINimum:Y[:RESult]?
FETCh:PTABle:P1DB:MINimum:Y[:RESult]?
FETCh:PTABle:P2DB:MINimum:Y[:RESult]?
FETCh:PTABle:P3DB:MINimum:Y[:RESult]?
FETCh:PTABle:POUT:MINimum:Y[:RESult]?
FETCh:PTABle:RMS:MINimum:Y[:RESult]?
FETCh:PTABle:VCC:MINimum:Y[:RESult]?

These commands query the y-axis value at which the minimum result value for the parameter was determined, as shown in the "Parameter Sweep" table.

For details on the parameters, see [Chapter 2.2, "Amplifier parameters"](#), on page 33.

Return values:

<Results> <numeric value>

The value depends on the parameter selected for the y-axis (see [CONFigure:PSweep:Y:SETting](#) on page 306).

Example: FETC:PTAB:VCC:MIN:Y:RES?

Usage: Query only

```

FETCh:PTABle:ACP:ACHannel<ch>:BALanced:MINimum[:RESult]?
FETCh:PTABle:ACP:ACHannel<ch>:LOWer:MINimum[:RESult]?
FETCh:PTABle:ACP:ACHannel<ch>:UPPer:MINimum[:RESult]?
FETCh:PTABle:ACP:BALanced:MINimum[:RESult]?
FETCh:PTABle:ACP:MINimum[:RESult]?
FETCh:PTABle:AMAM:CWIDth:MINimum[:RESult]?
FETCh:PTABle:AMPM:CWIDth:MINimum[:RESult]?
FETCh:PTABle:BBPower:MINimum[:RESult]?
FETCh:PTABle:CFACTOR:MINimum[:RESult]?
FETCh:PTABle:EVM:MINimum[:RESult]?
FETCh:PTABle:GAIN:MINimum[:RESult]?
FETCh:PTABle:ICC:MINimum[:RESult]?
FETCh:PTABle:PAE:MINimum[:RESult]?
FETCh:PTABle:P1DB:MINimum[:RESult]?
FETCh:PTABle:P2DB:MINimum[:RESult]?
FETCh:PTABle:P3DB:MINimum[:RESult]?
FETCh:PTABle:POUT:MINimum[:RESult]?
FETCh:PTABle:RMS:MINimum[:RESult]?
FETCh:PTABle:VCC:MINimum[:RESult]?

```

These commands query the minimum result values for the parameter as shown in the "Parameter Sweep" table.

For details on the parameters, see [Chapter 2.2, "Amplifier parameters"](#), on page 33.

Return values:

<Results> <numeric value>

Example: FETC:PTAB:VCC:MIN:X?
 //Result: 10000000

Usage: Query only

5.8.2.4 Retrieving results of the statistics table

Retrieving the results in the statistics table requires different commands for every result type.

For each parameter, you can query either the current value (default) or the following statistical values calculated for the capture buffer or the entire measurement:

- AVER: average of the results
- MIN: minimum of the results
- MAX: maximum of the results
- SDEV: standard deviation of the results

For each result query, you can specify for which result range you require results:

- SElected: retrieve result of the currently selected result range
- CURRent: retrieve results over the current capture buffer
- ALL: retrieve the results over the entire measurement

In the following example, the SCPI commands querying the statistical results for amplitude droop are described.

- `FETCh:STABle:ADRoop:SElected[:RESult?]` queries the result of the currently selected result range (corresponds to the blue area of the statistics table).
- `FETCh:STABle:ADRoop:AVERage? CURRent` queries the average value of all result ranges found in the current capture buffer (corresponding to the green area of the statistics table).
- `FETCh:STABle:ADRoop:AVERage? ALL` queries the average value of all result ranges found in the entire measurement (corresponding to the black area of the statistics table).

<code>FETCh:STABle:ADRoop:SElected[:RESult?]</code>	377
<code>FETCh:STABle:ADRoop:AVERage?</code>	377
<code>FETCh:STABle:ADRoop:MAXimum?</code>	377
<code>FETCh:STABle:ADRoop:MINimum?</code>	377
<code>FETCh:STABle:ADRoop:STDeviation?</code>	377
<code>FETCh:STABle:AMAM:CWIDth:SElected[:RESult?]</code>	377
<code>FETCh:STABle:AMAM:CWIDth:AVERage?</code>	378
<code>FETCh:STABle:AMAM:CWIDth:MAXimum?</code>	378
<code>FETCh:STABle:AMAM:CWIDth:MINimum?</code>	378
<code>FETCh:STABle:AMAM:CWIDth:STDeviation?</code>	378
<code>FETCh:STABle:AMPM:CWIDth:SElected[:RESult?]</code>	378
<code>FETCh:STABle:AMPM:CWIDth:AVERage?</code>	378
<code>FETCh:STABle:AMPM:CWIDth:MAXimum?</code>	378
<code>FETCh:STABle:AMPM:CWIDth:MINimum?</code>	378
<code>FETCh:STABle:AMPM:CWIDth:STDeviation?</code>	378
<code>FETCh:STABle:APAE:AVG:SElected[:RESult?]</code>	378
<code>FETCh:STABle:APAE:AVG:AVERage?</code>	379
<code>FETCh:STABle:APAE:AVG:MAXimum?</code>	379
<code>FETCh:STABle:APAE:AVG:MINimum?</code>	379
<code>FETCh:STABle:APAE:AVG:STDeviation?</code>	379
<code>FETCh:STABle:APAE:MAX:SElected[:RESult?]</code>	379
<code>FETCh:STABle:APAE:MAX:AVERage?</code>	379
<code>FETCh:STABle:APAE:MAX:MAXimum?</code>	379
<code>FETCh:STABle:APAE:MAX:MINimum?</code>	379
<code>FETCh:STABle:APAE:MAX:STDeviation?</code>	379
<code>FETCh:STABle:APAE:MIN:SElected[:RESult?]</code>	379
<code>FETCh:STABle:APAE:MIN:AVERage?</code>	380
<code>FETCh:STABle:APAE:MIN:MAXimum?</code>	380
<code>FETCh:STABle:APAE:MIN:MINimum?</code>	380
<code>FETCh:STABle:APAE:MIN:STDeviation?</code>	380
<code>FETCh:STABle:BBPower:AVG:SElected[:RESult?]</code>	380
<code>FETCh:STABle:BBPower:AVG:AVERage?</code>	380
<code>FETCh:STABle:BBPower:AVG:MAXimum?</code>	380
<code>FETCh:STABle:BBPower:AVG:MINimum?</code>	380
<code>FETCh:STABle:BBPower:AVG:STDeviation?</code>	380
<code>FETCh:STABle:BBPower:MAX:SElected[:RESult?]</code>	380
<code>FETCh:STABle:BBPower:MAX:AVERage?</code>	380
<code>FETCh:STABle:BBPower:MAX:MAXimum?</code>	380
<code>FETCh:STABle:BBPower:MAX:MINimum?</code>	381

FETCh:STABle:BBPower:MAX:STDeviation?	381
FETCh:STABle:BBPower:MIN:SElected[:RESult]?	381
FETCh:STABle:BBPower:MIN:AVERage?	381
FETCh:STABle:BBPower:MIN:MAXimum?	381
FETCh:STABle:BBPower:MIN:MINimum?	381
FETCh:STABle:BBPower:MIN:STDeviation?	381
FETCh:STABle:CFActor:IN:SElected[:RESult]?	381
FETCh:STABle:CFActor:IN:AVERage?	381
FETCh:STABle:CFActor:IN:MAXimum?	381
FETCh:STABle:CFActor:IN:MINimum?	382
FETCh:STABle:CFActor:IN:STDeviation?	382
FETCh:STABle:CFActor:OUT:SElected[:RESult]?	382
FETCh:STABle:CFActor:OUT:AVERage?	382
FETCh:STABle:CFActor:OUT:MAXimum?	382
FETCh:STABle:CFActor:OUT:MINimum?	382
FETCh:STABle:CFActor:OUT:STDeviation?	382
FETCh:STABle:FERRor:SElected[:RESult]?	382
FETCh:STABle:FERRor:AVERage?	382
FETCh:STABle:FERRor:MAXimum?	382
FETCh:STABle:FERRor:MINimum?	383
FETCh:STABle:FERRor:STDeviation?	383
FETCh:STABle:GAIN:SElected[:RESult]?	383
FETCh:STABle:GAIN:AVERage?	383
FETCh:STABle:GAIN:MAXimum?	383
FETCh:STABle:GAIN:MINimum?	383
FETCh:STABle:GAIN:STDeviation?	383
FETCh:STABle:GIMBalance:SElected[:RESult]?	383
FETCh:STABle:GIMBalance:AVERage?	383
FETCh:STABle:GIMBalance:MAXimum?	383
FETCh:STABle:GIMBalance:MINimum?	384
FETCh:STABle:GIMBalance:STDeviation?	384
FETCh:STABle:ICC:AVG:SElected[:RESult]?	384
FETCh:STABle:ICC:AVG:AVERage?	384
FETCh:STABle:ICC:AVG:MAXimum?	384
FETCh:STABle:ICC:AVG:MINimum?	384
FETCh:STABle:ICC:AVG:STDeviation?	384
FETCh:STABle:ICC:MAX:SElected[:RESult]?	384
FETCh:STABle:ICC:MAX:AVERage?	384
FETCh:STABle:ICC:MAX:MAXimum?	384
FETCh:STABle:ICC:MAX:MINimum?	385
FETCh:STABle:ICC:MAX:STDeviation?	385
FETCh:STABle:ICC:MIN:SElected[:RESult]?	385
FETCh:STABle:ICC:MIN:AVERage?	385
FETCh:STABle:ICC:MIN:MAXimum?	385
FETCh:STABle:ICC:MIN:MINimum?	385
FETCh:STABle:ICC:MIN:STDeviation?	385
FETCh:STABle:IQIMbalance:SElected[:RESult]?	385
FETCh:STABle:IQIMbalance:AVERage?	385
FETCh:STABle:IQIMbalance:MAXimum?	385
FETCh:STABle:IQIMbalance:MINimum?	386

FETCh:STABle:IQIMbalance:STDeviation?	386
FETCh:STABle:IQOFfset:SELected[:RESult]?	386
FETCh:STABle:IQOFfset:AVERage?	386
FETCh:STABle:IQOFfset:MAXimum?	386
FETCh:STABle:IQOFfset:MINimum?	386
FETCh:STABle:IQOFfset:STDeviation?	386
FETCh:STABle:IVOLtage:AVG:SELected[:RESult]?	386
FETCh:STABle:IVOLtage:AVG:AVERage?	386
FETCh:STABle:IVOLtage:AVG:MAXimum?	386
FETCh:STABle:IVOLtage:AVG:MINimum?	387
FETCh:STABle:IVOLtage:AVG:STDeviation?	387
FETCh:STABle:IVOLtage:MAX:SELected[:RESult]?	387
FETCh:STABle:IVOLtage:MAX:AVERage?	387
FETCh:STABle:IVOLtage:MAX:MAXimum?	387
FETCh:STABle:IVOLtage:MAX:MINimum?	387
FETCh:STABle:IVOLtage:MAX:STDeviation?	387
FETCh:STABle:IVOLtage:MIN:SELected[:RESult]?	387
FETCh:STABle:IVOLtage:MIN:AVERage?	387
FETCh:STABle:IVOLtage:MIN:MAXimum?	387
FETCh:STABle:IVOLtage:MIN:MINimum?	388
FETCh:STABle:IVOLtage:MIN:STDeviation?	388
FETCh:STABle:MERRor:SELected[:RESult]?	388
FETCh:STABle:MERRor:AVERage?	388
FETCh:STABle:MERRor:MAXimum?	388
FETCh:STABle:MERRor:MINimum?	388
FETCh:STABle:MERRor:STDeviation?	388
FETCh:STABle:P1DB:IN:SELected[:RESult]?	388
FETCh:STABle:P1DB:IN:AVERage?	388
FETCh:STABle:P1DB:IN:MAXimum?	388
FETCh:STABle:P1DB:IN:MINimum?	389
FETCh:STABle:P1DB:IN:STDeviation?	389
FETCh:STABle:P1DB:OUT:SELected[:RESult]?	389
FETCh:STABle:P1DB:OUT:AVERage?	389
FETCh:STABle:P1DB:OUT:MAXimum?	389
FETCh:STABle:P1DB:OUT:MINimum?	389
FETCh:STABle:P1DB:OUT:STDeviation?	389
FETCh:STABle:P2DB:IN:SELected[:RESult]?	389
FETCh:STABle:P2DB:IN:AVERage?	389
FETCh:STABle:P2DB:IN:MAXimum?	389
FETCh:STABle:P2DB:IN:MINimum?	390
FETCh:STABle:P2DB:IN:STDeviation?	390
FETCh:STABle:P2DB:OUT:SELected[:RESult]?	390
FETCh:STABle:P2DB:OUT:AVERage?	390
FETCh:STABle:P2DB:OUT:MAXimum?	390
FETCh:STABle:P2DB:OUT:MINimum?	390
FETCh:STABle:P2DB:OUT:STDeviation?	390
FETCh:STABle:P3DB:IN:SELected[:RESult]?	390
FETCh:STABle:P3DB:IN:AVERage?	390
FETCh:STABle:P3DB:IN:MAXimum?	390
FETCh:STABle:P3DB:IN:MINimum?	391

FETCh:STABle:P3DB:IN:STDeviatiOn?	391
FETCh:STABle:P3DB:OUT:SElecteD[:RESult]?	391
FETCh:STABle:P3DB:OUT:AVERage?	391
FETCh:STABle:P3DB:OUT:MAXimum?	391
FETCh:STABle:P3DB:OUT:MINimum?	391
FETCh:STABle:P3DB:OUT:STDeviatiOn?	391
FETCh:STABle:PC:SElecteD[:RESult]?	391
FETCh:STABle:PC:AVERage?	391
FETCh:STABle:PC:MAXimum?	391
FETCh:STABle:PC:MINimum?	392
FETCh:STABle:PC:STDeviatiOn?	392
FETCh:STABle:PCPA:SElecteD[:RESult]?	392
FETCh:STABle:PCPA:AVERage?	392
FETCh:STABle:PCPA:MAXimum?	392
FETCh:STABle:PCPA:MINimum?	392
FETCh:STABle:PCPA:STDeviatiOn?	392
FETCh:STABle:PERRor:SElecteD[:RESult]?	392
FETCh:STABle:PERRor:AVERage?	392
FETCh:STABle:PERRor:MAXimum?	392
FETCh:STABle:PERRor:MINimum?	392
FETCh:STABle:PERRor:STDeviatiOn?	392
FETCh:STABle:POWer:INPut:AVG:SElecteD[:RESult]?	393
FETCh:STABle:POWer:INPut:AVG:AVERage?	393
FETCh:STABle:POWer:INPut:AVG:MAXimum?	393
FETCh:STABle:POWer:INPut:AVG:MINimum?	393
FETCh:STABle:POWer:INPut:AVG:STDeviatiOn?	393
FETCh:STABle:POWer:INPut:MAX:SElecteD[:RESult]?	393
FETCh:STABle:POWer:INPut:MAX:AVERage?	393
FETCh:STABle:POWer:INPut:MAX:MAXimum?	393
FETCh:STABle:POWer:INPut:MAX:MINimum?	393
FETCh:STABle:POWer:INPut:MAX:STDeviatiOn?	393
FETCh:STABle:POWer:INPut:MIN:SElecteD[:RESult]?	394
FETCh:STABle:POWer:INPut:MIN:AVERage?	394
FETCh:STABle:POWer:INPut:MIN:MAXimum?	394
FETCh:STABle:POWer:INPut:MIN:MINimum?	394
FETCh:STABle:POWer:INPut:MIN:STDeviatiOn?	394
FETCh:STABle:POWer:OUTPut:AVG:SElecteD[:RESult]?	394
FETCh:STABle:POWer:OUTPut:AVG:AVERage?	394
FETCh:STABle:POWer:OUTPut:AVG:MAXimum?	394
FETCh:STABle:POWer:OUTPut:AVG:MINimum?	394
FETCh:STABle:POWer:OUTPut:AVG:STDeviatiOn?	394
FETCh:STABle:POWer:OUTPut:MAX:SElecteD[:RESult]?	395
FETCh:STABle:POWer:OUTPut:MAX:AVERage?	395
FETCh:STABle:POWer:OUTPut:MAX:MAXimum?	395
FETCh:STABle:POWer:OUTPut:MAX:MINimum?	395
FETCh:STABle:POWer:OUTPut:MAX:STDeviatiOn?	395
FETCh:STABle:POWer:OUTPut:MIN:SElecteD[:RESult]?	395
FETCh:STABle:POWer:OUTPut:MIN:AVERage?	395
FETCh:STABle:POWer:OUTPut:MIN:MAXimum?	395
FETCh:STABle:POWer:OUTPut:MIN:MINimum?	395

