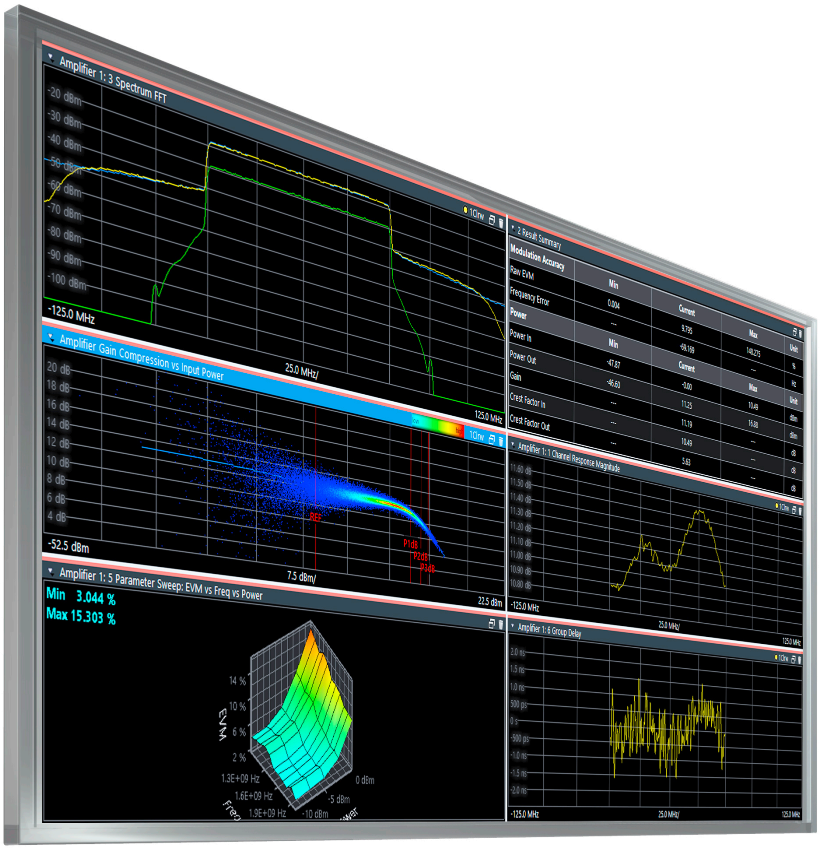
# R&S®VSE-K18
# Power Amplifier and Envelope Tracking Measurements
# User Manual




1179327302
Version 05

ROHDE&SCHWARZ
Make ideas real

This manual applies to the following software, version 2.31 and later:

- R&S®VSE Enterprise Edition base software (1345.1105.06)
- R&S®VSE Basic Edition base software (1345.1011.06)

The following firmware options are described:

- R&S®VSE-K18 (1345.1434.02)
- R&S®VSE-K18D (1345.1440.02)
- R&S®VSE-K18F (1345.1457.02)
- R&S®VSE-K18M (1345.1492.02)
- R&S®VSE-KT18 (1345.2060.02)
- R&S®VSE-KT18D (1345.2053.02)
- R&S®VSE-KT18F (1345.2047.02)
- R&S®VSE-KT18M (1345.2030.02)
- R&S®VSE-KP18 (1345.2418.xx)
- R&S®VSE-KP18D (1345.2424.xx)
- R&S®VSE-KP18F (1345.2430.xx)
- R&S®VSE-KP18M (1345.2447.xx)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Throughout this manual, products from Rohde & Schwarz are indicated without the ® symbol , e.g. R&S®VSE is indicated as R&S VSE.

# Contents

# 1 Welcome to the amplifier measurement application

The R&S VSE-K18 is a firmware application that adds functionality to measure the efficiency of amplifiers with the R&S VSE signal analyzer. You extend the amplifier application with the R&S VSE-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 R&S VSE user manual. The latest versions of the manuals are available for download at the product homepage.

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

**Installation**

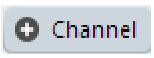
Find detailed installing instructions in the getting started or the release notes of the R&S VSE.



## 1.1 Starting the application

The amplifier measurement application adds a new type of measurement to the R&S VSE.

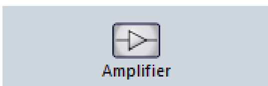
**To activate the amplifier application**

1. 


   Select the "Add Channel" function in the Sequence tool window.

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

2. Select the "Amplifier" item.


   The R&S VSE opens a new measurement channel for the Amplifier measurement application.

## 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.

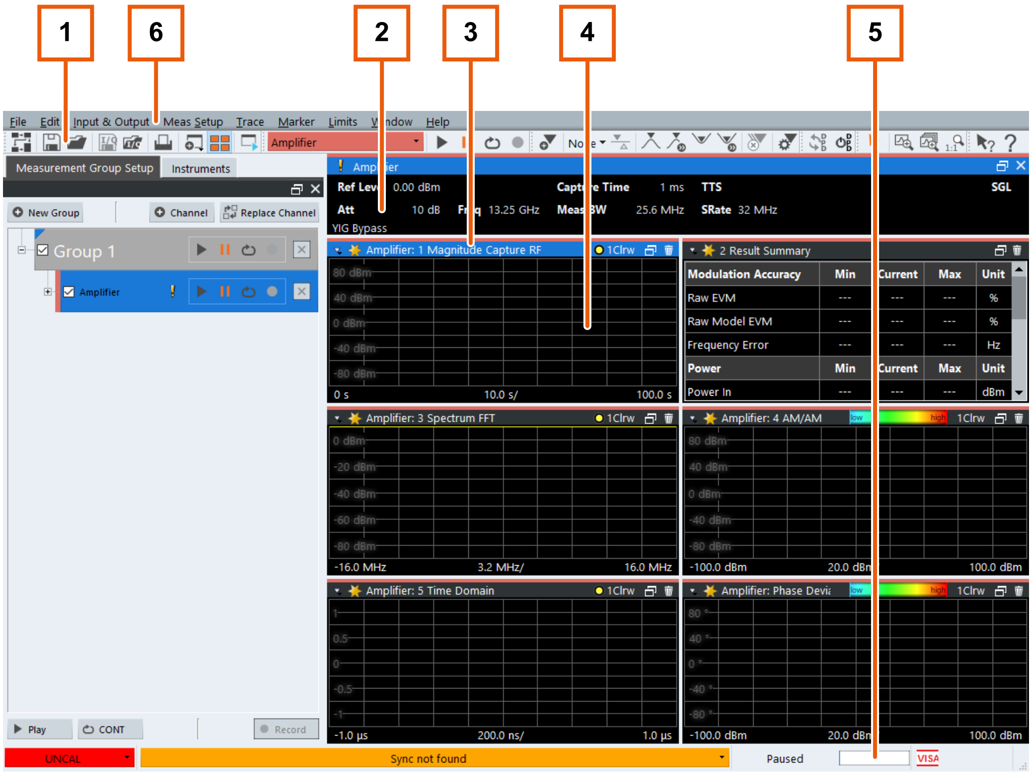



*Figure 1-1: Screen layout of the amplifier measurement application*

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 R&S VSE.