FETCh:STABle:POWer:OUTPut:MIN:STDeviatiOn?	395
FETCh:STABle:QERRor:SElecteD[:RESult]?	396
FETCh:STABle:QERRor:AVERage?	396
FETCh:STABle:QERRor:MAXimum?	396
FETCh:STABle:QERRor:MINimum?	396
FETCh:STABle:QERRor:STDeviatiOn?	396
FETCh:STABle:QVOLTage:AVG:SElecteD[:RESult]?	396
FETCh:STABle:QVOLTage:AVG:AVERage?	396
FETCh:STABle:QVOLTage:AVG:MAXimum?	396
FETCh:STABle:QVOLTage:AVG:MINimum?	396
FETCh:STABle:QVOLTage:AVG:STDeviatiOn?	396
FETCh:STABle:QVOLTage:MAX:SElecteD[:RESult]?	397
FETCh:STABle:QVOLTage:MAX:AVERage?	397
FETCh:STABle:QVOLTage:MAX:MAXimum?	397
FETCh:STABle:QVOLTage:MAX:MINimum?	397
FETCh:STABle:QVOLTage:MAX:STDeviatiOn?	397
FETCh:STABle:QVOLTage:MIN:SElecteD[:RESult]?	397
FETCh:STABle:QVOLTage:MIN:AVERage?	397
FETCh:STABle:QVOLTage:MIN:MAXimum?	397
FETCh:STABle:QVOLTage:MIN:MINimum?	397
FETCh:STABle:QVOLTage:MIN:STDeviatiOn?	397
FETCh:STABle:REVM:AVG:SElecteD[:RESult]?	398
FETCh:STABle:REVM:AVG:AVERage?	398
FETCh:STABle:REVM:AVG:MAXimum?	398
FETCh:STABle:REVM:AVG:MINimum?	398
FETCh:STABle:REVM:AVG:STDeviatiOn?	398
FETCh:STABle:REVM:MAX:SElecteD[:RESult]?	398
FETCh:STABle:REVM:MAX:AVERage?	398
FETCh:STABle:REVM:MAX:MAXimum?	398
FETCh:STABle:REVM:MAX:MINimum?	398
FETCh:STABle:REVM:MAX:STDeviatiOn?	398
FETCh:STABle:REVM:MIN:SElecteD[:RESult]?	399
FETCh:STABle:REVM:MIN:AVERage?	399
FETCh:STABle:REVM:MIN:MAXimum?	399
FETCh:STABle:REVM:MIN:MINimum?	399
FETCh:STABle:REVM:MIN:STDeviatiOn?	399
FETCh:STABle:RMEV:AVG:SElecteD[:RESult]?	399
FETCh:STABle:RMEV:AVG:AVERage?	399
FETCh:STABle:RMEV:AVG:MAXimum?	399
FETCh:STABle:RMEV:AVERage:MINimum?	399
FETCh:STABle:RMEV:AVG:MINimum?	399
FETCh:STABle:RMEV:AVG:STDeviatiOn?	399
FETCh:STABle:RMEV:MAX:SElecteD[:RESult]?	400
FETCh:STABle:RMEV:MAX:AVERage?	400
FETCh:STABle:RMEV:MAX:MAXimum?	400
FETCh:STABle:RMEV:MAX:MINimum?	400
FETCh:STABle:RMEV:MAX:STDeviatiOn?	400
FETCh:STABle:RMEV:MIN:SElecteD[:RESult]?	400
FETCh:STABle:RMEV:MIN:AVERage?	400
FETCh:STABle:RMEV:MIN:MAXimum?	400

FETCh:STABle:RMEV:MIN:MINimum?	400
FETCh:STABle:RMEV:MIN:STDeviation?	400
FETCh:STABle:SRERor:SElected[:RESult]?	401
FETCh:STABle:SRERor:AVERage?	401
FETCh:STABle:SRERor:MAXimum?	401
FETCh:STABle:SRERor:MINimum?	401
FETCh:STABle:SRERor:STDeviation?	401
FETCh:STABle:VCC:AVG:SElected[:RESult]?	401
FETCh:STABle:VCC:AVG:AVERage?	401
FETCh:STABle:VCC:AVG:MAXimum?	401
FETCh:STABle:VCC:AVG:MINimum?	401
FETCh:STABle:VCC:AVG:STDeviation?	401
FETCh:STABle:VCC:MAX:SElected[:RESult]?	402
FETCh:STABle:VCC:MAX:AVERage?	402
FETCh:STABle:VCC:MAX:MAXimum?	402
FETCh:STABle:VCC:MAX:MINimum?	402
FETCh:STABle:VCC:MAX:STDeviation?	402
FETCh:STABle:VCC:MIN:SElected[:RESult]?	402
FETCh:STABle:VCC:MIN:AVERage?	402
FETCh:STABle:VCC:MIN:MAXimum?	402
FETCh:STABle:VCC:MIN:MINimum?	402
FETCh:STABle:VCC:MIN:STDeviation?	402

FETCh:STABle:ADRoop:SElected[:RESult]?

Returns the amplitude droop for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:ADRoop:AVERage? <QueryRange>

FETCh:STABle:ADRoop:MAXimum? <Power>

FETCh:STABle:ADRoop:MINimum? <Power>

FETCh:STABle:ADRoop:STDeviation? <Power>

Returns the statistical value for the amplitude droop.

Query parameters:

<Power> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "Amplitude Droop" on page 34

FETCh:STABle:AMAM:CWIDTH:SElected[:RESult]?

Returns the AM/AM curve width for the currently selected result range.

Return values:

<CurveWidth>

Usage: Query only

FETCh:STABLE:AMAM:CWIDth:AVERAge? <QueryRange>
FETCh:STABLE:AMAM:CWIDth:MAXimum? <QueryRange>
FETCh:STABLE:AMAM:CWIDth:MINimum? <QueryRange>
FETCh:STABLE:AMAM:CWIDth:STDeviatiOn? <QueryRange>

Returns the statistical value for the AM/AM curve width.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only**Manual operation:** See "[AM/AM Curve Width](#)" on page 38

FETCh:STABLE:AMPM:CWIDth:SElected[:RESult]?

Returns the AM/PM curve width for the currently selected result range.

Return values:

<CurveWidth>

Usage: Query only

FETCh:STABLE:AMPM:CWIDth:AVERAge? <QueryRange>
FETCh:STABLE:AMPM:CWIDth:MAXimum? <QueryRange>
FETCh:STABLE:AMPM:CWIDth:MINimum? <QueryRange>
FETCh:STABLE:AMPM:CWIDth:STDeviatiOn? <QueryRange>

Returns the statistical value for the AM/PM curve width.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only**Manual operation:** See "[AM/PM Curve Width](#)" on page 39

FETCh:STABLE:APAE:AVG:SElected[:RESult]?

Returns the average average PAE for the currently selected result range.

Return values:

<PAE>

Usage: Query only

FETCh:STABle:APAE:AVG:AVERAge? <QueryRange>
FETCh:STABle:APAE:AVG:MAXimum? <QueryRange>
FETCh:STABle:APAE:AVG:MINimum? <QueryRange>
FETCh:STABle:APAE:AVG:STDeviation? <QueryRange>

Returns the statistical value for the average average PAE.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Average PAE](#)" on page 44

FETCh:STABle:APAE:MAX:SELEcted[:RESult]?

Returns the maximum average PAE for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:APAE:MAX:AVERAge? <QueryRange>
FETCh:STABle:APAE:MAX:MAXimum? <QueryRange>
FETCh:STABle:APAE:MAX:MINimum? <QueryRange>
FETCh:STABle:APAE:MAX:STDeviation? <QueryRange>

Returns the statistical value for the maximum average PAE.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Average PAE](#)" on page 44

FETCh:STABle:APAE:MIN:SELEcted[:RESult]?

Returns the minimum average PAE for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:APAE:MIN:AVERage? <QueryRange>
FETCh:STABle:APAE:MIN:MAXimum? <QueryRange>
FETCh:STABle:APAE:MIN:MINimum? <QueryRange>
FETCh:STABle:APAE:MIN:STDeviatiOn? <QueryRange>

Returns the statistical value for the minimum average PAE.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Average PAE](#)" on page 44

FETCh:STABle:BBPower:AVG:SELEcted[:RESult]?

Returns the average power for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:BBPower:AVG:AVERage? <QueryRange>
FETCh:STABle:BBPower:AVG:MAXimum? <QueryRange>
FETCh:STABle:BBPower:AVG:MINimum? <QueryRange>
FETCh:STABle:BBPower:AVG:STDeviatiOn? <QueryRange>

Returns the statistical value for the average power.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Power](#)" on page 44

FETCh:STABle:BBPower:MAX:SELEcted[:RESult]?

Returns the maximum power for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:BBPower:MAX:AVERage? <Power>
FETCh:STABle:BBPower:MAX:MAXimum? <QueryRange>

FETCH:STABLE:BBPower:MAX:MINimum? <QueryRange>
FETCH:STABLE:BBPower:MAX:STDeviation? <QueryRange>

Returns the statistical value for the maximum power.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Power](#)" on page 44

FETCH:STABLE:BBPower:MIN:SElected[:RESult]?

Returns the minimum power for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCH:STABLE:BBPower:MIN:AVERage? <Power>
FETCH:STABLE:BBPower:MIN:MAXimum? <Power>
FETCH:STABLE:BBPower:MIN:MINimum? <Power>
FETCH:STABLE:BBPower:MIN:STDeviation? <Power>

Returns the statistical value for the minimum power.

Query parameters:

<Power> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Power](#)" on page 44

FETCH:STABLE:CFACTOR:IN:SElected[:RESult]?

Returns the crest factor in for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCH:STABLE:CFACTOR:IN:AVERage? <QueryRange>
FETCH:STABLE:CFACTOR:IN:MAXimum? <QueryRange>

FETCH:STABLE:CFACTOR:IN:MINimum? <QueryRange>
FETCH:STABLE:CFACTOR:IN:STDeviation? <QueryRange>

Returns the statistical value for the crest factor in.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Crest Factor In](#)" on page 41

FETCH:STABLE:CFACTOR:OUT:SElected[:RESult]?

Returns the crest factor out for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCH:STABLE:CFACTOR:OUT:AVERAge? <QueryRange>
FETCH:STABLE:CFACTOR:OUT:MAXimum? <QueryRange>
FETCH:STABLE:CFACTOR:OUT:MINimum? <QueryRange>
FETCH:STABLE:CFACTOR:OUT:STDeviation? <QueryRange>

Returns the statistical value for the crest factor out.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Crest Factor Out](#)" on page 41

FETCH:STABLE:FERRor:SElected[:RESult]?

Returns the frequency error for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCH:STABLE:FERRor:AVERAge? <Error>
FETCH:STABLE:FERRor:MAXimum? <QueryRange>

FETCH:STABLE:FERRor:MINimum? <QueryRange>

FETCH:STABLE:FERRor:STDeviation? <QueryRange>

Returns the statistical value for the frequency error.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Frequency Error](#)" on page 34

FETCH:STABLE:GAIN:SElected[:RESult]?

Returns the gain for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCH:STABLE:GAIN:AVERage? <QueryRange>

FETCH:STABLE:GAIN:MAXimum? <QueryRange>

FETCH:STABLE:GAIN:MINimum? <QueryRange>

FETCH:STABLE:GAIN:STDeviation? <QueryRange>

Returns the statistical value for the gain.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Gain](#)" on page 41

FETCH:STABLE:GIMBalance:SElected[:RESult]?

Returns the gain imbalance for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCH:STABLE:GIMBalance:AVERage? <QueryRange>

FETCH:STABLE:GIMBalance:MAXimum? <QueryRange>

FETCH:STABLE:GIMBalance:MINimum? <QueryRange>
FETCH:STABLE:GIMBalance:STDeviation? <QueryRange>

Returns the statistical value for the gain imbalance.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Gain Imbalance](#)" on page 34

FETCH:STABLE:ICC:AVG:SElected[:RESult]?

Returns the average current for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCH:STABLE:ICC:AVG:AVERage? <QueryRange>
FETCH:STABLE:ICC:AVG:MAXimum? <QueryRange>
FETCH:STABLE:ICC:AVG:MINimum? <QueryRange>
FETCH:STABLE:ICC:AVG:STDeviation? <QueryRange>

Returns the statistical value for the average current.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Current](#)" on page 44

FETCH:STABLE:ICC:MAX:SElected[:RESult]?

Returns the maximum current for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCH:STABLE:ICC:MAX:AVERage? <QueryRange>
FETCH:STABLE:ICC:MAX:MAXimum? <QueryRange>

FETCH:STABLE:ICC:MAX:MINimum? <QueryRange>
FETCH:STABLE:ICC:MAX:STDeviation? <QueryRange>
 Returns the statistical value for the maximum current.

Query parameters:
 <QueryRange> CURRent | ALL

Return values:
 <Result>

Usage: Query only

Manual operation: See "[Current](#)" on page 44

FETCH:STABLE:ICC:MIN:SElected[:RESult]?

Returns the minimum current for the currently selected result range.

Return values:
 <Power>

Usage: Query only

FETCH:STABLE:ICC:MIN:AVERage? <QueryRange>
FETCH:STABLE:ICC:MIN:MAXimum? <QueryRange>
FETCH:STABLE:ICC:MIN:MINimum? <QueryRange>
FETCH:STABLE:ICC:MIN:STDeviation? <QueryRange>

Returns the statistical value for the minimum current.

Query parameters:
 <QueryRange> CURRent | ALL

Return values:
 <Result>

Usage: Query only

Manual operation: See "[Current](#)" on page 44

FETCH:STABLE:IQIMbalance:SElected[:RESult]?

Returns the I/Q imbalance for the currently selected result range.

Return values:
 <Power>

Usage: Query only

FETCH:STABLE:IQIMbalance:AVERage? <QueryRange>
FETCH:STABLE:IQIMbalance:MAXimum? <QueryRange>

FETCH:STABLE:IQIMbalance:MINimum? <QueryRange>
FETCH:STABLE:IQIMbalance:STDeviation? <QueryRange>

Returns the statistical value for the I/Q imbalance.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[I/Q Imbalance](#)" on page 34

FETCH:STABLE:IQOffset:SElected[:RESult]?

Returns the I/Q offset for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCH:STABLE:IQOffset:AVERage? <QueryRange>
FETCH:STABLE:IQOffset:MAXimum? <QueryRange>
FETCH:STABLE:IQOffset:MINimum? <QueryRange>
FETCH:STABLE:IQOffset:STDeviation? <QueryRange>

Returns the statistical value for the I/Q offset.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[I/Q Offset](#)" on page 35

FETCH:STABLE:IVOLTage:AVG:SElected[:RESult]?

Returns the average baseband I input voltage for the currently selected result range.

Return values:

<Voltage>

Usage: Query only

FETCH:STABLE:IVOLTage:AVG:AVERage? <Voltage>
FETCH:STABLE:IVOLTage:AVG:MAXimum? <Voltage>

FETCh:STABle:IVOLtage:AVG:MINimum? <Voltage>

FETCh:STABle:IVOLtage:AVG:STDeviatiOn? <Voltage>

Returns the statistical value for the average baseband voltage i.

Query parameters:

<Voltage> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Baseband Input Voltage I](#)" on page 43

FETCh:STABle:IVOLtage:MAX:SElected[:RESult]?

Returns the maximum baseband I input voltage for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:IVOLtage:MAX:AVERage? <Voltage>

FETCh:STABle:IVOLtage:MAX:MAXimum? <Voltage>

FETCh:STABle:IVOLtage:MAX:MINimum? <Voltage>

FETCh:STABle:IVOLtage:MAX:STDeviatiOn? <Voltage>

Returns the statistical value for the maximum baseband voltage i.

Query parameters:

<Voltage> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Baseband Input Voltage I](#)" on page 43

FETCh:STABle:IVOLtage:MIN:SElected[:RESult]?

Returns the minimum baseband I input voltage for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:IVOLtage:MIN:AVERage? <Voltage>

FETCh:STABle:IVOLtage:MIN:MAXimum? <Voltage>

FETCH:STABLE:IVOLTage:MIN:MINimum? <Voltage>

FETCH:STABLE:IVOLTage:MIN:STDeviation? <Voltage>

Returns the statistical value for the minimum baseband voltage i.

Query parameters:

<Voltage> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Baseband Input Voltage I](#)" on page 43

FETCH:STABLE:MERRor:SElected[:RESult]?

Returns the magnitude error for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCH:STABLE:MERRor:AVERage? <QueryRange>

FETCH:STABLE:MERRor:MAXimum? <QueryRange>

FETCH:STABLE:MERRor:MINimum? <QueryRange>

FETCH:STABLE:MERRor:STDeviation? <QueryRange>

Returns the statistical value for the magnitude error.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Magnitude Error](#)" on page 35

FETCH:STABLE:P1DB:IN:SElected[:RESult]?

Returns the 1dB input compression point for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCH:STABLE:P1DB:IN:AVERage? <QueryRange>

FETCH:STABLE:P1DB:IN:MAXimum? <QueryRange>

FETCH:STABLE:P1DB:IN:MINimum? <QueryRange>
FETCH:STABLE:P1DB:IN:STDeviation? <QueryRange>

Returns the statistical value for the 1dB input compression point.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Compression Point \(1 dB / 2 dB / 3 dB\)](#)" on page 40

FETCH:STABLE:P1DB:OUT:SElected[:RESult]?

Returns the 1dB output compression point for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCH:STABLE:P1DB:OUT:AVERage? <QueryRange>
FETCH:STABLE:P1DB:OUT:MAXimum? <QueryRange>
FETCH:STABLE:P1DB:OUT:MINimum? <QueryRange>
FETCH:STABLE:P1DB:OUT:STDeviation? <QueryRange>

Returns the statistical value for the 1dB output compression point.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Output Compression Point \(1 dB / 2 dB / 3 dB\)](#)" on page 42

FETCH:STABLE:P2DB:IN:SElected[:RESult]?

Returns the 2dB input compression point for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCH:STABLE:P2DB:IN:AVERage? <QueryRange>
FETCH:STABLE:P2DB:IN:MAXimum? <QueryRange>

FETCH:STABLE:P2DB:IN:MINimum? <QueryRange>
FETCH:STABLE:P2DB:IN:STDeviation? <QueryRange>

Returns the statistical value for the 2dB input compression point.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Compression Point \(1 dB / 2 dB / 3 dB\)](#)" on page 40

FETCH:STABLE:P2DB:OUT:SElected[:RESult]?

Returns the 2dB output compression point for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCH:STABLE:P2DB:OUT:AVERage? <QueryRange>
FETCH:STABLE:P2DB:OUT:MAXimum? <QueryRange>
FETCH:STABLE:P2DB:OUT:MINimum? <QueryRange>
FETCH:STABLE:P2DB:OUT:STDeviation? <QueryRange>

Returns the statistical value for the 2dB output compression point.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Output Compression Point \(1 dB / 2 dB / 3 dB\)](#)" on page 42

FETCH:STABLE:P3DB:IN:SElected[:RESult]?

Returns the 3dB input compression point for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCH:STABLE:P3DB:IN:AVERage? <QueryRange>
FETCH:STABLE:P3DB:IN:MAXimum? <QueryRange>

FETCH:STABLE:P3DB:IN:MINimum? <QueryRange>
FETCH:STABLE:P3DB:IN:STDeviation? <QueryRange>

Returns the statistical value for the 3dB input compression point.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Compression Point \(1 dB / 2 dB / 3 dB\)](#)" on page 40

FETCH:STABLE:P3DB:OUT:SElected[:RESult]?

Returns the 3dB output compression point for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCH:STABLE:P3DB:OUT:AVERage? <QueryRange>
FETCH:STABLE:P3DB:OUT:MAXimum? <QueryRange>
FETCH:STABLE:P3DB:OUT:MINimum? <QueryRange>
FETCH:STABLE:P3DB:OUT:STDeviation? <QueryRange>

Returns the statistical value for the 3dB output compression point.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Output Compression Point \(1 dB / 2 dB / 3 dB\)](#)" on page 42

FETCH:STABLE:PC:SElected[:RESult]?

Returns the average power consumption for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCH:STABLE:PC:AVERage? <QueryRange>
FETCH:STABLE:PC:MAXimum? <QueryRange>

FETCh:STABle:PC:MINimum? <QueryRange>

FETCh:STABle:PC:STDeviation? <QueryRange>

Returns the statistical value for the power consumption.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

FETCh:STABle:PCPA:SElected[:RESult]?

Returns the PC based average PAE for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:PCPA:AVERage? <QueryRange>

FETCh:STABle:PCPA:MAXimum? <QueryRange>

FETCh:STABle:PCPA:MINimum? <QueryRange>

FETCh:STABle:PCPA:STDeviation? <QueryRange>

Returns the statistical value for the PC based average PAE.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

FETCh:STABle:PERRor:SElected[:RESult]?

Returns the phase error for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:PERRor:AVERage? <QueryRange>

FETCh:STABle:PERRor:MAXimum? <QueryRange>

FETCh:STABle:PERRor:MINimum? <QueryRange>

FETCh:STABle:PERRor:STDeviation? <QueryRange>

Returns the statistical value for the phase error.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only**Manual operation:** See "[Phase Error](#)" on page 35

FETCh:STABLE:POWer:INPut:AVG:SELEcted[:RESult]?

Returns the average power in for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABLE:POWer:INPut:AVG:AVERAge? <QueryRange>
FETCh:STABLE:POWer:INPut:AVG:MAXimum? <QueryRange>
FETCh:STABLE:POWer:INPut:AVG:MINimum? <QueryRange>
FETCh:STABLE:POWer:INPut:AVG:STDeviAtion? <QueryRange>

Returns the statistical value for the average power in.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only**Manual operation:** See "[Power In](#)" on page 42

FETCh:STABLE:POWer:INPut:MAX:SELEcted[:RESult]?

Returns the maximum power in for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABLE:POWer:INPut:MAX:AVERAge? <QueryRange>
FETCh:STABLE:POWer:INPut:MAX:MAXimum? <QueryRange>
FETCh:STABLE:POWer:INPut:MAX:MINimum? <QueryRange>
FETCh:STABLE:POWer:INPut:MAX:STDeviAtion? <QueryRange>

Returns the statistical value for the maximum power in.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only
Manual operation: See "Power In" on page 42

FETCh:STABle:POWer:INPut:MIN:SELeCted[:RESult]?

Returns the minimum power in for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:POWer:INPut:MIN:AVErAge? <QueryRange>
FETCh:STABle:POWer:INPut:MIN:MAXimum? <QueryRange>
FETCh:STABle:POWer:INPut:MIN:MINimum? <QueryRange>
FETCh:STABle:POWer:INPut:MIN:STDeviAtion? <QueryRange>

Returns the statistical value for the minimum power in.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "Power In" on page 42

FETCh:STABle:POWer:OUTPut:AVG:SELeCted[:RESult]?

Returns the average power out for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:POWer:OUTPut:AVG:AVErAge? <QueryRange>
FETCh:STABle:POWer:OUTPut:AVG:MAXimum? <QueryRange>
FETCh:STABle:POWer:OUTPut:AVG:MINimum? <QueryRange>
FETCh:STABle:POWer:OUTPut:AVG:STDeviAtion? <QueryRange>

Returns the statistical value for the average power out.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "Power Out" on page 42

FETCh:STABle:POWer:OUTPut:MAX:SELEcted[:RESult]?

Returns the maximum power out for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:POWer:OUTPut:MAX:AVERAge? <QueryRange>

FETCh:STABle:POWer:OUTPut:MAX:MAXimum? <QueryRange>

FETCh:STABle:POWer:OUTPut:MAX:MINimum? <QueryRange>

FETCh:STABle:POWer:OUTPut:MAX:STDeviatiOn? <QueryRange>

Returns the statistical value for the maximum power out.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Power Out](#)" on page 42

FETCh:STABle:POWer:OUTPut:MIN:SELEcted[:RESult]?

Returns the minimum power out for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:POWer:OUTPut:MIN:AVERAge? <QueryRange>

FETCh:STABle:POWer:OUTPut:MIN:MAXimum? <QueryRange>

FETCh:STABle:POWer:OUTPut:MIN:MINimum? <QueryRange>

FETCh:STABle:POWer:OUTPut:MIN:STDeviatiOn? <QueryRange>

Returns the statistical value for the minimum power out.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Power Out](#)" on page 42

FETCh:STABle:QERRor:SELected[:RESult]?

Returns the quadrature error for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:QERRor:AVERage? <QueryRange>

FETCh:STABle:QERRor:MAXimum? <QueryRange>

FETCh:STABle:QERRor:MINimum? <QueryRange>

FETCh:STABle:QERRor:STDeviation? <QueryRange>

Returns the statistical value for the quadrature error.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Quadrature Error](#)" on page 36

FETCh:STABle:QVOLTage:AVG:SELected[:RESult]?

Returns the average baseband Q input voltage for the currently selected result range.

Return values:

<Voltage>

Usage: Query only

FETCh:STABle:QVOLTage:AVG:AVERage? <Voltage>

FETCh:STABle:QVOLTage:AVG:MAXimum? <Voltage>

FETCh:STABle:QVOLTage:AVG:MINimum? <Voltage>

FETCh:STABle:QVOLTage:AVG:STDeviation? <Voltage>

Returns the statistical value for the average baseband input voltage q.

Query parameters:

<Voltage> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Baseband Input Voltage Q](#)" on page 43

FETCh:STABle:QVOLTage:MAX:SElected[:RESult]?

Returns the maximum baseband Q input voltage for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:QVOLTage:MAX:AVERage? <Voltage>

FETCh:STABle:QVOLTage:MAX:MAXimum? <Voltage>

FETCh:STABle:QVOLTage:MAX:MINimum? <Voltage>

FETCh:STABle:QVOLTage:MAX:STDeviation? <Voltage>

Returns the statistical value for the maximum baseband input voltage q.

Query parameters:

<Voltage> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Baseband Input Voltage Q](#)" on page 43

FETCh:STABle:QVOLTage:MIN:SElected[:RESult]?

Returns the minimum baseband Q input voltage for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:QVOLTage:MIN:AVERage? <Voltage>

FETCh:STABle:QVOLTage:MIN:MAXimum? <Voltage>

FETCh:STABle:QVOLTage:MIN:MINimum? <Voltage>

FETCh:STABle:QVOLTage:MIN:STDeviation? <Voltage>

Returns the statistical value for the minimum baseband input voltage q.

Query parameters:

<Voltage> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Baseband Input Voltage Q](#)" on page 43

FETCh:STABle:REVM:AVG:SELEcted[:RESult]?

Returns the average raw EVM for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:REVM:AVG:AVERage? <QueryRange>

FETCh:STABle:REVM:AVG:MAXimum? <QueryRange>

FETCh:STABle:REVM:AVG:MINimum? <QueryRange>

FETCh:STABle:REVM:AVG:STDeviation? <QueryRange>

Returns the statistical value for the average raw evm.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Raw EVM](#)" on page 37

FETCh:STABle:REVM:MAX:SELEcted[:RESult]?

Returns the maximum raw EVM for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:REVM:MAX:AVERage? <QueryRange>

FETCh:STABle:REVM:MAX:MAXimum? <QueryRange>

FETCh:STABle:REVM:MAX:MINimum? <QueryRange>

FETCh:STABle:REVM:MAX:STDeviation? <QueryRange>

Returns the statistical value for the maximum raw evm.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Raw EVM](#)" on page 37

FETCh:STABle:REVM:MIN:SElected[:RESult]?

Returns the minimum raw EVM for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:REVM:MIN:AVERage? <QueryRange>

FETCh:STABle:REVM:MIN:MAXimum? <QueryRange>

FETCh:STABle:REVM:MIN:MINimum? <QueryRange>

FETCh:STABle:REVM:MIN:STDeviation? <QueryRange>

Returns the statistical value for the minimum raw evm.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Raw EVM](#)" on page 37

FETCh:STABle:RMEV:AVG:SElected[:RESult]?

Returns the average raw model EVM for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:RMEV:AVG:AVERage? <QueryRange>

FETCh:STABle:RMEV:AVG:MAXimum? <QueryRange>

FETCh:STABle:RMEV:AVG:MINimum? <QueryRange>

FETCh:STABle:RMEV:AVG:MINimum? <QueryRange>

FETCh:STABle:RMEV:AVG:STDeviation? <QueryRange>

Returns the statistical value for the average raw model evm.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Raw Model EVM](#)" on page 37

FETCh:STABle:RMEV:MAX:SELEcted[:RESult]?

Returns the maximum raw model EVM for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:RMEV:MAX:AVERage? <QueryRange>

FETCh:STABle:RMEV:MAX:MAXimum? <QueryRange>

FETCh:STABle:RMEV:MAX:MINimum? <QueryRange>

FETCh:STABle:RMEV:MAX:STDeviation? <QueryRange>

Returns the statistical value for the maximum raw model evm.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Raw Model EVM](#)" on page 37

FETCh:STABle:RMEV:MIN:SELEcted[:RESult]?

Returns the minimum raw model EVM for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:RMEV:MIN:AVERage? <QueryRange>

FETCh:STABle:RMEV:MIN:MAXimum? <QueryRange>

FETCh:STABle:RMEV:MIN:MINimum? <QueryRange>

FETCh:STABle:RMEV:MIN:STDeviation? <QueryRange>

Returns the statistical value for the minimum raw model evm.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Raw Model EVM](#)" on page 37

FETCh:STABle:SRERor:SElecte[d]:RESult]?

Returns the sample rate error for the currently selected result range.

Return values:

<Power>

Usage: Query only

FETCh:STABle:SRERor:AVERage? <QueryRange>

FETCh:STABle:SRERor:MAXimum? <QueryRange>

FETCh:STABle:SRERor:MINimum? <QueryRange>

FETCh:STABle:SRERor:STDeviation? <QueryRange>

Returns the statistical value for the sample rate error.

Query parameters:

<QueryRange> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Sample Rate Error](#)" on page 37

FETCh:STABle:VCC:AVG:SElecte[d]:RESult]?

Returns the average amplifier supply voltage for the currently selected result range.

Return values:

<Voltage>

Usage: Query only

FETCh:STABle:VCC:AVG:AVERage? <Voltage>

FETCh:STABle:VCC:AVG:MAXimum? <Voltage>

FETCh:STABle:VCC:AVG:MINimum? <Voltage>

FETCh:STABle:VCC:AVG:STDeviation? <Voltage>

Returns the statistical value for the average amplifier supply voltage.

Query parameters:

<Voltage> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Voltage](#)" on page 43

FETCh:STABle:VCC:MAX:SElected[:RESult]?

Returns the maximum amplifier supply voltage for the currently selected result range.

Return values:

<Voltage>

Usage: Query only

FETCh:STABle:VCC:MAX:AVERage? <Voltage>

FETCh:STABle:VCC:MAX:MAXimum? <Voltage>

FETCh:STABle:VCC:MAX:MINimum? <Voltage>

FETCh:STABle:VCC:MAX:STDeviation? <Voltage>

Returns the statistical value for the maximum amplifier supply voltage.

Query parameters:

<Voltage> CURRent | ALL

Return values:

<Result>

Example: FETCh:STABle:VCC:MAX:STD? ALL

Usage: Query only

Manual operation: See "[Voltage](#)" on page 43

FETCh:STABle:VCC:MIN:SElected[:RESult]?

Returns the minimum amplifier supply voltage for the currently selected result range.

Return values:

<Voltage>

Usage: Query only

FETCh:STABle:VCC:MIN:AVERage? <Voltage>

FETCh:STABle:VCC:MIN:MAXimum? <Voltage>

FETCh:STABle:VCC:MIN:MINimum? <Voltage>

FETCh:STABle:VCC:MIN:STDeviation? <Voltage>

Returns the statistical value for the minimum amplifier supply voltage.

Query parameters:

<Voltage> CURRent | ALL

Return values:

<Result>

Usage: Query only

Manual operation: See "[Voltage](#)" on page 43

5.8.3 Retrieving I/Q data

TRACe:IQ:EQualized?.....	403
TRACe:IQ:REF[:DATA]?.....	403
TRACe:IQ:SYNChronized?.....	403

TRACe:IQ:EQualized? <Input>

This command queries the equalized I/Q data.

Prerequisites for this command

- Equalized data must be available.

Query parameters:

<Input> RF
You have to state this parameter, but it is always "RF".

Return values:

<Result> String containing the I/Q data.

Example: //Query equalized I/Q data
TRAC:IQ:EQU? RF
//Query raw I/Q data
TRAC:IQ:DATA?

Usage: Query only

TRACe:IQ:REF[:DATA]?

This command queries the reference trace I/Q data.

Example: //Query reference trace I/Q data
TRAC:IQ:REF?