### Channel bar information

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

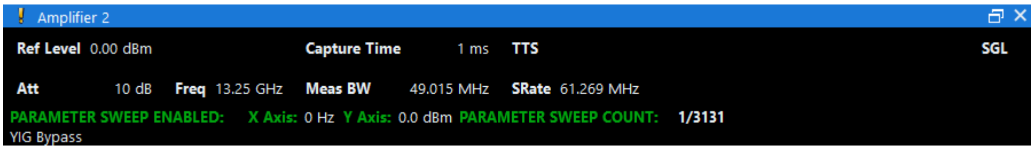



*Figure 1-2: Channel bar of the amplifier application*

| | |
|---|---|
| "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.



## 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 20
- "Numeric Result Summary" on page 24
- "Spectrum FFT" on page 25
- "AM/AM" on page 14
- "Time Domain" on page 25
- "Phase deviation vs Input power"

The following evaluation methods are available for amplifier measurements:

**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 VSE-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 3.15, "Adjacent channel leakage error (ACLR) measurements", on page 117.

Remote command:
Selection: `LAY:ADD? '1',LEFT,ACP`
Result query: `CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult?`
on page 263

**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.

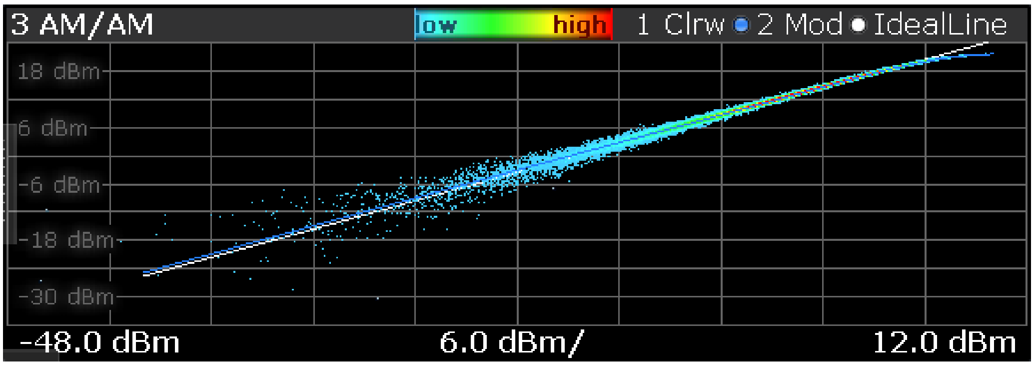
The width of the "AM/AM" trace is an indicator of memory effects: the larger the width of the trace, the more memory effects occur. The "AM/AM" Curve Width is shown in the numerical Result Summary.

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 309

**AM/PM**

The "AM/PM" result disyplay 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".

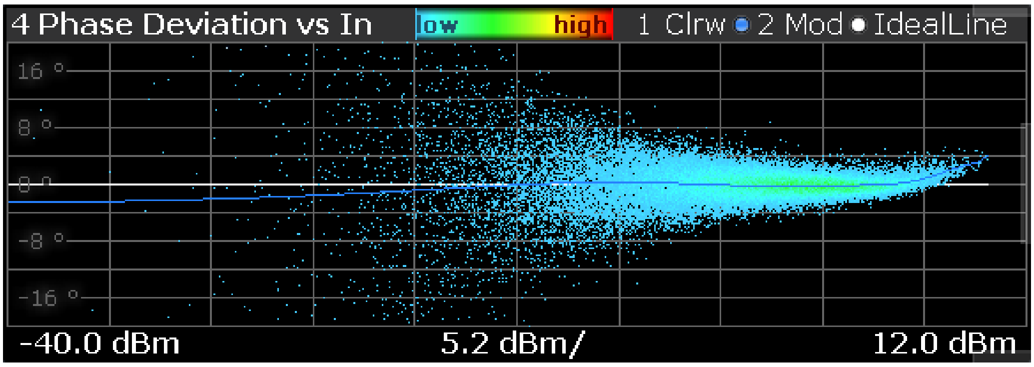
The x-axis shows the levels of all samples of the reference signal (input power) or the measurement signal (output power) in dBm. You can select the reference of the x-axis (input or output power) in the "Result Configuration" dialog box.

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.

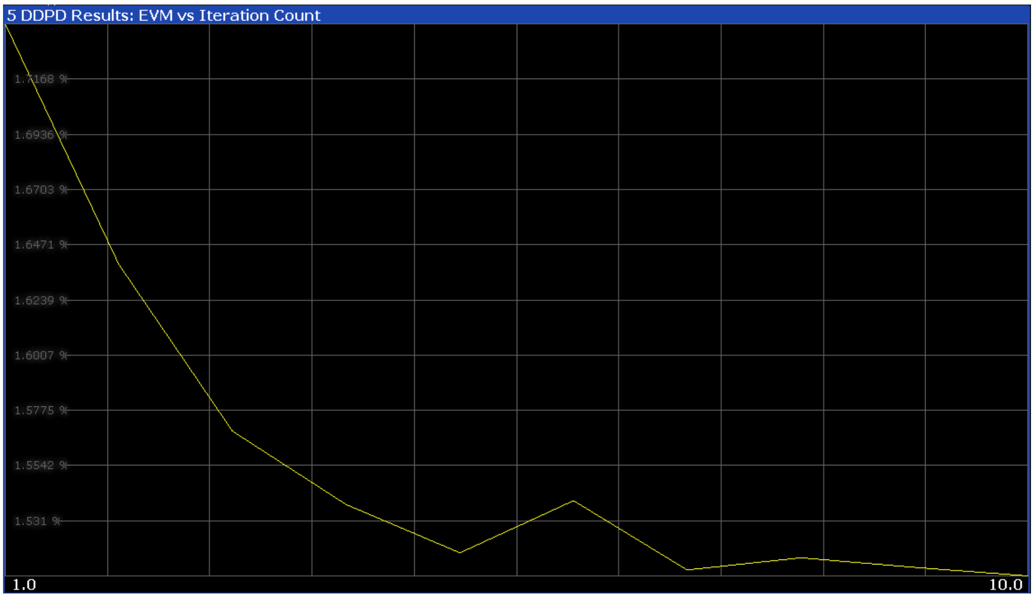
All traces include the digital predistortion, when you have turned on that feature.



Remote command:
Selection: `LAY:ADD? '1',LEFT,AMPM`
Result query: `TRACe<n>[:DATA]?` on page 309

**DDPD Results (R&S VSE-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 R&S VSE-K18M). It is only available with application R&S VSE-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 138.