Usage: Query only

Manual operation: See "[Reference signal information](#)" on page 49

TRACe:IQ:SYNChronized? <InpMode>

This command queries the (measured) synchronized I/Q data (which corresponds to the green bar in the "Magnitude Capture" result display).

Query parameters:

<InpMode> **BB**
Queries the data captured on the optional analog baseband input.

RF
Queries the data captured on the RF input.

Return values:

<Result> String containing the synchronized measurement values.

Example: TRAC:IQ:SYNC? RF
would return, e.g.
'-40.376233,-39.982912, ...'

Usage: Query only

5.9 Managing measurement data

MMEMory:LOAD:IQ:STATe.....	404
MMEMory:STORe<n>:IQ:COMMeNt.....	404
MMEMory:STORe<n>:IQ:STATe.....	404

MMEMory:LOAD:IQ:STATe <1>, <FileName>

This command restores the currently captured I/Q data to a file.

After restoring the I/Q data, the application also analyzes the data again.

Setting parameters:

<1>

<FileName> String containing the path and file name.

Example: MMEM:LOAD:IQ:STAT 1, 'C:\IQData\Amplfier.iq.tar'
Restores the specified I/Q data.

Usage: Setting only

MMEMory:STORe<n>:IQ:COMMeNt <Comment>

This command defines a comment for I/Q data you want to store.

Suffix:

<n> 1..n
irrelevant

Setting parameters:

<Comment> String containing the comment.

Example: See [MMEMory:STORe<n>:IQ:STATe](#).

MMEMory:STORe<n>:IQ:STATe <Number>, <FileName>

This command stores the currently captured I/Q data to a file.

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

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

Deprecated remote commands for amplifier measurements

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

Suffix:

<n> 1..n
 irrelevant

Setting parameters:

<Number> Always '1'.

<FileName> String containing the path and file name.
 The file type is .iq.tar.

Example:

```
MMEM:STOR:IQ:COMM 'A sensible comment'
MMEM:STOR:IQ:STAT 1, 'C:\IQData\Amplifier.iq.tar'
Saves the I/Q data to the specified file and adds a sensible comment.
```

Usage: Setting only

5.10 Deprecated remote commands for amplifier measurements

Following is a list of deprecated remote commands. The remote commands are still supported to maintain compatibility to previous versions of amplifier measurements, but it is strongly recommended to use the command system in the way it is meant to be used in the latest version of the R&S FSW-K18.

Legacy command	Replaced by	Comment
CALCulate:GAIN:X	CALCulate:PREference:X	
CONFigure:DPD:MODorder		
CONFigure:MODELing:AMAM:MORDER	CONFigure:MODELing:AMAM:ORDER	
CONFigure:MODELing:AMPM:MORDER	CONFigure:MODELing:AMPM:ORDER	
CONFigure:MODELing:ORDER	CONFigure:MODELing:SEQUence	
FETCH:POWER:CURRENT[:RESULT]	FETCH:BBPower:CURRENT[:RESULT]	
FETCH:POWER:MAXimum[:RESULT]	FETCH:BBPower:MAXimum[:RESULT]	
FETCH:POWER:MINimum[:RESULT]	FETCH:BBPower:MINimum[:RESULT]	
CONFigure:GENERator:IPConnection:LEDState	CONFigure:GENERator:CONNECTION:CState	

List of Commands (Amplifier)

[SENSe:]WINDow<n>:DETEctor<t>[:FUNction].....	316
[SENSe:]ADJust:TIME:TRIGger.....	177
[SENSe:]BANDwidth[:RESolution].....	252
[SENSe:]BANDwidth[:RESolution]:AUTO.....	252
[SENSe:]DETEctor<t>:DEFault[:FUNction].....	314
[SENSe:]DETEctor<t>:TRACe[:POINt].....	315
[SENSe:]EFRontend:ALIGnment<ch>:FILE.....	209
[SENSe:]EFRontend:ALIGnment<ch>:STATe.....	210
[SENSe:]EFRontend:CONNectiOn:CONFig.....	202
[SENSe:]EFRontend:CONNectiOn:CSTATe?.....	202
[SENSe:]EFRontend:CONNectiOn[:STATe].....	201
[SENSe:]EFRontend:FREQuency:BAND:COUNT?.....	203
[SENSe:]EFRontend:FREQuency:BAND:LOWer?.....	203
[SENSe:]EFRontend:FREQuency:BAND:UPPer?.....	203
[SENSe:]EFRontend:FREQuency:BCONfig:AUTO.....	204
[SENSe:]EFRontend:FREQuency:BCONfig:LIST?.....	204
[SENSe:]EFRontend:FREQuency:BCONfig:SElect.....	205
[SENSe:]EFRontend:FREQuency:IFREquency:SIDeband?.....	205
[SENSe:]EFRontend:FREQuency:IFREquency[:VALue]?.....	205
[SENSe:]EFRontend:FREQuency:LOSCillator:INPut:FREQuency?.....	206
[SENSe:]EFRontend:FREQuency:LOSCillator:MODE.....	206
[SENSe:]EFRontend:FREQuency:LOSCillator:OUTPut:FREQuency?.....	206
[SENSe:]EFRontend:FREQuency:LOSCillator:OUTPut:STATe.....	207
[SENSe:]EFRontend:FREQuency:REFerence.....	207
[SENSe:]EFRontend:FREQuency:REFerence:LIST?.....	207
[SENSe:]EFRontend:FWUPdate.....	210
[SENSe:]EFRontend:IDN?.....	208
[SENSe:]EFRontend:NETWork.....	208
[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:CORRection:FILE.....	211
[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:CORRection:STATe.....	212
[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:CORRection:VALid?.....	212
[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:FREQuency:MAXimum?.....	213
[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:FREQuency:MINimum?.....	214
[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:GAIN?.....	214
[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:LIST?.....	212
[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:NAME?.....	214
[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:REFResh.....	213
[SENSe:]EFRontend[:CHANnel<ch>]:EXTDevice<di>:TYPE?.....	215
[SENSe:]EFRontend[:STATe].....	209
[SENSe:]EFRontend<fe>:SELFtest:RESult?.....	210
[SENSe:]EFRontend<fe>:SELFtest?.....	210
[SENSe:]FREQuency:CENTer.....	234
[SENSe:]FREQuency:CENTer:STEP.....	234
[SENSe:]FREQuency:OFFSet.....	235
[SENSe:]JQ:WBAND.....	242
[SENSe:]PMETer:LEVel:CORRection:APPLY.....	230
[SENSe:]PMETer<p>:DCYClE:VALue.....	226

[SENSe:]PMETer<p>:DCYCLe[:STATe].....	226
[SENSe:]PMETer<p>:FREQuency.....	227
[SENSe:]PMETer<p>:FREQuency:LINK.....	227
[SENSe:]PMETer<p>:MTIME.....	228
[SENSe:]PMETer<p>:MTIME:AVERAge:COUNT.....	228
[SENSe:]PMETer<p>:MTIME:AVERAge[:STATe].....	228
[SENSe:]PMETer<p>:ROFFset[:STATe].....	229
[SENSe:]PMETer<p>:SOFFset.....	229
[SENSe:]PMETer<p>:TRIGger:DTIME.....	232
[SENSe:]PMETer<p>:TRIGger:HOLDoff.....	232
[SENSe:]PMETer<p>:TRIGger:HYSTeresis.....	232
[SENSe:]PMETer<p>:TRIGger:LEVel.....	233
[SENSe:]PMETer<p>:TRIGger:SLOPe.....	233
[SENSe:]PMETer<p>:TRIGger[:STATe].....	234
[SENSe:]PMETer<p>[:STATe].....	229
[SENSe:]POWer:ACHannel:AABW.....	298
[SENSe:]POWer:ACHannel:ACPairs.....	298
[SENSe:]POWer:ACHannel:BANDwidth:ACHannel.....	298
[SENSe:]POWer:ACHannel:BANDwidth:ALTerNate<ch>.....	299
[SENSe:]POWer:ACHannel:BANDwidth[:CHANnel<ch>].....	299
[SENSe:]POWer:ACHannel:FILTer:ALPHa:ACHannel.....	299
[SENSe:]POWer:ACHannel:FILTer:ALPHa:ALTerNate<ch>.....	300
[SENSe:]POWer:ACHannel:FILTer:ALPHa:CHANnel<ch>.....	300
[SENSe:]POWer:ACHannel:FILTer[:STATe]:ACHannel.....	300
[SENSe:]POWer:ACHannel:FILTer[:STATe]:ALTerNate<ch>.....	300
[SENSe:]POWer:ACHannel:FILTer[:STATe]:CHANnel<ch>.....	301
[SENSe:]POWer:ACHannel:REFerence:TXCHannel:AUTO.....	301
[SENSe:]POWer:ACHannel:REFerence:TXCHannel:MANual.....	301
[SENSe:]POWer:ACHannel:SPACing:ALTerNate<ch>.....	302
[SENSe:]POWer:ACHannel:SPACing:CHANnel<ch>.....	301
[SENSe:]POWer:ACHannel:SPACing[:ACHannel].....	302
[SENSe:]POWer:ACHannel:TXCHannel:COUNT.....	302
[SENSe:]PSERvoing:INPut:STEP.....	309
[SENSe:]PSERvoing:MAX:ITERation.....	309
[SENSe:]PSERvoing:START.....	310
[SENSe:]PSERvoing:STATe.....	308
[SENSe:]PSERvoing:TARGet:PARAmeter.....	308
[SENSe:]PSERvoing:TARGet:TOLerance.....	309
[SENSe:]PSERvoing:TARGet:VALue.....	309
[SENSe:]PSERvoing[:GLC].....	309
[SENSe:]REFSig:TIME?.....	253
[SENSe:]SWAPiq.....	253
[SENSe:]SWEep:IQAVg:COUNT.....	257
[SENSe:]SWEep:IQAVg:COUNT:CURRent?.....	257
[SENSe:]SWEep:IQAVg:MAVerage[:STATe].....	257
[SENSe:]SWEep:IQAVg[:STATe].....	258
[SENSe:]SWEep:LENGth.....	253
[SENSe:]SWEep:STATistics:CONTInuous[:STATe].....	258
[SENSe:]SWEep:STATistics:COUNT.....	258
[SENSe:]SWEep:STATistics:MODE.....	259

[SENSe:]SWEep:STATistics[:STATe].....	258
[SENSe:]SWEep:TIME.....	254
[SENSe:]SWEep:TIME:AUTO.....	254
CALCulate:MDPD:MODEl.....	289
CALCulate:MSERror:CONFigure:EQUalizer:FILTer:LENGTh.....	294
CALCulate:MSERror:IQAVg:COUNT.....	294
CALCulate:MSERror?.....	294
CALCulate:PMETer:LEVel:CORRection.....	230
CALCulate<n>:AMPM:DEFinition.....	333
CALCulate<n>:DELTamarker<m>:AOFF.....	319
CALCulate<n>:DELTamarker<m>:LINK.....	319
CALCulate<n>:DELTamarker<m>:MAXimum:LEFT.....	324
CALCulate<n>:DELTamarker<m>:MAXimum:NEXT.....	325
CALCulate<n>:DELTamarker<m>:MAXimum:RIGHT.....	325
CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK].....	325
CALCulate<n>:DELTamarker<m>:MINimum:LEFT.....	325
CALCulate<n>:DELTamarker<m>:MINimum:NEXT.....	326
CALCulate<n>:DELTamarker<m>:MINimum:RIGHT.....	326
CALCulate<n>:DELTamarker<m>:MINimum[:PEAK].....	326
CALCulate<n>:DELTamarker<m>:MREFerence.....	320
CALCulate<n>:DELTamarker<m>:TRACe.....	321
CALCulate<n>:DELTamarker<m>:X.....	321
CALCulate<n>:DELTamarker<m>:Y?.....	322
CALCulate<n>:DELTamarker<m>[:STATe].....	320
CALCulate<n>:DELTamarker<ms>:LINK:TO:MARKer<md>.....	320
CALCulate<n>:MARKer<m>:AOFF.....	322
CALCulate<n>:MARKer<m>:FUNCTion:POWer:RESult?.....	298
CALCulate<n>:MARKer<m>:LINK.....	317
CALCulate<n>:MARKer<m>:MAXimum:LEFT.....	326
CALCulate<n>:MARKer<m>:MAXimum:NEXT.....	327
CALCulate<n>:MARKer<m>:MAXimum:RIGHT.....	327
CALCulate<n>:MARKer<m>:MAXimum[:PEAK].....	327
CALCulate<n>:MARKer<m>:MINimum:LEFT.....	327
CALCulate<n>:MARKer<m>:MINimum:NEXT.....	328
CALCulate<n>:MARKer<m>:MINimum:RIGHT.....	328
CALCulate<n>:MARKer<m>:MINimum[:PEAK].....	328
CALCulate<n>:MARKer<m>:TRACe.....	323
CALCulate<n>:MARKer<m>:X.....	323
CALCulate<n>:MARKer<m>:Y?.....	324
CALCulate<n>:MARKer<m>[:STATe].....	323
CALCulate<n>:MARKer<ms>:LINK:TO:MARKer<md>.....	322
CALCulate<n>:PMETer<p>:RELative:STATe.....	225
CALCulate<n>:PMETer<p>:RELative[:MAGNitude].....	225
CALCulate<n>:PMETer<p>:RELative[:MAGNitude]:AUTO ONCE.....	225
CALCulate<n>:PREFerence:X.....	334
CALCulate<n>:UNIT:ANGLE.....	334
CALibration:AIQ:HATiming[:STATe].....	194
CALibration:PMETer<p>:ZERO:AUTO ONCE.....	224
CONFigure:AMPM:CWIDTH:REFerence.....	338
CONFigure:AMPM:CWIDTH:REFerence:AUTO.....	338

CONFigure:CFReduction:APPLy.....	192
CONFigure:CFReduction:APPLy:LEDState?.....	192
CONFigure:CFReduction:CCFactor?.....	191
CONFigure:CFReduction:CFDelta.....	191
CONFigure:CFReduction:CFDelta:LEDState?.....	191
CONFigure:CFReduction:CSPacing.....	190
CONFigure:CFReduction:CSPacing:AUTO.....	190
CONFigure:CFReduction:CSPacing:LEDState?.....	191
CONFigure:CFReduction:FILTer.....	190
CONFigure:CFReduction:FILTer:LEDState?.....	190
CONFigure:CFReduction:ITERations.....	189
CONFigure:CFReduction:ITERations:LEDState?.....	190
CONFigure:CFReduction:MFORder.....	192
CONFigure:CFReduction:MFORder:LEDState?.....	193
CONFigure:CFReduction:PFRequency.....	193
CONFigure:CFReduction:PFRequency:LEDState?.....	193
CONFigure:CFReduction:READ.....	192
CONFigure:CFReduction:READ:LEDState?.....	192
CONFigure:CFReduction:RSORignal.....	189
CONFigure:CFReduction:SBANdwidth.....	188
CONFigure:CFReduction:SBANdwidth:AUTO.....	189
CONFigure:CFReduction:SBANdwidth:LEDState?.....	189
CONFigure:CFReduction:SFRequency.....	193
CONFigure:CFReduction:SFRequency:LEDState?.....	194
CONFigure:CFReduction[:STATe].....	188
CONFigure:CFReduction[:STATe]:LEDState?.....	188
CONFigure:DDPD:ABORt.....	281
CONFigure:DDPD:APPLy:WRAP[:STATe].....	282
CONFigure:DDPD:APPLy[:STATe].....	281
CONFigure:DDPD:CONTInue.....	282
CONFigure:DDPD:COUNt.....	282
CONFigure:DDPD:COUNt:CURRent?.....	283
CONFigure:DDPD:FINish.....	283
CONFigure:DDPD:FNAME.....	283
CONFigure:DDPD:GEXPansion.....	284
CONFigure:DDPD:RMS[:CURRent]?.....	284
CONFigure:DDPD:STARt.....	284
CONFigure:DDPD:TRADeoff.....	285
CONFigure:DDPD:WINDow<n>:RESult.....	285
CONFigure:DDPD[:STATe].....	284
CONFigure:DPD:AMAM:LEDState?.....	274
CONFigure:DPD:AMAM[:STATe].....	274
CONFigure:DPD:AMPM:LEDState?.....	274
CONFigure:DPD:AMPM[:STATe].....	275
CONFigure:DPD:AMXM[:STATe].....	275
CONFigure:DPD:FILE:GENerate.....	275
CONFigure:DPD:FILE:GENerate:ALL.....	276
CONFigure:DPD:FNAME.....	276
CONFigure:DPD:METHod.....	276
CONFigure:DPD:SEQUence.....	277