The following result types are available:

"EVM" Error vector magnitude

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

"ACLR Adj Upper" Power of the upper adjacent channel

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

"ACLR Adj Lower" Power of the lower adjacent channel

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

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

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

Remote command:
Selection: `LAY:ADD? '1',LEFT,DDPD`
Result query: `TRACe<n>[:DATA]?` on page 309

**EVM vs Power**

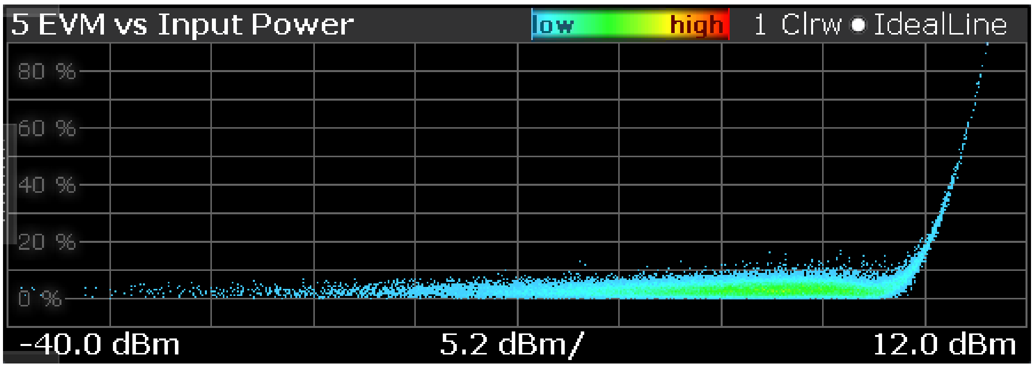
The "EVM vs Power" result display shows the EVM against the measured power values.

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 309

**Error Vector Spectrum**

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

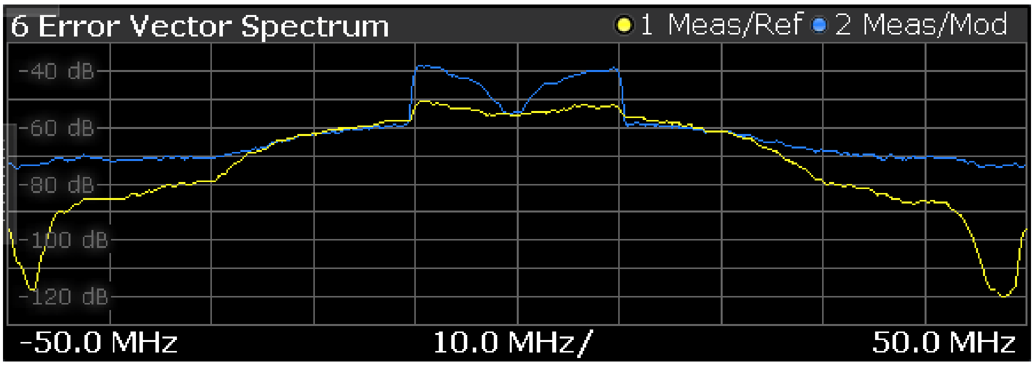
The EV is a measure of the modulation accuracy. It compares two signals and shows the distance of the measured constellation points and the ideal constellation points.

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 309

**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.

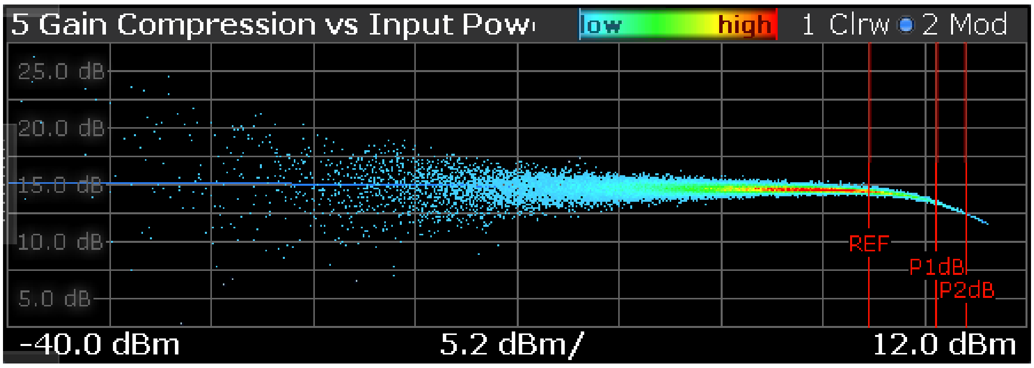
You can analyze the gain characteristics of the measured signal and the modeled signal.

- 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 frequencies, 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 309

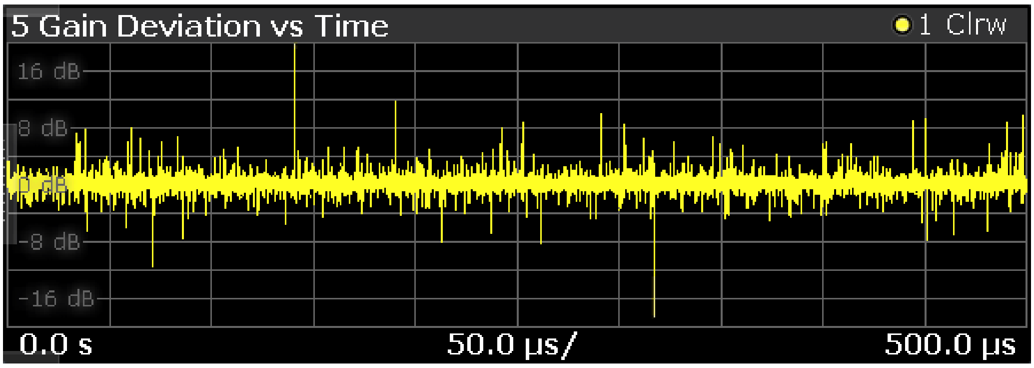
**Gain Deviation vs Time**

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 309

**Magnitude Capture**

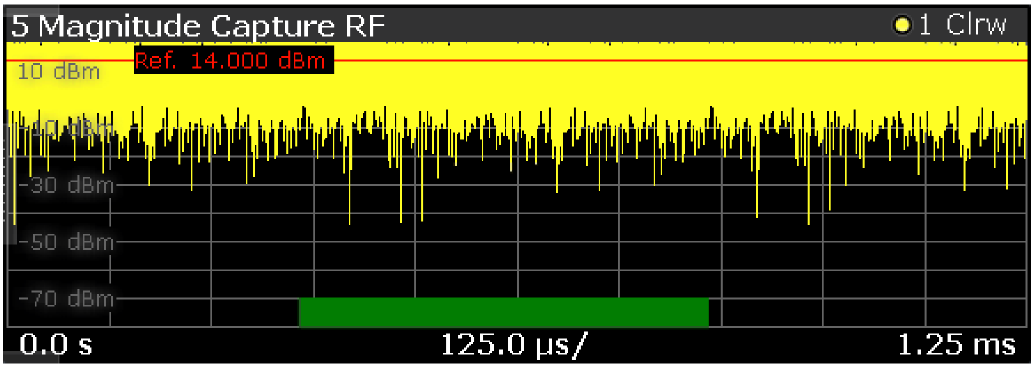
The "Magnitude Capture" result display contains the raw data that has been recorded and thus represents the characteristics of the DUT.