CONFigure:DPD:SHAPing:MODE.....	278
CONFigure:DPD:TRADeoff.....	278
CONFigure:DPD:UPDate.....	278
CONFigure:DPD:UPDate:ALL.....	278
CONFigure:DPD:UPDate:LEDState?.....	279
CONFigure:DUT:STIME.....	243
CONFigure:EQUalizer:FILTer:FILE:FORMat.....	268
CONFigure:EQUalizer:FILTer:LENGth.....	268
CONFigure:EQUalizer:FPARameters.....	269
CONFigure:EQUalizer:TRAIIn.....	270
CONFigure:EQUalizer[:STATe].....	269
CONFigure:ESTimation:FULL.....	259
CONFigure:ESTimation:RANGe.....	260
CONFigure:ESTimation:STARt.....	260
CONFigure:ESTimation:STOP.....	260
CONFigure:EVALuation:FULL.....	263
CONFigure:EVALuation:RANGe.....	264
CONFigure:EVALuation:STARt.....	264
CONFigure:EVALuation:STOP.....	264
CONFigure:FDOMain:FFTLength.....	310
CONFigure:FDOMain:SQUelch.....	311
CONFigure:FDOMain:WFUNction.....	311
CONFigure:FDOMain:WLFRatio.....	311
CONFigure:FDOMain:WOVerlap.....	311
CONFigure:FRSPan.....	335
CONFigure:FRSPan:AUTO.....	335
CONFigure:GENerator:CONNection:CSState?.....	246
CONFigure:GENerator:CONTRol[:STATe].....	243
CONFigure:GENerator:DUT:INPut:MAXimum:POWer.....	243
CONFigure:GENerator:DUT:INPut:MAXimum:POWer:LEDState?.....	244
CONFigure:GENerator:EXTernal:ROSCillator.....	244
CONFigure:GENerator:EXTernal:ROSCillator:LEDState?.....	244
CONFigure:GENerator:FREQuency:CENTer.....	245
CONFigure:GENerator:FREQuency:CENTer:LEDState?.....	245
CONFigure:GENerator:FREQuency:CENTer:SYNC[:STATe].....	245
CONFigure:GENerator:IPConnexion:ADDRes.....	246
CONFigure:GENerator:LEVel:DUTLimit.....	243
CONFigure:GENerator:POWer:LEVel.....	246
CONFigure:GENerator:POWer:LEVel:ATTenuation.....	247
CONFigure:GENerator:POWer:LEVel:ATTenuation:LEDState?.....	247
CONFigure:GENerator:POWer:LEVel:LEDState?.....	248
CONFigure:GENerator:POWer:LEVel:OFFSet.....	248
CONFigure:GENerator:POWer:LEVel:OFFSet:LEDState?.....	248
CONFigure:GENerator:RELay:READ?.....	251
CONFigure:GENerator:RELay:WRITe.....	251
CONFigure:GENerator:RFOutput:LEDState?.....	249
CONFigure:GENerator:RFOutput[:STATe].....	249
CONFigure:GENerator:SEGMENT.....	249
CONFigure:GENerator:SEGMENT:LEDState?.....	250
CONFigure:GENerator:SETTings:UPDate.....	250

CONFigure:GENerator:TARGet:PATH:BB?	250
CONFigure:GENerator:TARGet:PATH:RF	251
CONFigure:GMP:LAG:ORDer:MEMory	287
CONFigure:GMP:LAG:ORDer:POLYnomial	287
CONFigure:GMP:LAG:ORDer:XTERm	287
CONFigure:GMP:LEAD:ORDer:MEMory	287
CONFigure:GMP:LEAD:ORDer:POLYnomial	288
CONFigure:GMP:LEAD:ORDer:XTERm	288
CONFigure:HAMMerstein:FILTer[:STATe]	293
CONFigure:HAMMerstein:GENWaveform[:SElect]	293
CONFigure:HAMMerstein:ITERation	292
CONFigure:HAMMerstein:MUPGenerator	292
CONFigure:HAMMerstein:NONLinearity[:STATe]	293
CONFigure:HAMMerstein:ORDer:MEMory	292
CONFigure:HAMMerstein:ORDer:POLYnomial	292
CONFigure:HAMMerstein[:STATe]	292
CONFigure:MDPD:APPLY:MODEl	288
CONFigure:MDPD:COEFFicient:SElect	288
CONFigure:MDPD:ITERation	289
CONFigure:MDPD:ORDer:MEMory	289
CONFigure:MDPD:ORDer:POLYnomial	289
CONFigure:MDPD:RMS[:CURRent]?	290
CONFigure:MDPD:WAVeform:SElect	290
CONFigure:MDPD:WAVeform:UPDate	290
CONFigure:MDPD[:STATe]	289
CONFigure:MODeling:AMAM:ORDer	271
CONFigure:MODeling:AMPM:ORDer	271
CONFigure:MODeling:LRANge	272
CONFigure:MODeling:NPOints	272
CONFigure:MODeling:SCALE	272
CONFigure:MODeling:SEQUence	272
CONFigure:MODeling[:STATe]	273
CONFigure:PAE:ICHannel:MULTIplier	296
CONFigure:PAE:ICHannel:OFFSet	296
CONFigure:PAE:ICHannel:RESistor	296
CONFigure:PAE:PCONsumption[:PARAMeter]:A	296
CONFigure:PAE:PCONsumption[:PARAMeter]:B	297
CONFigure:PAE:QCHannel:MULTIplier	297
CONFigure:PAE:QCHannel:OFFSet	297
CONFigure:POWer:RESult:P3DB:REFerence	303
CONFigure:POWer:RESult:P3DB[:STATe]	303
CONFigure:POWer:UNIT	335
CONFigure:PSWeep:ADJust:LEVel[:STATe]	304
CONFigure:PSWeep:EXPEcted:GAIN	304
CONFigure:PSWeep:X:SETTing	305
CONFigure:PSWeep:X:START	305
CONFigure:PSWeep:X:STEP	305
CONFigure:PSWeep:X:STOP	306
CONFigure:PSWeep:Y:SETTing	306
CONFigure:PSWeep:Y:START	306

CONFigure:PSWeep:Y:STATE.....	307
CONFigure:PSWeep:Y:STEP.....	307
CONFigure:PSWeep:Y:STOP.....	307
CONFigure:PSWeep:Z<n>:RESult.....	335
CONFigure:PSWeep[:STATE].....	304
CONFigure:REFSignal:CGW:AMODE[:STATE].....	179
CONFigure:REFSignal:CGW:LEDState?.....	179
CONFigure:REFSignal:CGW:READ.....	180
CONFigure:REFSignal:CGW:DPIPower.....	180
CONFigure:REFSignal:CGW:ETGenerator[:STATE].....	180
CONFigure:REFSignal:CGW:FPAth.....	181
CONFigure:REFSignal:CGW:LEDState?.....	181
CONFigure:REFSignal:CGW:WRITe.....	182
CONFigure:REFSignal:GOS:BWIDth.....	182
CONFigure:REFSignal:GOS:CRESt.....	183
CONFigure:REFSignal:GOS:DCYCle.....	183
CONFigure:REFSignal:GOS:FPAth.....	183
CONFigure:REFSignal:GOS:LEDState?.....	183
CONFigure:REFSignal:GOS:NPOStion.....	184
CONFigure:REFSignal:GOS:NWIDth.....	184
CONFigure:REFSignal:GOS:PAth.....	185
CONFigure:REFSignal:GOS:RLENgth.....	185
CONFigure:REFSignal:GOS:SLENgth.....	185
CONFigure:REFSignal:GOS:SRATe.....	185
CONFigure:REFSignal:GOS:WNAME.....	186
CONFigure:REFSignal:GOS:WRITe.....	186
CONFigure:REFSignal:SEGMENT.....	186
CONFigure:REFSignal:SINFo:CFACTOR?.....	188
CONFigure:REFSignal:SINFo:FPAth?.....	187
CONFigure:REFSignal:SINFo:OBW?.....	188
CONFigure:REFSignal:SINFo:SLENgth?.....	187
CONFigure:REFSignal:SINFo:SRATe?.....	187
CONFigure:RESult:RANGE[:SElected].....	259
CONFigure:SETTings.....	251
CONFigure:SIGNal:ERRor:COMPensation:ADRoop[:STATE].....	265
CONFigure:SIGNal:ERRor:COMPensation:FERRor[:STATE].....	265
CONFigure:SIGNal:ERRor:COMPensation:IQIMbalance[:STATE].....	266
CONFigure:SIGNal:ERRor:COMPensation:IQOFFset[:STATE].....	266
CONFigure:SIGNal:ERRor:COMPensation:SRATe[:STATE].....	266
CONFigure:SIGNal:ERRor:ESTimation:ADRoop[:STATE].....	267
CONFigure:SIGNal:ERRor:ESTimation:FERRor[:STATE].....	267
CONFigure:SIGNal:ERRor:ESTimation:IQIMbalance[:STATE].....	267
CONFigure:SIGNal:ERRor:ESTimation:IQOFFset[:STATE].....	267
CONFigure:SIGNal:ERRor:ESTimation:SRATe[:STATE].....	268
CONFigure:SYNC:CONFidence.....	261
CONFigure:SYNC:DOMain.....	261
CONFigure:SYNC:SECond:STAT.....	261
CONFigure:SYNC:SOFail.....	262
CONFigure:SYNC:STAT.....	262
DISPlay:FORMat.....	167

DISPlay[:WINDow<n>]:MINFo[:STATe].....	318
DISPlay[:WINDow<n>]:MTABLE.....	318
DISPlay[:WINDow<n>]:PTABLE:ITEM.....	328
DISPlay[:WINDow<n>]:PTABLE:ITEM:ALL.....	329
DISPlay[:WINDow<n>]:SIZE.....	167
DISPlay[:WINDow<n>]:STABLE:ITEM.....	332
DISPlay[:WINDow<n>]:STABLE:ITEM:MACCuracy:ALL.....	332
DISPlay[:WINDow<n>]:STABLE:ITEM:POWer:ALL.....	332
DISPlay[:WINDow<n>]:STABLE:ITEM:VCURrent:ALL.....	333
DISPlay[:WINDow<n>]:TABLE:ITEM.....	329
DISPlay[:WINDow<n>]:TABLE:ITEM:MACCuracy:ALL.....	331
DISPlay[:WINDow<n>]:TABLE:ITEM:POWer:ALL.....	331
DISPlay[:WINDow<n>]:TABLE:ITEM:VCURrent:ALL.....	331
DISPlay[:WINDow<n>]:TDOMain:X[:SCALe]:DURation.....	336
DISPlay[:WINDow<n>]:TDOMain:X[:SCALe]:MODE.....	337
DISPlay[:WINDow<n>]:TDOMain:X[:SCALe]:OFFSet.....	337
DISPlay[:WINDow<n>]:TDOMain:Y[:SCALe]:NORMalise[:STATe].....	338
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:MODE.....	312
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:PRESet.....	315
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:RESult.....	315
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALe]:AUTO.....	339
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALe]:MAXimum.....	339
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALe]:MINimum.....	340
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALe]:PDIVisioN.....	340
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALe]:UNIT?.....	341
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:AUTO.....	341
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MAXimum.....	342
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MINimum.....	342
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:PDIVisioN.....	343
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel.....	235
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet.....	236
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RPOSition.....	343
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RVALue.....	344
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:UNIT?.....	344
FETCh:AMAM:CWIDth:CURRent[:RESult]?.....	355
FETCh:AMAM:CWIDth:MAXimum[:RESult]?.....	355
FETCh:AMAM:CWIDth:MINimum[:RESult]?.....	355
FETCh:AMAM:PEAK:CWIDth:CURRent[:RESult]?.....	357
FETCh:AMAM:PEAK:CWIDth:MAXimum[:RESult]?.....	357
FETCh:AMAM:PEAK:CWIDth:MINimum[:RESult]?.....	357
FETCh:AMPM:CWIDth:CURRent[:RESult]?.....	356
FETCh:AMPM:CWIDth:MAXimum[:RESult]?.....	356
FETCh:AMPM:CWIDth:MINimum[:RESult]?.....	356
FETCh:AMPM:PEAK:CWIDth:CURRent[:RESult]?.....	356
FETCh:AMPM:PEAK:CWIDth:MAXimum[:RESult]?.....	356
FETCh:AMPM:PEAK:CWIDth:MINimum[:RESult]?.....	356
FETCh:APAE:CURRent[:RESult]?.....	362
FETCh:APAE:MAXimum[:RESult]?.....	362
FETCh:APAE:MINimum[:RESult]?.....	362
FETCh:BBPower:CURRent[:RESult]?.....	362

FETCh:BBPower:MAXimum[:RESult]?	362
FETCh:BBPower:MINimum[:RESult]?	362
FETCh:DDPD:OPERation:STATus?	285
FETCh:DDPD:WAVeform:PATH?	286
FETCh:DPD:POLYnomial?	280
FETCh:DPD:WAVeform:PATH?	280
FETCh:ICC:CURRent[:RESult]?	363
FETCh:ICC:MAXimum[:RESult]?	363
FETCh:ICC:MINimum[:RESult]?	363
FETCh:IVOLtage:PURE:CURRent[:RESult]?	363
FETCh:IVOLtage:PURE:MAXimum[:RESult]?	363
FETCh:IVOLtage:PURE:MINimum[:RESult]?	363
FETCh:MACCuracy:ADRoop:CURRent[:RESult]?	350
FETCh:MACCuracy:ADRoop:MAXimum[:RESult]?	350
FETCh:MACCuracy:ADRoop:MINimum[:RESult]?	350
FETCh:MACCuracy:FERRor:CURRent[:RESult]?	350
FETCh:MACCuracy:FERRor:MAXimum[:RESult]?	350
FETCh:MACCuracy:FERRor:MINimum[:RESult]?	350
FETCh:MACCuracy:GIMBalance:CURRent[:RESult]?	350
FETCh:MACCuracy:GIMBalance:MAXimum[:RESult]?	350
FETCh:MACCuracy:GIMBalance:MINimum[:RESult]?	350
FETCh:MACCuracy:IQIMbalance:CURRent[:RESult]?	351
FETCh:MACCuracy:IQIMbalance:MAXimum[:RESult]?	351
FETCh:MACCuracy:IQIMbalance:MINimum[:RESult]?	351
FETCh:MACCuracy:IQOffset:CURRent[:RESult]?	351
FETCh:MACCuracy:IQOffset:MAXimum[:RESult]?	351
FETCh:MACCuracy:IQOffset:MINimum[:RESult]?	351
FETCh:MACCuracy:MERRor:CURRent[:RESult]?	351
FETCh:MACCuracy:MERRor:MAXimum[:RESult]?	351
FETCh:MACCuracy:MERRor:MINimum[:RESult]?	351
FETCh:MACCuracy:PERRor:CURRent[:RESult]?	352
FETCh:MACCuracy:PERRor:MAXimum[:RESult]?	352
FETCh:MACCuracy:PERRor:MINimum[:RESult]?	352
FETCh:MACCuracy:POFFset[:RESult]?	352
FETCh:MACCuracy:QERRor:CURRent[:RESult]?	353
FETCh:MACCuracy:QERRor:MAXimum[:RESult]?	353
FETCh:MACCuracy:QERRor:MINimum[:RESult]?	353
FETCh:MACCuracy:REVM:CURRent[:RESult]?	353
FETCh:MACCuracy:REVM:MAXimum[:RESult]?	353
FETCh:MACCuracy:REVM:MINimum[:RESult]?	353
FETCh:MACCuracy:RMEV:CURRent[:RESult]?	353
FETCh:MACCuracy:RMEV:MAXimum[:RESult]?	353
FETCh:MACCuracy:RMEV:MINimum[:RESult]?	353
FETCh:MACCuracy:SRERRor:CURRent[:RESult]?	354
FETCh:MACCuracy:SRERRor:MAXimum[:RESult]?	354
FETCh:MACCuracy:SRERRor:MINimum[:RESult]?	354
FETCh:MACCuracy[:RESult]:ALL?	348
FETCh:MDPD:COEFFicients?	290
FETCh:MDPD:WAVeform:PATH?	291
FETCh:PC:CURRent[:RESult]?	357

FETCh:PCPA:CURRent[:RESult]?	357
FETCh:PMETer<p>?	226
FETCh:POWer:CFACtor:IN:CURRent[:RESult]?	357
FETCh:POWer:CFACtor:IN:MAXimum[:RESult]?	357
FETCh:POWer:CFACtor:IN:MINimum[:RESult]?	357
FETCh:POWer:CFACtor:OUT:CURRent[:RESult]?	358
FETCh:POWer:CFACtor:OUT:MAXimum[:RESult]?	358
FETCh:POWer:CFACtor:OUT:MINimum[:RESult]?	358
FETCh:POWer:GAIN:CURRent[:RESult]?	358
FETCh:POWer:GAIN:MAXimum[:RESult]?	358
FETCh:POWer:GAIN:MINimum[:RESult]?	358
FETCh:POWer:INPut:CURRent[:RESult]?	358
FETCh:POWer:INPut:MAXimum[:RESult]?	358
FETCh:POWer:INPut:MINimum[:RESult]?	358
FETCh:POWer:OBW:CURRent[:RESult]?	359
FETCh:POWer:OBW:MAXimum[:RESult]?	359
FETCh:POWer:OBW:MINimum[:RESult]?	359
FETCh:POWer:OUTPut:CURRent[:RESult]?	359
FETCh:POWer:OUTPut:MAXimum[:RESult]?	359
FETCh:POWer:OUTPut:MINimum[:RESult]?	359
FETCh:POWer:OUTPut:P1DB:MAXimum[:RESult]?	359
FETCh:POWer:OUTPut:P1DB:MINimum[:RESult]?	359
FETCh:POWer:OUTPut:P2DB:MAXimum[:RESult]?	359
FETCh:POWer:OUTPut:P2DB:MINimum[:RESult]?	359
FETCh:POWer:OUTPut:P3DB:MAXimum[:RESult]?	360
FETCh:POWer:OUTPut:P3DB:MINimum[:RESult]?	360
FETCh:POWer:P1DB:CURRent[:RESult]?	360
FETCh:POWer:P1DB:MAXimum[:RESult]?	360
FETCh:POWer:P1DB:MINimum[:RESult]?	360
FETCh:POWer:P1DB:OUT:CURRent[:RESult]?	360
FETCh:POWer:P1DB:OUT:MAXimum[:RESult]?	360
FETCh:POWer:P1DB:OUT:MINimum[:RESult]?	360
FETCh:POWer:P2DB:CURRent[:RESult]?	360
FETCh:POWer:P2DB:MAXimum[:RESult]?	360
FETCh:POWer:P2DB:MINimum[:RESult]?	360
FETCh:POWer:P2DB:OUT:CURRent[:RESult]?	360
FETCh:POWer:P2DB:OUT:MAXimum[:RESult]?	360
FETCh:POWer:P2DB:OUT:MINimum[:RESult]?	360
FETCh:POWer:P3DB:CURRent[:RESult]?	360
FETCh:POWer:P3DB:MAXimum[:RESult]?	360
FETCh:POWer:P3DB:MINimum[:RESult]?	360
FETCh:POWer:P3DB:OUT:CURRent[:RESult]?	360
FETCh:POWer:P3DB:OUT:MAXimum[:RESult]?	360
FETCh:POWer:P3DB:OUT:MINimum[:RESult]?	360
FETCh:POWer:SENsOr:IN:CURRent[:RESult]?	361
FETCh:POWer:SENsOr:IN:MAXimum[:RESult]?	361
FETCh:POWer:SENsOr:IN:MINimum[:RESult]?	361
FETCh:POWer:SENsOr:OUT:CURRent[:RESult]?	361
FETCh:POWer:SENsOr:OUT:MAXimum[:RESult]?	361
FETCh:POWer:SENsOr:OUT:MINimum[:RESult]?	361

FETCh:POWer[:RESult]:ALL?	349
FETCh:PSERvoing:OPERation:STATus?	310
FETCh:PTABLE:ACP:ACHannel<ch>:BALanced:MAXimum:X[:RESult]?	367
FETCh:PTABLE:ACP:ACHannel<ch>:BALanced:MAXimum:Y[:RESult]?	368
FETCh:PTABLE:ACP:ACHannel<ch>:BALanced:MAXimum[:RESult]?	369
FETCh:PTABLE:ACP:ACHannel<ch>:BALanced:MINimum:X[:RESult]?	369
FETCh:PTABLE:ACP:ACHannel<ch>:BALanced:MINimum:Y[:RESult]?	370
FETCh:PTABLE:ACP:ACHannel<ch>:BALanced:MINimum[:RESult]?	371
FETCh:PTABLE:ACP:ACHannel<ch>:LOWer:MAXimum:X[:RESult]?	367
FETCh:PTABLE:ACP:ACHannel<ch>:LOWer:MAXimum:Y[:RESult]?	368
FETCh:PTABLE:ACP:ACHannel<ch>:LOWer:MAXimum[:RESult]?	369
FETCh:PTABLE:ACP:ACHannel<ch>:LOWer:MINimum:X[:RESult]?	369
FETCh:PTABLE:ACP:ACHannel<ch>:LOWer:MINimum:Y[:RESult]?	370
FETCh:PTABLE:ACP:ACHannel<ch>:LOWer:MINimum[:RESult]?	371
FETCh:PTABLE:ACP:ACHannel<ch>:UPPer:MAXimum:X[:RESult]?	367
FETCh:PTABLE:ACP:ACHannel<ch>:UPPer:MAXimum:Y[:RESult]?	368
FETCh:PTABLE:ACP:ACHannel<ch>:UPPer:MAXimum[:RESult]?	369
FETCh:PTABLE:ACP:ACHannel<ch>:UPPer:MINimum:X[:RESult]?	369
FETCh:PTABLE:ACP:ACHannel<ch>:UPPer:MINimum:Y[:RESult]?	370
FETCh:PTABLE:ACP:ACHannel<ch>:UPPer:MINimum[:RESult]?	371
FETCh:PTABLE:ACP:BALanced:MAXimum:X[:RESult]?	367
FETCh:PTABLE:ACP:BALanced:MAXimum:Y[:RESult]?	368
FETCh:PTABLE:ACP:BALanced:MAXimum[:RESult]?	369
FETCh:PTABLE:ACP:BALanced:MINimum:X[:RESult]?	369
FETCh:PTABLE:ACP:BALanced:MINimum:Y[:RESult]?	370
FETCh:PTABLE:ACP:BALanced:MINimum[:RESult]?	371
FETCh:PTABLE:ACP:MAXimum:X[:RESult]?	367
FETCh:PTABLE:ACP:MAXimum:Y[:RESult]?	368
FETCh:PTABLE:ACP:MAXimum[:RESult]?	369
FETCh:PTABLE:ACP:MINimum:X[:RESult]?	369
FETCh:PTABLE:ACP:MINimum:Y[:RESult]?	370
FETCh:PTABLE:ACP:MINimum[:RESult]?	371
FETCh:PTABLE:AMAM:CWIDth:MAXimum:X[:RESult]?	367
FETCh:PTABLE:AMAM:CWIDth:MAXimum:Y[:RESult]?	368
FETCh:PTABLE:AMAM:CWIDth:MAXimum[:RESult]?	369
FETCh:PTABLE:AMAM:CWIDth:MINimum:X[:RESult]?	369
FETCh:PTABLE:AMAM:CWIDth:MINimum:Y[:RESult]?	370
FETCh:PTABLE:AMAM:CWIDth:MINimum[:RESult]?	371
FETCh:PTABLE:AMPM:CWIDth:MAXimum:X[:RESult]?	367
FETCh:PTABLE:AMPM:CWIDth:MAXimum:Y[:RESult]?	368
FETCh:PTABLE:AMPM:CWIDth:MAXimum[:RESult]?	369
FETCh:PTABLE:AMPM:CWIDth:MINimum:X[:RESult]?	369
FETCh:PTABLE:AMPM:CWIDth:MINimum:Y[:RESult]?	370
FETCh:PTABLE:AMPM:CWIDth:MINimum[:RESult]?	371
FETCh:PTABLE:BBPower:MAXimum:X[:RESult]?	367
FETCh:PTABLE:BBPower:MAXimum:Y[:RESult]?	368
FETCh:PTABLE:BBPower:MAXimum[:RESult]?	369
FETCh:PTABLE:BBPower:MINimum:X[:RESult]?	369
FETCh:PTABLE:BBPower:MINimum:Y[:RESult]?	370
FETCh:PTABLE:BBPower:MINimum[:RESult]?	371

FETCh:PTABle:CFACtor:MAXimum:X[:RESult]?	367
FETCh:PTABle:CFACtor:MAXimum:Y[:RESult]?	368
FETCh:PTABle:CFACtor:MAXimum[:RESult]?	369
FETCh:PTABle:CFACtor:MINimum:X[:RESult]?	369
FETCh:PTABle:CFACtor:MINimum:Y[:RESult]?	370
FETCh:PTABle:CFACtor:MINimum[:RESult]?	371
FETCh:PTABle:EVM:MAXimum:X[:RESult]?	367
FETCh:PTABle:EVM:MAXimum:Y[:RESult]?	368
FETCh:PTABle:EVM:MAXimum[:RESult]?	369
FETCh:PTABle:EVM:MINimum:X[:RESult]?	369
FETCh:PTABle:EVM:MINimum:Y[:RESult]?	370
FETCh:PTABle:EVM:MINimum[:RESult]?	371
FETCh:PTABle:GAIN:MAXimum:X[:RESult]?	368
FETCh:PTABle:GAIN:MAXimum:Y[:RESult]?	368
FETCh:PTABle:GAIN:MAXimum[:RESult]?	369
FETCh:PTABle:GAIN:MINimum:X[:RESult]?	369
FETCh:PTABle:GAIN:MINimum:Y[:RESult]?	370
FETCh:PTABle:GAIN:MINimum[:RESult]?	371
FETCh:PTABle:ICC:MAXimum:X[:RESult]?	368
FETCh:PTABle:ICC:MAXimum:Y[:RESult]?	368
FETCh:PTABle:ICC:MAXimum[:RESult]?	369
FETCh:PTABle:ICC:MINimum:X[:RESult]?	369
FETCh:PTABle:ICC:MINimum:Y[:RESult]?	370
FETCh:PTABle:ICC:MINimum[:RESult]?	371
FETCh:PTABle:P1DB:MAXimum:X[:RESult]?	368
FETCh:PTABle:P1DB:MAXimum:Y[:RESult]?	368
FETCh:PTABle:P1DB:MAXimum[:RESult]?	369
FETCh:PTABle:P1DB:MINimum:X[:RESult]?	369
FETCh:PTABle:P1DB:MINimum:Y[:RESult]?	370
FETCh:PTABle:P1DB:MINimum[:RESult]?	371
FETCh:PTABle:P2DB:MAXimum:X[:RESult]?	368
FETCh:PTABle:P2DB:MAXimum:Y[:RESult]?	368
FETCh:PTABle:P2DB:MAXimum[:RESult]?	369
FETCh:PTABle:P2DB:MINimum:X[:RESult]?	370
FETCh:PTABle:P2DB:MINimum:Y[:RESult]?	370
FETCh:PTABle:P2DB:MINimum[:RESult]?	371
FETCh:PTABle:P3DB:MAXimum:X[:RESult]?	368
FETCh:PTABle:P3DB:MAXimum:Y[:RESult]?	368
FETCh:PTABle:P3DB:MAXimum[:RESult]?	369
FETCh:PTABle:P3DB:MINimum:X[:RESult]?	370
FETCh:PTABle:P3DB:MINimum:Y[:RESult]?	370
FETCh:PTABle:P3DB:MINimum[:RESult]?	371
FETCh:PTABle:PAE:MAXimum:X[:RESult]?	368
FETCh:PTABle:PAE:MAXimum:Y[:RESult]?	368
FETCh:PTABle:PAE:MAXimum[:RESult]?	369
FETCh:PTABle:PAE:MINimum:X[:RESult]?	369
FETCh:PTABle:PAE:MINimum:Y[:RESult]?	370
FETCh:PTABle:PAE:MINimum[:RESult]?	371
FETCh:PTABle:POUT:MAXimum:X[:RESult]?	368
FETCh:PTABle:POUT:MAXimum:Y[:RESult]?	368

FETCh:PTABle:POUT:MAXimum[:RESult]?	369
FETCh:PTABle:POUT:MINimum:X[:RESult]?	370
FETCh:PTABle:POUT:MINimum:Y[:RESult]?	370
FETCh:PTABle:POUT:MINimum[:RESult]?	371
FETCh:PTABle:RMS:MAXimum:X[:RESult]?	368
FETCh:PTABle:RMS:MAXimum:Y[:RESult]?	368
FETCh:PTABle:RMS:MAXimum[:RESult]?	369
FETCh:PTABle:RMS:MINimum:X[:RESult]?	370
FETCh:PTABle:RMS:MINimum:Y[:RESult]?	370
FETCh:PTABle:RMS:MINimum[:RESult]?	371
FETCh:PTABle:VCC:MAXimum:X[:RESult]?	368
FETCh:PTABle:VCC:MAXimum:Y[:RESult]?	368
FETCh:PTABle:VCC:MAXimum[:RESult]?	369
FETCh:PTABle:VCC:MINimum:X[:RESult]?	370
FETCh:PTABle:VCC:MINimum:Y[:RESult]?	370
FETCh:PTABle:VCC:MINimum[:RESult]?	371
FETCh:PTABle[:RESult]:ALL?	367
FETCh:QVOLTage:PURE:CURRent[:RESult]?	363
FETCh:QVOLTage:PURE:MAXimum[:RESult]?	363
FETCh:QVOLTage:PURE:MINimum[:RESult]?	363
FETCh:STABle:ADRoop:AVERage?	377
FETCh:STABle:ADRoop:MAXimum?	377
FETCh:STABle:ADRoop:MINimum?	377
FETCh:STABle:ADRoop:SElected[:RESult]?	377
FETCh:STABle:ADRoop:STDeviation?	377
FETCh:STABle:AMAM:CWIDth:AVERage?	378
FETCh:STABle:AMAM:CWIDth:MAXimum?	378
FETCh:STABle:AMAM:CWIDth:MINimum?	378
FETCh:STABle:AMAM:CWIDth:SElected[:RESult]?	377
FETCh:STABle:AMAM:CWIDth:STDeviation?	378
FETCh:STABle:AMPM:CWIDth:AVERage?	378
FETCh:STABle:AMPM:CWIDth:MAXimum?	378
FETCh:STABle:AMPM:CWIDth:MINimum?	378
FETCh:STABle:AMPM:CWIDth:SElected[:RESult]?	378
FETCh:STABle:AMPM:CWIDth:STDeviation?	378
FETCh:STABle:APAE:AVG:AVERage?	379
FETCh:STABle:APAE:AVG:MAXimum?	379
FETCh:STABle:APAE:AVG:MINimum?	379
FETCh:STABle:APAE:AVG:SElected[:RESult]?	378
FETCh:STABle:APAE:AVG:STDeviation?	379
FETCh:STABle:APAE:MAX:AVERage?	379
FETCh:STABle:APAE:MAX:MAXimum?	379
FETCh:STABle:APAE:MAX:MINimum?	379
FETCh:STABle:APAE:MAX:SElected[:RESult]?	379
FETCh:STABle:APAE:MAX:STDeviation?	379
FETCh:STABle:APAE:MIN:AVERage?	380
FETCh:STABle:APAE:MIN:MAXimum?	380
FETCh:STABle:APAE:MIN:MINimum?	380
FETCh:STABle:APAE:MIN:SElected[:RESult]?	379
FETCh:STABle:APAE:MIN:STDeviation?	380