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`
Result query: `TRACe<n>[:DATA]?` on page 309

**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 R&S VSE-K18M installed.

8 Memory DPD Coefficients

| 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 258

**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:**

5 Parameter Sweep Table

| 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 28.

For more information about how to select the parameters, see "Selecting the data to be evaluated during the parameter sweep" on page 122.

Remote command:
Selection: `LAY:ADD? '1',LEFT,PTAB`
Result query: Chapter 5.8.2.3, "Retrieving results of the parameter sweep table", on page 328

**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."

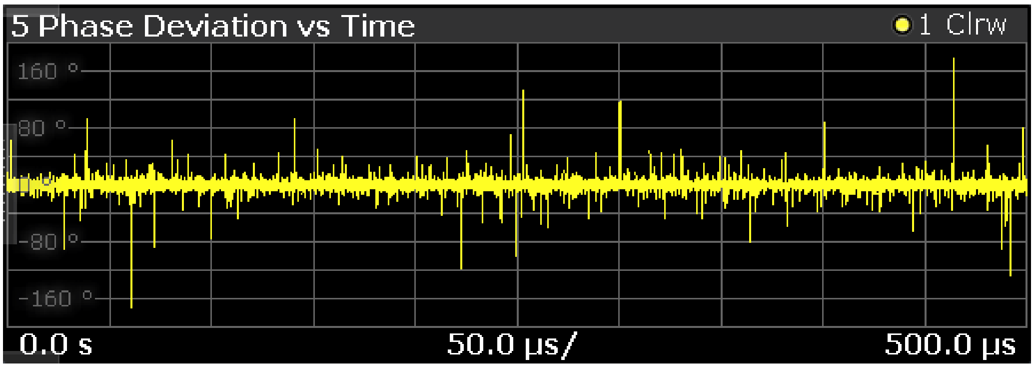
Remote command:
Selection: `LAY:ADD? '1',LEFT,PSW`
Result query: `TRACe<n>[:DATA]?` on page 309

**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 309

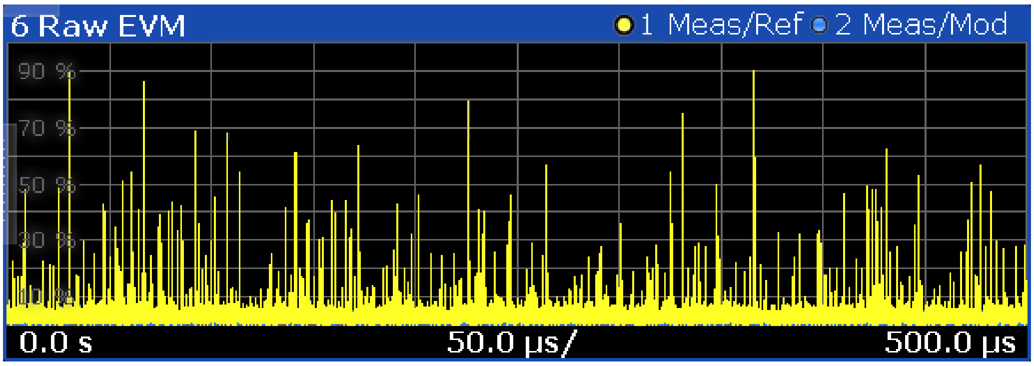
**Raw EVM**
The "Raw EVM" result display shows the error vector magnitude of the signal over time.

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 309

**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

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"

**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 28.

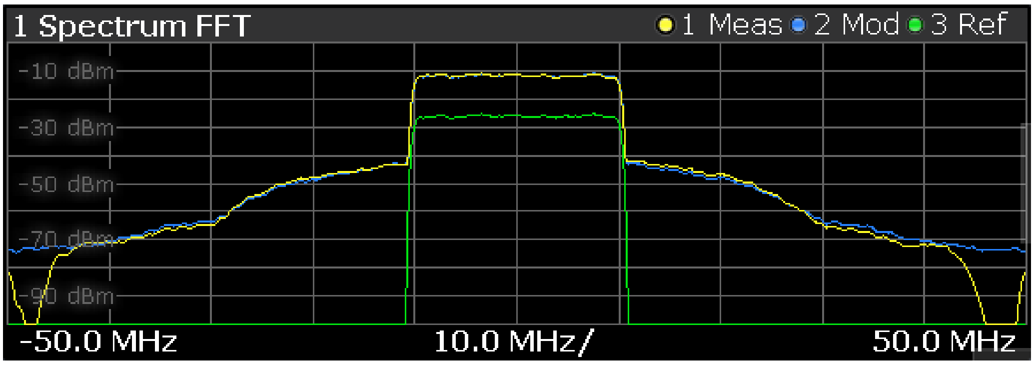
Remote command:
Selecting the result display: `LAY:ADD? '1',LEFT,RTAB`
Querying results: see Chapter 5.8.2, "Retrieving numeric results", on page 311

**Spectrum FFT**

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

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`
Result query: `TRACe<n>[:DATA]?` on page 309

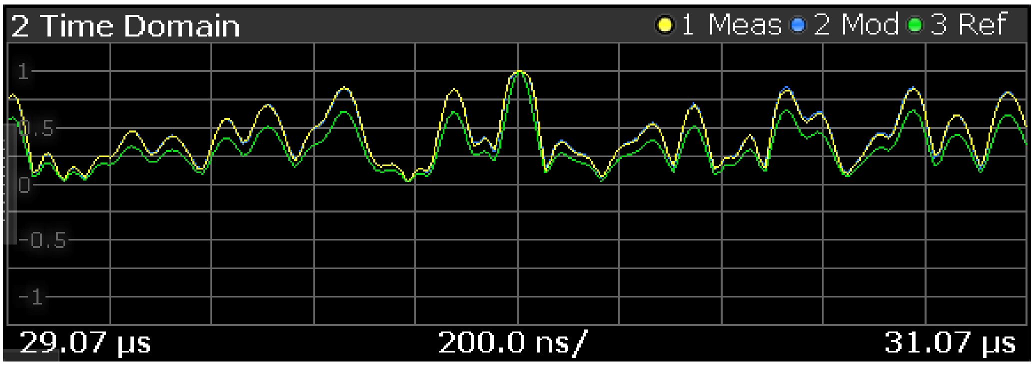
**Time Domain**

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.

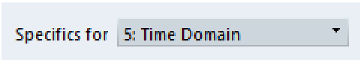



Remote command:
Selection: `LAY:ADD? '1',LEFT,TDOM`
Result query: `TRACe<n>[:DATA]?` on page 309

**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.

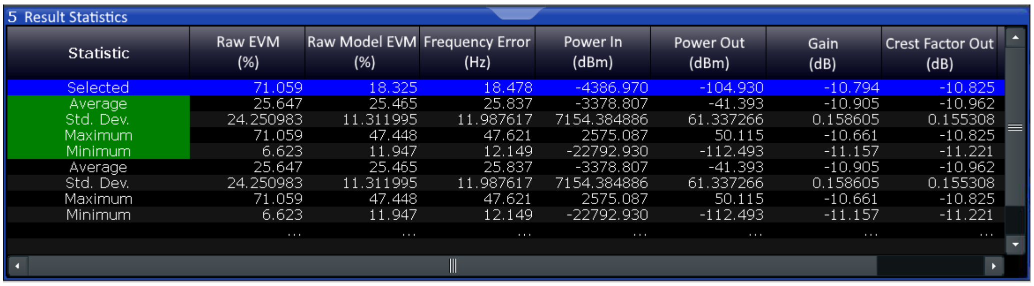
The signal characteristics displayed in the time domain result display all have a different unit. Therefore, the application provides a feature that normalizes all results to 1 (see "Time domain result display" on page 139). Normalization makes it easier to compare the timing between the traces. By default, 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 227. 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.


5 Result Statistics

| 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 28.

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 335

Configuring statistics table: Chapter 5.7.4, "Configuring the statistics table", on page 296
Navigating through results ranges found in a capture: CONFigure:RESult:RANGe[:SELected] on page 227

## 2.2 Amplifier parameters

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



### 2.2.1 Modulation accuracy parameters

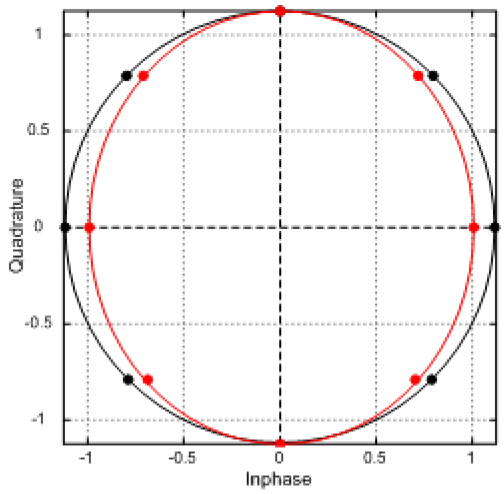


**Amplitude Droop**
Amplitude droop is a measure of the change in magnitude of the signal over the frame (reference signal) being measured in dB.

Note that amplitude droop is not available if the amplitude droop estimation is switched off. See also Chapter 3.9, "Signal error estimation and compensation", on page 96.

Remote command:
`FETCh:MACCuracy:ADRoop:CURRent[:RESult]?` on page 313
`FETCh:STABle:ADRoop:STDeviation?` on page 339

**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 3.9, "Signal error estimation and compensation", on page 96.

Remote command:
`FETCh:MACCuracy:GIMBalance:CURRent[:RESult]?` on page 314
`FETCh:STABle:GIMBalance:STDeviation?` on page 342

**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 3.9, "Signal error estimation and compensation", on page 96.

Remote command:
`FETCh:MACCuracy:FERRor:CURRent[:RESult]?` on page 314
`FETCh:STABle:FERRor:STDeviation?` on page 341

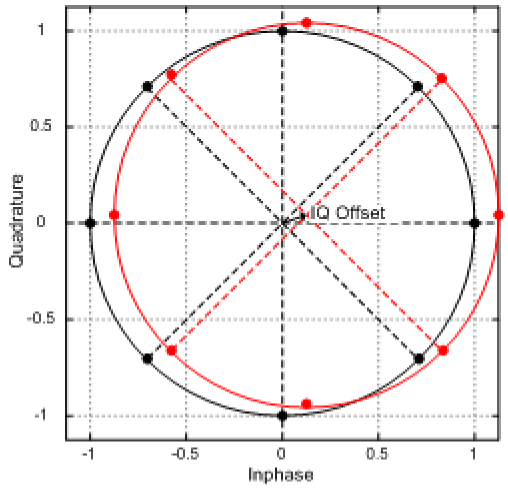
**I/Q Imbalance**
Combination of Quadrature error and Gain imbalance.

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 3.9, "Signal error estimation and compensation", on page 96.

Remote command:
`FETCh:MACCuracy:IQIMbalance:CURRent[:RESult]?` on page 314
`FETCh:STABle:IQIMbalance:STDeviation?` on page 343

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



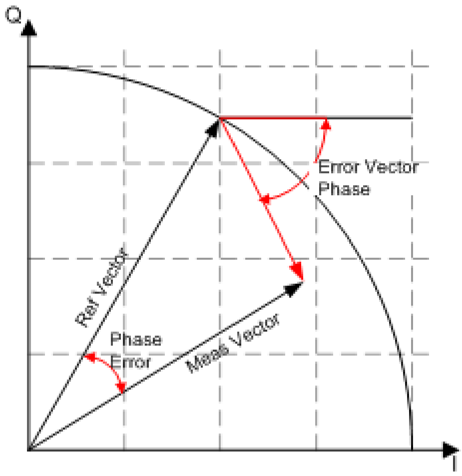

Note that I/Q offset is not available if the I/Q Offset estimation is switched off. See also Chapter 3.9, "Signal error estimation and compensation", on page 96.

Remote command:
`FETCh:MACCuracy:IQOFfset:CURRent[:RESult]?` on page 315
`FETCh:STABle:IQOFfset:STDeviation?` on page 343

**Magnitude Error**
Difference in magnitude between the reference signal and the measured signal.

Remote command:
`FETCh:MACCuracy:MERRor:CURRent[:RESult]?` on page 315
`FETCh:STABle:MERRor:STDeviation?` on page 344

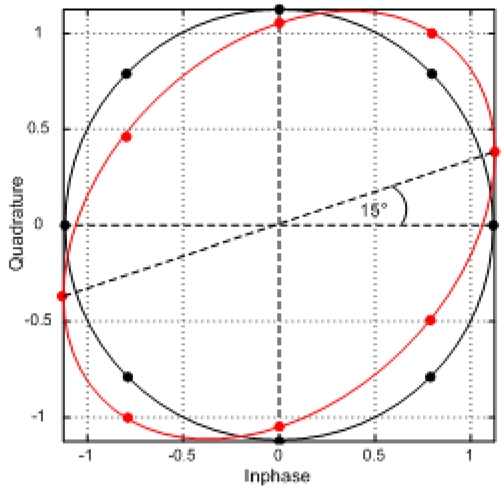
**Phase Error**
Phase difference between the reference and the (unwrapped) measured signal.




Remote command:
`FETCh:MACCuracy:PERRor:CURRent[:RESult]?` on page 315
`FETCh:STABle:PERRor:STDeviation?` on page 348

**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 3.9, "Signal error estimation and compensation", on page 96.

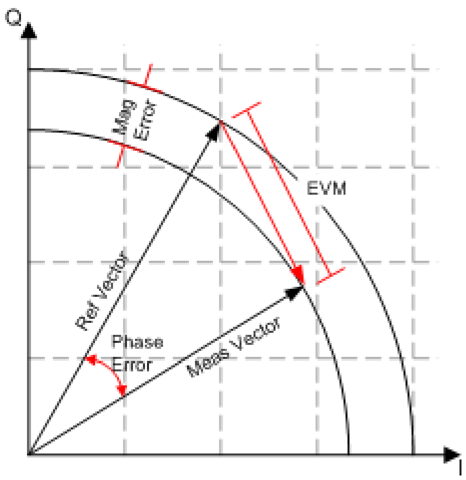
Remote command:

`FETCh:MACCuracy:QERRor:CURRent[:RESult]?` on page 316

`FETCh:STABle:QERRor:STDeviation?` on page 352

**Raw EVM**

Error vector magnitude between synchronized reference and measured signal.