FETCh:STABle:BBPower:AVG:AVERage?	380
FETCh:STABle:BBPower:AVG:MAXimum?	380
FETCh:STABle:BBPower:AVG:MINimum?	380
FETCh:STABle:BBPower:AVG:SELEcted[:RESult]?	380
FETCh:STABle:BBPower:AVG:STDeviatiOn?	380
FETCh:STABle:BBPower:MAX:AVERage?	380
FETCh:STABle:BBPower:MAX:MAXimum?	380
FETCh:STABle:BBPower:MAX:MINimum?	381
FETCh:STABle:BBPower:MAX:SELEcted[:RESult]?	380
FETCh:STABle:BBPower:MAX:STDeviatiOn?	381
FETCh:STABle:BBPower:MIN:AVERage?	381
FETCh:STABle:BBPower:MIN:MAXimum?	381
FETCh:STABle:BBPower:MIN:MINimum?	381
FETCh:STABle:BBPower:MIN:SELEcted[:RESult]?	381
FETCh:STABle:BBPower:MIN:STDeviatiOn?	381
FETCh:STABle:CFACtor:IN:AVERage?	381
FETCh:STABle:CFACtor:IN:MAXimum?	381
FETCh:STABle:CFACtor:IN:MINimum?	382
FETCh:STABle:CFACtor:IN:SELEcted[:RESult]?	381
FETCh:STABle:CFACtor:IN:STDeviatiOn?	382
FETCh:STABle:CFACtor:OUT:AVERage?	382
FETCh:STABle:CFACtor:OUT:MAXimum?	382
FETCh:STABle:CFACtor:OUT:MINimum?	382
FETCh:STABle:CFACtor:OUT:SELEcted[:RESult]?	382
FETCh:STABle:CFACtor:OUT:STDeviatiOn?	382
FETCh:STABle:FERRor:AVERage?	382
FETCh:STABle:FERRor:MAXimum?	382
FETCh:STABle:FERRor:MINimum?	383
FETCh:STABle:FERRor:SELEcted[:RESult]?	382
FETCh:STABle:FERRor:STDeviatiOn?	383
FETCh:STABle:GAIN:AVERage?	383
FETCh:STABle:GAIN:MAXimum?	383
FETCh:STABle:GAIN:MINimum?	383
FETCh:STABle:GAIN:SELEcted[:RESult]?	383
FETCh:STABle:GAIN:STDeviatiOn?	383
FETCh:STABle:GIMBalance:AVERage?	383
FETCh:STABle:GIMBalance:MAXimum?	383
FETCh:STABle:GIMBalance:MINimum?	384
FETCh:STABle:GIMBalance:SELEcted[:RESult]?	383
FETCh:STABle:GIMBalance:STDeviatiOn?	384
FETCh:STABle:ICC:AVG:AVERage?	384
FETCh:STABle:ICC:AVG:MAXimum?	384
FETCh:STABle:ICC:AVG:MINimum?	384
FETCh:STABle:ICC:AVG:SELEcted[:RESult]?	384
FETCh:STABle:ICC:AVG:STDeviatiOn?	384
FETCh:STABle:ICC:MAX:AVERage?	384
FETCh:STABle:ICC:MAX:MAXimum?	384
FETCh:STABle:ICC:MAX:MINimum?	385
FETCh:STABle:ICC:MAX:SELEcted[:RESult]?	384
FETCh:STABle:ICC:MAX:STDeviatiOn?	385

FETCh:STABle:ICc:MIN:AVERage?	385
FETCh:STABle:ICc:MIN:MAXimum?	385
FETCh:STABle:ICc:MIN:MINimum?	385
FETCh:STABle:ICc:MIN:SElecte[d]:RESult?	385
FETCh:STABle:ICc:MIN:STDeviatiOn?	385
FETCh:STABle:IQIMbalance:AVERage?	385
FETCh:STABle:IQIMbalance:MAXimum?	385
FETCh:STABle:IQIMbalance:MINimum?	386
FETCh:STABle:IQIMbalance:SElecte[d]:RESult?	385
FETCh:STABle:IQIMbalance:STDeviatiOn?	386
FETCh:STABle:IQOFset:AVERage?	386
FETCh:STABle:IQOFset:MAXimum?	386
FETCh:STABle:IQOFset:MINimum?	386
FETCh:STABle:IQOFset:SElecte[d]:RESult?	386
FETCh:STABle:IQOFset:STDeviatiOn?	386
FETCh:STABle:IVOLtage:AVG:AVERage?	386
FETCh:STABle:IVOLtage:AVG:MAXimum?	386
FETCh:STABle:IVOLtage:AVG:MINimum?	387
FETCh:STABle:IVOLtage:AVG:SElecte[d]:RESult?	386
FETCh:STABle:IVOLtage:AVG:STDeviatiOn?	387
FETCh:STABle:IVOLtage:MAX:AVERage?	387
FETCh:STABle:IVOLtage:MAX:MAXimum?	387
FETCh:STABle:IVOLtage:MAX:MINimum?	387
FETCh:STABle:IVOLtage:MAX:SElecte[d]:RESult?	387
FETCh:STABle:IVOLtage:MAX:STDeviatiOn?	387
FETCh:STABle:IVOLtage:MIN:AVERage?	387
FETCh:STABle:IVOLtage:MIN:MAXimum?	387
FETCh:STABle:IVOLtage:MIN:MINimum?	388
FETCh:STABle:IVOLtage:MIN:SElecte[d]:RESult?	387
FETCh:STABle:IVOLtage:MIN:STDeviatiOn?	388
FETCh:STABle:MERRor:AVERage?	388
FETCh:STABle:MERRor:MAXimum?	388
FETCh:STABle:MERRor:MINimum?	388
FETCh:STABle:MERRor:SElecte[d]:RESult?	388
FETCh:STABle:MERRor:STDeviatiOn?	388
FETCh:STABle:P1DB:IN:AVERage?	388
FETCh:STABle:P1DB:IN:MAXimum?	388
FETCh:STABle:P1DB:IN:MINimum?	389
FETCh:STABle:P1DB:IN:SElecte[d]:RESult?	388
FETCh:STABle:P1DB:IN:STDeviatiOn?	389
FETCh:STABle:P1DB:OUT:AVERage?	389
FETCh:STABle:P1DB:OUT:MAXimum?	389
FETCh:STABle:P1DB:OUT:MINimum?	389
FETCh:STABle:P1DB:OUT:SElecte[d]:RESult?	389
FETCh:STABle:P1DB:OUT:STDeviatiOn?	389
FETCh:STABle:P2DB:IN:AVERage?	389
FETCh:STABle:P2DB:IN:MAXimum?	389
FETCh:STABle:P2DB:IN:MINimum?	390
FETCh:STABle:P2DB:IN:SElecte[d]:RESult?	389
FETCh:STABle:P2DB:IN:STDeviatiOn?	390

FETCh:STABle:P2DB:OUT:AVERage?	390
FETCh:STABle:P2DB:OUT:MAXimum?	390
FETCh:STABle:P2DB:OUT:MINimum?	390
FETCh:STABle:P2DB:OUT:SELected[:RESult]?	390
FETCh:STABle:P2DB:OUT:STDeviation?	390
FETCh:STABle:P3DB:IN:AVERage?	390
FETCh:STABle:P3DB:IN:MAXimum?	390
FETCh:STABle:P3DB:IN:MINimum?	391
FETCh:STABle:P3DB:IN:SELected[:RESult]?	390
FETCh:STABle:P3DB:IN:STDeviation?	391
FETCh:STABle:P3DB:OUT:AVERage?	391
FETCh:STABle:P3DB:OUT:MAXimum?	391
FETCh:STABle:P3DB:OUT:MINimum?	391
FETCh:STABle:P3DB:OUT:SELected[:RESult]?	391
FETCh:STABle:P3DB:OUT:STDeviation?	391
FETCh:STABle:PC:AVERage?	391
FETCh:STABle:PC:MAXimum?	391
FETCh:STABle:PC:MINimum?	392
FETCh:STABle:PC:SELected[:RESult]?	391
FETCh:STABle:PC:STDeviation?	392
FETCh:STABle:PCPA:AVERage?	392
FETCh:STABle:PCPA:MAXimum?	392
FETCh:STABle:PCPA:MINimum?	392
FETCh:STABle:PCPA:SELected[:RESult]?	392
FETCh:STABle:PCPA:STDeviation?	392
FETCh:STABle:PERRor:AVERage?	392
FETCh:STABle:PERRor:MAXimum?	392
FETCh:STABle:PERRor:MINimum?	392
FETCh:STABle:PERRor:SELected[:RESult]?	392
FETCh:STABle:PERRor:STDeviation?	392
FETCh:STABle:POWer:INPut:AVG:AVERage?	393
FETCh:STABle:POWer:INPut:AVG:MAXimum?	393
FETCh:STABle:POWer:INPut:AVG:MINimum?	393
FETCh:STABle:POWer:INPut:AVG:SELected[:RESult]?	393
FETCh:STABle:POWer:INPut:AVG:STDeviation?	393
FETCh:STABle:POWer:INPut:MAX:AVERage?	393
FETCh:STABle:POWer:INPut:MAX:MAXimum?	393
FETCh:STABle:POWer:INPut:MAX:MINimum?	393
FETCh:STABle:POWer:INPut:MAX:SELected[:RESult]?	393
FETCh:STABle:POWer:INPut:MAX:STDeviation?	393
FETCh:STABle:POWer:INPut:MIN:AVERage?	394
FETCh:STABle:POWer:INPut:MIN:MAXimum?	394
FETCh:STABle:POWer:INPut:MIN:MINimum?	394
FETCh:STABle:POWer:INPut:MIN:SELected[:RESult]?	394
FETCh:STABle:POWer:INPut:MIN:STDeviation?	394
FETCh:STABle:POWer:OUTPut:AVG:AVERage?	394
FETCh:STABle:POWer:OUTPut:AVG:MAXimum?	394
FETCh:STABle:POWer:OUTPut:AVG:MINimum?	394
FETCh:STABle:POWer:OUTPut:AVG:SELected[:RESult]?	394
FETCh:STABle:POWer:OUTPut:AVG:STDeviation?	394

FETCh:STABle:POWer:OUTPut:MAX:AVERage?	395
FETCh:STABle:POWer:OUTPut:MAX:MAXimum?	395
FETCh:STABle:POWer:OUTPut:MAX:MINimum?	395
FETCh:STABle:POWer:OUTPut:MAX:SELEcted[:RESult]?	395
FETCh:STABle:POWer:OUTPut:MAX:STDeviatiOn?	395
FETCh:STABle:POWer:OUTPut:MIN:AVERage?	395
FETCh:STABle:POWer:OUTPut:MIN:MAXimum?	395
FETCh:STABle:POWer:OUTPut:MIN:MINimum?	395
FETCh:STABle:POWer:OUTPut:MIN:SELEcted[:RESult]?	395
FETCh:STABle:POWer:OUTPut:MIN:STDeviatiOn?	395
FETCh:STABle:QERRor:AVERage?	396
FETCh:STABle:QERRor:MAXimum?	396
FETCh:STABle:QERRor:MINimum?	396
FETCh:STABle:QERRor:SELEcted[:RESult]?	396
FETCh:STABle:QERRor:STDeviatiOn?	396
FETCh:STABle:QVOLTage:AVG:AVERage?	396
FETCh:STABle:QVOLTage:AVG:MAXimum?	396
FETCh:STABle:QVOLTage:AVG:MINimum?	396
FETCh:STABle:QVOLTage:AVG:SELEcted[:RESult]?	396
FETCh:STABle:QVOLTage:AVG:STDeviatiOn?	396
FETCh:STABle:QVOLTage:MAX:AVERage?	397
FETCh:STABle:QVOLTage:MAX:MAXimum?	397
FETCh:STABle:QVOLTage:MAX:MINimum?	397
FETCh:STABle:QVOLTage:MAX:SELEcted[:RESult]?	397
FETCh:STABle:QVOLTage:MAX:STDeviatiOn?	397
FETCh:STABle:QVOLTage:MIN:AVERage?	397
FETCh:STABle:QVOLTage:MIN:MAXimum?	397
FETCh:STABle:QVOLTage:MIN:MINimum?	397
FETCh:STABle:QVOLTage:MIN:SELEcted[:RESult]?	397
FETCh:STABle:QVOLTage:MIN:STDeviatiOn?	397
FETCh:STABle:REVM:AVG:AVERage?	398
FETCh:STABle:REVM:AVG:MAXimum?	398
FETCh:STABle:REVM:AVG:MINimum?	398
FETCh:STABle:REVM:AVG:SELEcted[:RESult]?	398
FETCh:STABle:REVM:AVG:STDeviatiOn?	398
FETCh:STABle:REVM:MAX:AVERage?	398
FETCh:STABle:REVM:MAX:MAXimum?	398
FETCh:STABle:REVM:MAX:MINimum?	398
FETCh:STABle:REVM:MAX:SELEcted[:RESult]?	398
FETCh:STABle:REVM:MAX:STDeviatiOn?	398
FETCh:STABle:REVM:MIN:AVERage?	399
FETCh:STABle:REVM:MIN:MAXimum?	399
FETCh:STABle:REVM:MIN:MINimum?	399
FETCh:STABle:REVM:MIN:SELEcted[:RESult]?	399
FETCh:STABle:REVM:MIN:STDeviatiOn?	399
FETCh:STABle:RMEV:AVERage:MINimum?	399
FETCh:STABle:RMEV:AVG:AVERage?	399
FETCh:STABle:RMEV:AVG:MAXimum?	399
FETCh:STABle:RMEV:AVG:MINimum?	399
FETCh:STABle:RMEV:AVG:SELEcted[:RESult]?	399

FETCh:STABle:RMEV:AVG:STDeviation?	399
FETCh:STABle:RMEV:MAX:AVERage?	400
FETCh:STABle:RMEV:MAX:MAXimum?	400
FETCh:STABle:RMEV:MAX:MINimum?	400
FETCh:STABle:RMEV:MAX:SElected[:RESult]?	400
FETCh:STABle:RMEV:MAX:STDeviation?	400
FETCh:STABle:RMEV:MIN:AVERage?	400
FETCh:STABle:RMEV:MIN:MAXimum?	400
FETCh:STABle:RMEV:MIN:MINimum?	400
FETCh:STABle:RMEV:MIN:SElected[:RESult]?	400
FETCh:STABle:RMEV:MIN:STDeviation?	400
FETCh:STABle:SRERor:AVERage?	401
FETCh:STABle:SRERor:MAXimum?	401
FETCh:STABle:SRERor:MINimum?	401
FETCh:STABle:SRERor:SElected[:RESult]?	401
FETCh:STABle:SRERor:STDeviation?	401
FETCh:STABle:VCC:AVG:AVERage?	401
FETCh:STABle:VCC:AVG:MAXimum?	401
FETCh:STABle:VCC:AVG:MINimum?	401
FETCh:STABle:VCC:AVG:SElected[:RESult]?	401
FETCh:STABle:VCC:AVG:STDeviation?	401
FETCh:STABle:VCC:MAX:AVERage?	402
FETCh:STABle:VCC:MAX:MAXimum?	402
FETCh:STABle:VCC:MAX:MINimum?	402
FETCh:STABle:VCC:MAX:SElected[:RESult]?	402
FETCh:STABle:VCC:MAX:STDeviation?	402
FETCh:STABle:VCC:MIN:AVERage?	402
FETCh:STABle:VCC:MIN:MAXimum?	402
FETCh:STABle:VCC:MIN:MINimum?	402
FETCh:STABle:VCC:MIN:SElected[:RESult]?	402
FETCh:STABle:VCC:MIN:STDeviation?	402
FETCh:SYNC:FAIL?	263
FETCh:TTF:CURRent[:RESult]?	348
FETCh:TTS:CURRent[:RESult]?	348
FETCh:VCC:CURRent[:RESult]?	364
FETCh:VCC:MAXimum[:RESult]?	364
FETCh:VCC:MINimum[:RESult]?	364
FETCh[:SYNC]?	262
FORMat:DEXPort:DSEPARATOR	313
FORMat:DEXPort:HEADer	313
FORMat:DEXPort:TRACes	314
FORMat[:DATA]	345
INITiate:SEQuencer:ABORT	176
INITiate:SEQuencer:IMMediate	176
INITiate:SEQuencer:MODE	176
INITiate<n>:CONMeas	175
INITiate<n>:CONTinuous	175
INITiate<n>[:IMMediate]	175
INPut:ATTenuation	236
INPut:ATTenuation:AUTO	237

INPut:ATTenuation:AUTO:MODE.....	238
INPut:CONNector.....	194
INPut:COUPling.....	195
INPut:DPATH.....	195
INPut:EATT.....	238
INPut:EATT:AUTO.....	239
INPut:EATT:STATe.....	239
INPut:EGain[:STATe].....	239
INPut:FILE:PATH.....	196
INPut:FILTer:HPASs[:STATe].....	196
INPut:FILTer:YIG[:STATe].....	197
INPut:GAIN:STATe.....	241
INPut:GAIN[:VALue].....	241
INPut:IMPedance.....	197
INPut:IQ:BALanced[:STATe].....	197
INPut:IQ:FULLscale:AUTO.....	240
INPut:IQ:FULLscale[:LEVel].....	240
INPut:SANalyzer:ATTenuation.....	237
INPut:SANalyzer:ATTenuation:AUTO.....	237
INPut:SElect.....	198
INPut:SElect:BBANalog[:STATe].....	198
INPut:TYPE.....	199
INSTRument:CREate:DUPLicate.....	162
INSTRument:CREate:REPLace.....	162
INSTRument:CREate[:NEW].....	163
INSTRument:DELeTe.....	163
INSTRument:LIST?.....	163
INSTRument:REName.....	165
INSTRument[:SElect].....	165
LAYout:ADD[:WINDow]?.....	167
LAYout:CATalog[:WINDow]?.....	169
LAYout:DIRection.....	170
LAYout:IDENtify[:WINDow]?.....	170
LAYout:REMove[:WINDow].....	170
LAYout:REPLace[:WINDow].....	170
LAYout:SPLitter.....	171
LAYout:WINDow<n>:ADD?.....	172
LAYout:WINDow<n>:IDENtify?.....	173
LAYout:WINDow<n>:REMove.....	173
LAYout:WINDow<n>:REPLace.....	173
LAYout:WINDow<n>:TYPE?.....	174
MMEMory:LOAD:EQUalizer:FILTer:COEFFicient.....	270
MMEMory:LOAD:IQ:STATe.....	404
MMEMory:LOAD:IQ:STReam.....	199
MMEMory:LOAD:IQ:STReam:AUTO.....	199
MMEMory:LOAD:IQ:STReam:LIST?.....	200
MMEMory:STORe:MDPD:COEFFicient.....	291
MMEMory:STORe:MDPD:WAVeform.....	291
MMEMory:STORe<n>:DDPD.....	286
MMEMory:STORe<n>:DPD.....	279