Remote command:

`FETCh:MACCuracy:REVM:CURRent[:RESult]?` on page 317

`FETCh:STABle:REVM:AVG:STDeviation?` on page 352

FETCh:STABle:REVM:MAX:STDeviation? on page 353
FETCh:STABle:REVM:MIN:STDeviation? on page 353
FETCh:PTABle:EVM..., see Chapter 5.8.2.3, "Retrieving results of the parameter sweep table", on page 328.

**Raw Model EVM**
Error vector magnitude between synchronized measured and model signal.

Remote command:
FETCh:MACCuracy:RMEV:CURRent[:RESult]? on page 317
FETCh:STABle:RMEV:AVG:STDeviation? on page 354
FETCh:STABle:RMEV:MAX:STDeviation? on page 354
FETCh:STABle:RMEV:MIN:STDeviation? on page 355

**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 3.9, "Signal error estimation and compensation", on page 96.

Remote command:
FETCh:MACCuracy:SRERror:CURRent[:RESult]? on page 317
FETCh:STABle:SRERor:STDeviation? on page 355

### 2.2.2 Power characteristics



**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 328.

**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 328.

**ACLR Adj Lower**
Power of the lower adjacent channels.

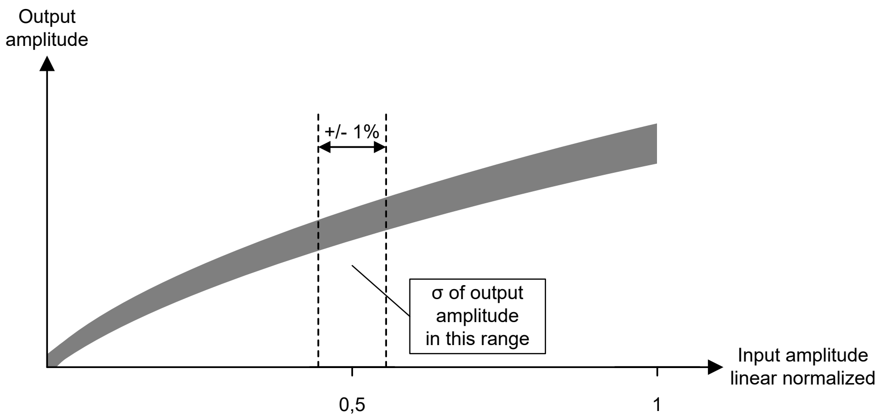
Remote command:
`FETCh:PTABle:ACP:ACHannel<ch>:LOW...`, see Chapter 5.8.2.3, "Retrieving results of the parameter sweep table", on page 328.

**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 328.

**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 319
`FETCh:STABle:AMAM:CWIDth:STDeviation?` on page 339
`FETCh:PTABle:AMAM:CWIDth...`, see Chapter 5.8.2.3, "Retrieving results of the parameter sweep table", on page 328.

**AM/AM Curve Width (Pk-Pk)**

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

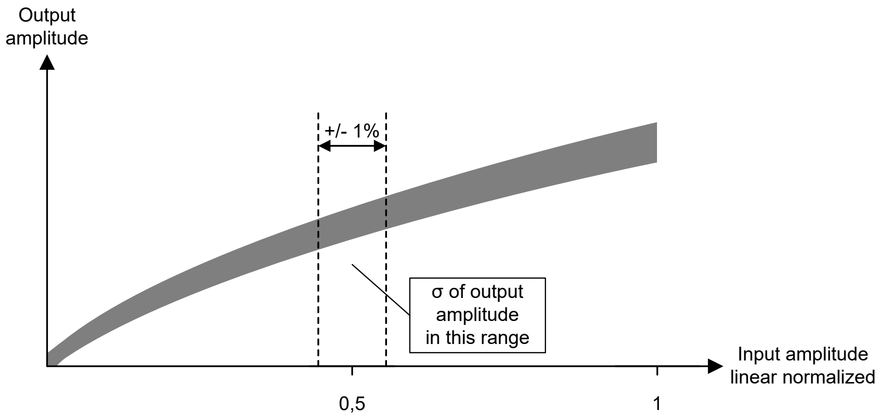
The values are Pk-Pk values, and represent max(output power/dBm) - min(output power/ dBm).

Remote command:
`FETCh:AMAM:PEAK:CWIDth:CURRent[:RESult]?` on page 320

**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 +/- 1% range around the mean amplitude in volt.




Remote command:
`FETCh:AMPM:CWIDth:CURRent[:RESult]?` on page 319
`FETCh:STABle:AMPM:CWIDth:STDeviation?` on page 340
`FETCh:PTABle:AMPM:CWIDth...`, see Chapter 5.8.2.3, "Retrieving results of the parameter sweep table", on page 328.

**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(phase deviation/°) - min(phase deviation/°).

Remote command:
`FETCh:AMPM:PEAK:CWIDth:CURRent[:RESult]?` on page 320

**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 117).

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

Remote command:
`FETCh:POWer:P1DB:CURRent[:RESult]?` on page 323
`FETCh:STABle:P1DB:IN:STDeviation?` on page 344
`FETCh:PTABle:P1DB...`, see Chapter 5.8.2.3, "Retrieving results of the parameter sweep table", on page 328.
`FETCh:POWer:P2DB:CURRent[:RESult]?` on page 323
`FETCh:STABle:P2DB:IN:STDeviation?` on page 345
`FETCh:PTABle:P2DB...`, see Chapter 5.8.2.3, "Retrieving results of the parameter sweep table", on page 328.
`FETCh:POWer:P3DB:CURRent[:RESult]?` on page 323
`FETCh:STABle:P3DB:IN:STDeviation?` on page 346
`FETCh:PTABle:P3DB...`, see Chapter 5.8.2.3, "Retrieving results of the parameter sweep table", on page 328.

**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 321
`FETCh:STABle:CFACtor:IN:STDeviation?` on page 340

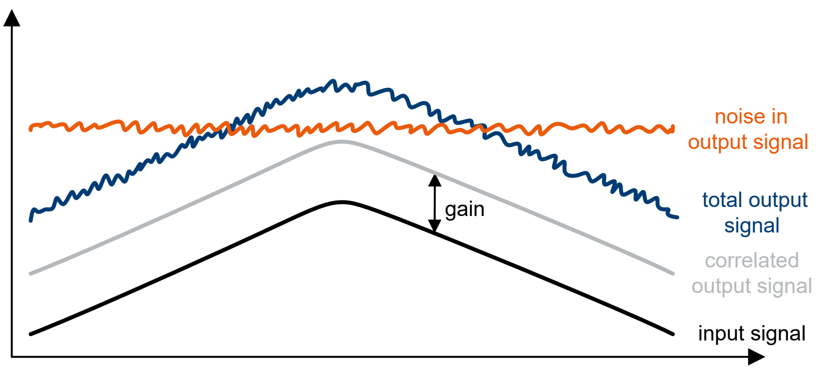
**Crest Factor Out**

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 321
`FETCh:STABle:CFACtor:OUT:STDeviation?` on page 341
`FETCh:PTABle:CFACtor...`, see Chapter 5.8.2.3, "Retrieving results of the parameter sweep table", on page 328.

**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 321
FETCh:STABle:GAIN:STDeviation? on page 342
FETCh:PTABle:GAIN..., see Chapter 5.8.2.3, "Retrieving results of the parameter sweep table", on page 328.

**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 324
FETCh:STABle:P1DB:OUT:STDeviation? on page 345
FETCh:POWer:P2DB:OUT:CURRent[:RESult]? on page 324
FETCh:STABle:P2DB:OUT:STDeviation? on page 346
FETCh:POWer:P3DB:OUT:CURRent[:RESult]? on page 324
FETCh:STABle:P3DB:OUT:STDeviation? on page 347

**Occupied Bandwidth**
Occupied bandwidth calculated for the defined evaluation range.

Remote command:
FETCh:POWer:OBW:CURRent[:RESult]? on page 322

**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 322
FETCh:STABle:POWer:INPut:AVG:STDeviation? on page 349
FETCh:STABle:POWer:INPut:MAX:STDeviation? on page 349
FETCh:STABle:POWer:INPut:MIN:STDeviation? on page 350

**Power Out**
Signal power at the DUT output.

It is the RMS power of:
- The currently selected frame, if R&S VSE-K18 has successfully synchronized.
- The current capture buffer, if R&S VSE-K18 has not synchronized.

Remote command:
FETCh:POWer:OUTPut:CURRent[:RESult]? on page 322
FETCh:STABle:POWer:OUTPut:AVG:STDeviation? on page 350
FETCh:STABle:POWer:OUTPut:MAX:STDeviation? on page 351
FETCh:STABle:POWer:OUTPut:MIN:STDeviation? on page 351
FETCh:PTABle:POUT..., see Chapter 5.8.2.3, "Retrieving results of the parameter sweep table", on page 328.

**Power Out (Sensor)**
Signal power at the output power sensor.

Remote command:
FETCh:POWer:SENSor:OUT:CURRent[:RESult]? on page 325

**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 328.

# 3 Configuration



## 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 3.2, "Reference signals", on page 40.
2. Input and output
   See Chapter 3.3, "Inputs and outputs", on page 51.
3. Trigger
   See Chapter 3.4, "Triggering", on page 86.
4. Data Acquisition
   See Chapter 3.5, "Data acquisition", on page 87.
5. Synchronization, error estimation and compensation
   See Chapter 3.7, "Synchronization", on page 92.
   See Chapter 3.9, "Signal error estimation and compensation", on page 96.
6. Measurement
   Modeling: see Chapter 3.11, "System models", on page 99.
   DPD: see Chapter 3.12, "Digital predistortion", on page 102.
7. Result configuration
   See Chapter 4, "Analysis", on page 127.
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.

Remote command:
`SYSTem:PRESet:CHANnel[:EXEC]` on page 150

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

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

## 3.2 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.

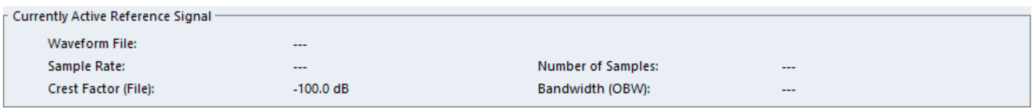
The remote commands required to configure the reference signal are described in Chapter 5.6.1, "Designing a reference signal", on page 160.



### 3.2.1 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.




- 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 168
Sample rate: CONFigure:REFSignal:SINFo:SRATe? on page 169
Sample length: CONFigure:REFSignal:SINFo:SLENgth? on page 168
Crest Factor: CONFigure:REFSignal:SINFo:CFACtor? on page 169
OBW: CONFigure:REFSignal:SINFo:OBW? on page 169
reference trace I/Q data: TRACe:IQ:REF[:DATA]? on page 356

### 3.2.2 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 168

### 3.2.3 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 3.3.6, "Controlling a signal generator", on page 67.

- 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 VSE-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 VSE-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.
  Check if the generator IP address / computer name are correct and if the connection has been established.

### 3.2.4 Current Generator Waveform

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

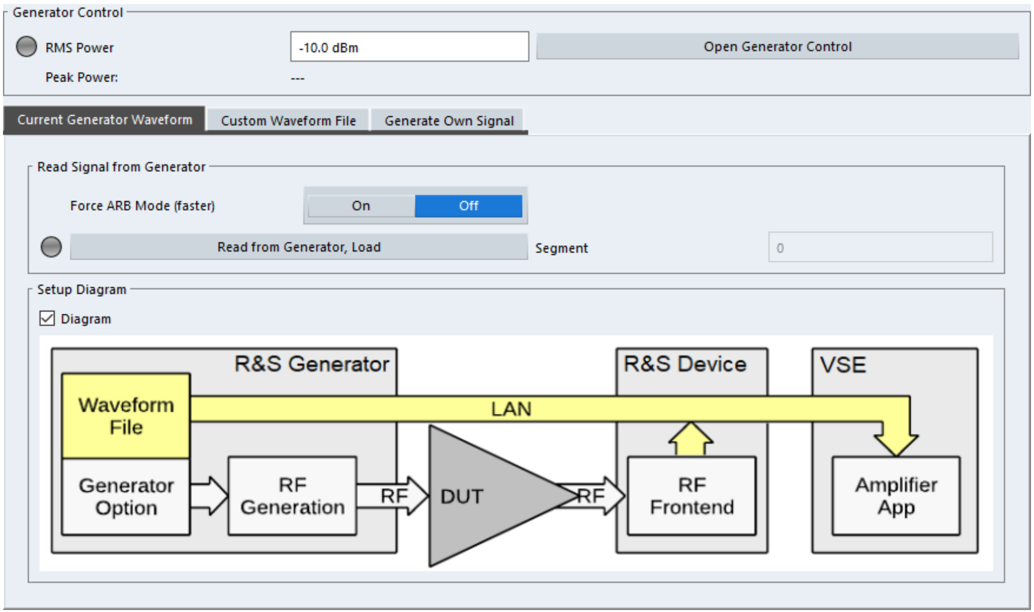
**Designing a reference signal on a signal generator**
One way to design a reference signal is to design the signal on the signal generator itself.

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 40.

The "Open Generator Control" button provides functionality to change the generator settings as described in Chapter 3.3.6, "Controlling a signal generator", on page 67.