MMEMory:STORe<n>:EQualizer:FILTer:COEFFicient.....	270
MMEMory:STORe<n>:IQ:COMMeNt.....	404
MMEMory:STORe<n>:IQ:STATe.....	404
MMEMory:STORe<n>:TRACe.....	314
READ:PMETer<p>?.....	226
SYSTem:COMMuNicate:RDEVice:PMETer<p>:CONFIgure:AUTO[:STATe].....	223
SYSTem:COMMuNicate:RDEVice:PMETer<p>:COUNT?.....	223
SYSTem:COMMuNicate:RDEVice:PMETer<p>:DEFine.....	224
SYSTem:PRESet:CHANnel[:EXEC].....	166
SYSTem:SEQuencer.....	177
TRACe:IQ:BWIDth.....	254
TRACe:IQ:DATA:FORMat.....	316
TRACe:IQ:DATA?.....	316
TRACe:IQ:DDPD[:DATA]?.....	316
TRACe:IQ:EQualized?.....	403
TRACe:IQ:FILE:REPetition:COUNT.....	200
TRACe:IQ:REF[:DATA]?.....	403
TRACe:IQ:RELENgth?.....	317
TRACe:IQ:SRATe.....	255
TRACe:IQ:SRATe:AUTO.....	255
TRACe:IQ:SYNC:RELENgth?.....	317
TRACe:IQ:SYNC:hronized?.....	403
TRACe:IQ:TPIS?.....	317
TRACe:IQ:TPISamPle?.....	295
TRACe:IQ:WBANd:MBWIDth.....	256
TRACe:IQ:WBANd[:STATe].....	256
TRACe<n>[:DATA]:X?.....	346
TRACe<n>[:DATA]:Y?.....	347
TRACe<n>[:DATA]?.....	345
TRIGGer[:SEQuence]:CTPis.....	294
TRIGGer[:SEQuence]:SOURce.....	230
UNIT<n>:PMETer<p>:POWer.....	231
UNIT<n>:PMETer<p>:POWer:RATIo.....	231

Index

A

Aborting	
Sweep	47, 48
AC/DC coupling	62, 71
ACLR Adj Lower	38
ACLR Adj Upper	38
ACLR Tx	38
ACP	
Configuration	128
Results	13
Adjacent channel power	
see ACP	13
AM/AM	14, 111
Model	109
AM/AM Curve Width	38
AM/AM Curve Width (Pk-Pk)	39
AM/PM	15, 111
Configuration of result display	149
Model	109
AM/PM Curve Width	39
AM/PM Curve Width (Pk-Pk)	40
Amplitude Droop	34, 106
Analog baseband	64
Analog Baseband	
Input	64
Analysis bandwidth	11, 96
ARB (arbitrary waveform)	48
Attenuation	
Auto	72
Electronic	73
Manual	72
Option	73
Reference signal	83
Automatic	
Analysis bandwidth	96
Capture time	97
Average count	
Power sensor	78
Average PAE	44

B

Balanced ACLR Magnitude	38
Bandwidth	
Analysis	96
CP/ACLR	130
Reference signal	55
Resolution	98
Spectrum measurements	98
Baseband capture	65
Baseband Input Voltage I	43
Baseband Input Voltage Q	43
Baseband measurements	126
Blue	
Line	103

C

Calculation	
of Results	104
Capture	95
Capture buffer	22, 103, 104

Capture time	11, 97
Channel	
Creating (remote)	162, 165
Deleting (remote)	163
Duplicating (remote)	162
Querying (remote)	163
Renaming (remote)	165
Replacing (remote)	162
Selecting (remote)	165
Channel bandwidth	
CP/ACLR	130
Channel bar	
Displayed information	10
Channel response	16
Channels	
CP/ACLR measurements	129
Spacings (CP/ACLR)	130
Weighting filters	131
Clock rate	11
Reference signal	49
Signal analysis	96
Closing	
Channels (remote)	163
Windows (remote)	173
Compensating	
Errors	105
Compression Point (1 dB / 2 dB / 3 dB)	40
Compression points	128
Confidence level	102
Continue single sweep	
Softkey	48
Continuous sweep	
Softkey	47
Conventions	
SCPI commands	157
Copying	
Channel (remote)	162
CP/ACLR	
Channel bandwidths	130
Channel spacings	130
Number of channels	129
Reference channel	130
Weighting filters	131
Crest factor	
Reference signal	56
Crest Factor In	41
Crest Factor Out	41
Current	44, 126
Measuring	64

D

Data capture	95
Data format	
Remote	313
DC offset	
Analog Baseband (B71, remote control)	194
DDPD Results	18
Decimal separator	
Trace export	141
Degree of model	109
Delta markers	145
Defining	145

Detailed MSE	124
Detector settings	142
Detectors	
Trace	140
Differential input	
Analog Baseband	65
Digital predistortion	
see DPD	111
Direct DPD	114
Result type selection	152
Direct path	
Input configuration	63
Display	
Information	10
Display line	
Blue	104
Red	22, 103
DPD	109
Configuration	111
Direct	114
Memory Polynomial	118
Method	112
Order of calculation	114
Polynomial	111
Shaping	113
Drop-out time	
Trigger (Power sensor)	79
Duplicating	
Channel (remote)	162
DUT behavior	
Describing	109
Duty cycle	
Power sensor	78
E	
Electronic input attenuation	72, 73
Envelope BIAS	133
Envelope to RF delay	133
Envelope tracking	126
Equalizer	107
Error compensation	105
Error vector	
Magnitude	27
Spectrum	19
Errors	
IF OVLD	69
Estimating	
Errors	105
Evaluation methods	
Remote	167
Evaluation range	104
Exporting	
I/Q data	92
Measurement settings	141
External trigger	
Level (power sensor)	78
Power sensor	78
F	
Falling	
Slope (Power sensor)	79
FFT	
Window functions	136

Files	
Format, I/Q data	86
I/Q data binary XML	92
I/Q data input	85
I/Q parameter XML	87
Filter training	107
Filters	
High-pass (RF input)	63
YIG (remote)	197
Format	
Data (remote)	313
Frequency	
Configuration	67
Coupling (power sensor)	76
Offset	68
Parameter Sweep	133
Power sensor	76
Reference signal	83
Signal	68
Stepsize	68
Synchronization	83
Frequency Error	34
Frequency spectrum	29
Full scale level	70
G	
Gain	41
Results	20, 21
Gain Compression	
Configuration of result display	149
Gain Imbalance	34
Generation	
Reference signal	48
Generator	
Attenuation	83
Control	79
Control (Parameter Sweep)	133
DPD	111
DPD update	113
Frequency	83
IP address	81
Level	82
Multi-waveform files	83
Path	83
Settings (query of)	81
Settings (update of)	81
Generator power	
Parameter Sweep	133
Green	
Bar	22
LED	50, 80
Grey	
LED	50, 80
Group delay	16
H	
Hammerstein model	122
Hardware settings	11
High-pass filter	
RF input	63
Hysteresis	
Trigger (Power sensor)	78

- I**
- I/Q data
 - Export file binary data description 92
 - Export file parameter description 87
 - Input file 67
 - Input files 85
 - Trigger point in sample (TPIS) 295
 - I/Q Imbalance 34, 106
 - I/Q inversion 98
 - I/Q Offset 35
 - IF output
 - see FSW User Manual 79
 - Impedance
 - Setting 62, 72
 - Importing
 - I/Q data 87
 - Input
 - Analog baseband 64
 - Coupling 62, 71
 - Full scale level 70
 - I/Q data files 66
 - Level characteristics 68
 - Parallel data capture 65
 - RF 61
 - Source 61
 - Input power 32
 - Input sources
 - I/Q data file 67
 - I/Q data files 85
 - Installation 9
 - IP address 81
 - iq-tar
 - Example file 89
 - Mandatory data elements 88
- K**
- Keys
 - Peak Search 146
 - RUN CONT 47
 - RUN SINGLE 47, 48
- L**
- LAN connection
 - see Generator setup 50
 - LED
 - Colored 50, 80
 - Level offset 82
 - Level range 110
 - Linking
 - Markers 145
 - LO feedthrough 63
- M**
- Magnitude Error 35
 - Marker to Trace 146
 - Markers 144
 - Assigned trace 146
 - Deactivating 146
 - Delta markers 145
 - Linking 145
 - Minimum 147
 - Next minimum 147
 - Next peak 147
 - Peak 146
 - Position 145
 - State 144
 - Table 143, 146
 - Type 145
 - X-value 145
 - Maximizing
 - Windows (remote) 167
 - Maximum bandwidth 96
 - Measurement bandwidth 11, 96
 - ACP 129
 - Measurement time 11, 97
 - Power sensor 77
 - Measurements
 - see result displays 12
 - Memory DPD Coefficients 23
 - Memory effects 20
 - Memory Polynomial DPD 118
 - Method of synchronization 102
 - Minimum 147
 - Marker positioning 147
 - Next 147
 - Model
 - Range 110
 - Modeling 108
 - Modulation accuracy 19
 - Multi-segment waveforms 50
 - Multi-waveform files 83
- N**
- Neighboring channels 13
 - Next Minimum 147
 - Marker positioning 147
 - Next Peak 147
 - Marker positioning 147
 - Noise notch 57
 - Noise source
 - see FSW User Manual 79
 - Notch position 57
 - Notch width
 - Reference signal 56
 - Number of Readings
 - Power sensor 78
 - Numeric results 28, 32
- O**
- Occupied Bandwidth 42
 - Offset
 - Frequency 68
 - Reference level 70
 - Options
 - Electronic attenuation 73
 - High-pass filter 63
 - Preamplifier 70
 - Output
 - see FSW User Manual 79
 - Output Compression Point (1 dB / 2 dB / 3 dB) 42
 - Output power 32
 - Overview
 - Configuration 45
- P**
- PAE 126
 - Results 23, 24

Parameter Sweep		
Available parameters	133	
Configuration	131	
Configuration of result display	149	
Diagram	26	
Result type selection	151	
Stepsize	133	
Peak search		
Key	146	
Peaks		
Marker positioning	146	
Next	147	
Softkey	146	
Phase		
Results	26	
Phase difference	15	
Phase Error	35	
Polynomial DPD	111	
Polynomial models	108	
Power	44	
Power added efficiency	126	
Power Added Efficiency	23, 24	
Power characteristics	127	
Power In	42	
Power Out	42	
Power Out (Sensor)	42	
Power sensors		
Activating/Deactivating	75	
Apply Auto Level Correction	75	
Average count	78	
Configuration (softkey)	74	
Duty cycle	78	
External power trigger	78	
External trigger level	78	
Frequency	76	
Frequency Coupling	76	
Measurement time	77	
Number of readings	78	
Reference level	77	
Reference level offset	77	
Selecting	76	
Settings	74	
Unit/Scale	77	
Zeroing	76	
Power servoing	134	
Preamplifier		
Setting	70	
Softkey	70	
Predistortion	111	
Presetting		
Channels	46	
Probes		
Characteristics	126	
Pulse duty cycle		
Reference signal	56	
Q		
Quadrature Error	36	
Query generator settings	81	
Quick Config		
Traces	140	
R		
R&S SMW-K541	111	
Ramp length		
Reference signal	56	
Raw EVM	37	
Raw Model EVM	37	
Red		
LED	50, 80	
Line	22, 103	
Reference channel		
CP/ACLR	130	
Reference level	69	
Offset	70	
Offset (Power sensor)	77	
Power sensor	77	
Unit	69	
Value	69	
Reference marker	145	
Reference signal		
Attenuation	83	
Bandwidth	55	
Crest factor	56	
Design	48	
Frequency	83	
Length	56, 97	
Level	82	
Notch position	57	
Notch width	56	
Pulse duty cycle	56	
Ramp length	56	
Sample rate	49	
Source	48	
Transmission	50	
Remote commands		
Basics on syntax	156	
Boolean values	160	
Capitalization	158	
Character data	161	
Data blocks	161	
Numeric values	159	
Optional keywords	158	
Parameters	159	
Strings	161	
Suffixes	158	
Resistance	126	
Resolution bandwidth	98	
Restoring		
Channel settings	46	
Result		
Type	140	
Result calculation	104	
Result displays	12	
ACP (table)	13	
AM/AM	14	
AM/PM	15	
Channel Response Magnitude	16	
Channel Response Phase	16	
Configuration	149	
DDPD Results	18	
Error Vector Spectrum	19	
EVM vs Power	19	
Gain Compression	20	
Gain Deviation vs Time	21	
Group Delay	16	
Icc vs Power	32	
Magnitude Capture	22	
Memory DPD Coefficients	23	
PAE vs Input Power	23	
PAE vs Output Power	23	

PAE vs Time	24
Parameter Sweep	25
Phase Deviation vs Time	26
Power vs Time	27
Raw EVM	27
Result Summary	28
Spectrum FFT	29
Statistics Table	32
Time Domain	30
Vcc vs Icc	22
Vcc vs Power	32
Voltage vs Current	22
Results	
Analysis	138
Data format (remote)	313
Table configuration	147
RF attenuation	
Auto	72
Manual	72
RF input	61
Rising	
Slope (Power sensor)	79
RMS level	82
RMS Power	42
RUN CONT	
Key	47
RUN SINGLE	
Key	47, 48
S	
Sample Error Rate	106
Sample rate	11
Reference signal	49
Signal analysis	96
Sample Rate Error	37
Scale	
X-axis	152
Y-axis	154
Sequencer	
Activating (remote)	176
Remote	175
see FSW user manual	12
Sequences	
Aborting (remote)	176
Mode (remote)	176
Signal capture	95
Signal characteristics	
see result displays	12
Signal errors	105
Signal generation	48
Signal length	
Reference signal	56
Signal synchronization	100
Single sweep	
Softkey	47
Slope	
Power sensor trigger	79
Trigger (Power sensor)	79
Softkeys	
Continue Single Sweep	48
Continuous Sweep	47
Marker to Trace	146
Min	147
Next Min	147
Next Peak	147
Norm/Delta	145
Peak	146
Power Sensor Config	74
Preamp	70
Ref Level	69
Ref Level Offset	70
RF Atten Auto	72
RF Atten Manual	72
Single Sweep	47
Spacings	
CP/ACLR	130
Specifics for	
Configuration	47
Status bar	11
Suffixes	
Common	161
Remote commands	158
Sweep	
Aborting	47, 48
Sweep count	11
Synchronization	
Additional	103
Failure	101
Method	102
Parameter Sweep	134
Range	103
Reference signal	100
Second	103
State	101
System models	108
T	
Time Domain	
Configuration of result display	149
Timing	
of Signals	30
TPIS	
I/Q data	295
Trace export	141
Trace selection	138
Traces	
Detector	140
Export format	141
Mode	139
Settings, predefined	140
Transmission channel	13
Trigger	
Drop-out time (Power sensor)	79
External (remote)	230
External power	78
Holdoff (Power sensor)	78
Hysteresis (Power sensor)	78
Level (Power sensor)	78
Power sensor	78
Slope (Power sensor)	79
Sources (list)	95
Trigger output	
see FSW User Manual	79
Trigger to frame	11
U	
Units	
Power sensor	77
Reference level	69
Update generator settings	81

V

Videos	9
Voltage	43, 126
Measuring	64

W

Waveform	
ARB (arbitrary)	48, 56
Design	48
File	56
Multi-segment	50
Weighting filters	
CP/ACLR	131
Window title bar information	11
Windows	
Adding (remote)	167
Closing (remote)	173
Configuring	47
Layout (remote)	171
Maximizing (remote)	167
Querying (remote)	169, 170
Replacing (remote)	170
Splitting (remote)	167
Types (remote)	167

X

X-value	
Marker	145

Y

YIG-preselector	
Activating/Deactivating	63
Activating/Deactivating (remote)	197

Z

Zeroing	
Power sensor	76