Most of the options available for the connected generator are supported by the automatic signal import functionality of the R&S VSE-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 161
`CONFigure:REFSignal:CGW:READ` on page 162
`CONFigure:REFSignal:CGW:LEDState?` on page 162

### 3.2.5 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.

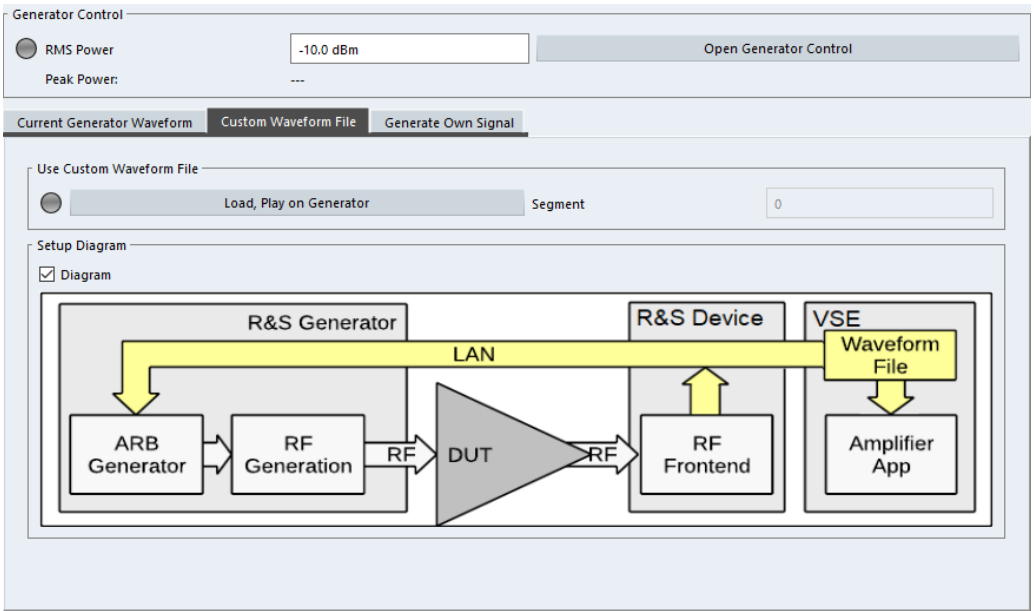
There are two ways to generate the reference signal through a custom waveform file.

- The generator is connected to the R&S VSE in a LAN, and can be recognized by the R&S VSE-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 VSE-K18. The generator then generates the corresponding signal with the appropriate signal level, and the R&S VSE-K18 is able to compare the measured signal to the ideal reference signal.
- The generator is not connected to the R&S VSE
  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 40.

The "Open Generator Control" button provides functionality to change the generator settings as described in Chapter 3.3.6, "Controlling a signal generator", on page 67.

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 163
Transfer file: `CONFigure:REFSignal:CWF:WRITe` on page 164
Transmission state: `CONFigure:REFSignal:CWF:LEDState?` on page 163
DUT input power: `CONFigure:REFSignal:CWF:DPIPower` on page 162

### 3.2.6 Generate Own Signal

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

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

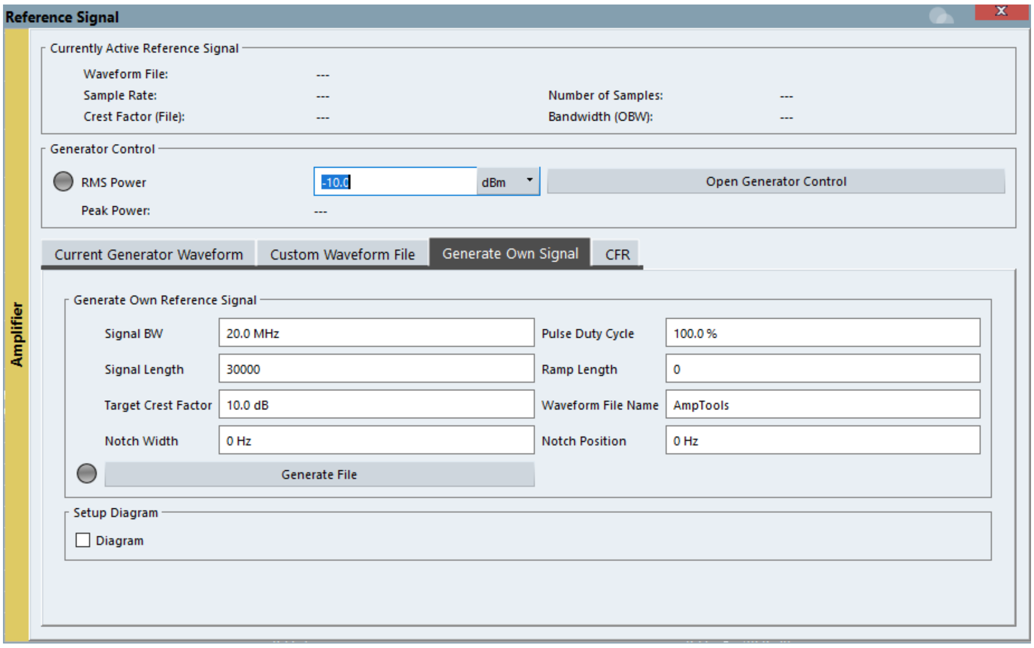
The generated signal is a pseudo-noise signal, whose basic properties, like crest factor and bandwidth, you can specify as required.

The parameters of the currently active reference signal are described in "Reference signal information" on page 40.

The "Open Generator Control" button provides functionality to change the generator settings as described in Chapter 3.3.6, "Controlling a signal generator", on page 67.

***Table 3-1: Parameter dependencies***

| Parameter | Min Value | Max Value |
|---|---|---|
| Target Crest Factor | 2 | 13 |
| Signal Length | ((N+2*RampLength)*100)/PulseDutyCycle<br>N=1000 for Target Crest Factor < 12.5 dB<br>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 %<br>Otherwise (Signal Length*PulseDutyCycle/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 46
- "Pulse Duty Cycle" on page 46
- "Signal Length" on page 47
- "Ramp Length" on page 47
- "Target Crest Factor" on page 47
- "Waveform File Name" on page 47
- "Notch Width" on page 47
- "Notch Position" on page 48

Remote command:
`CONFigure:REFSignal:GOS:WRITe` on page 167
`CONFigure:REFSignal:GOS:LEDState?` on page 165

**Signal Bandwidth ← Designing a reference signal within the R&S VSE-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 164

**Pulse Duty Cycle ← Designing a reference signal within the R&S VSE-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 µs. The actual length of the pulse is 1 µs. The duty cycle is 1 µs : 2 µs = 0.5 or 50 %.

Remote command:
`CONFigure:REFSignal:GOS:DCYCle` on page 164

**Signal Length ← Designing a reference signal within the R&S VSE-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 46.

Remote command:
`CONFigure:REFSignal:GOS:SLENgth` on page 167

**Ramp Length ← Designing a reference signal within the R&S VSE-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 166

**Target Crest Factor ← Designing a reference signal within the R&S VSE-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 164

**Waveform File Name ← Designing a reference signal within the R&S VSE-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 167

**Notch Width ← Designing a reference signal within the R&S VSE-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 166

**Notch Position** ← **Designing a reference signal within the R&S VSE-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 166

## 3.2.7 CFR (Crest Factor Reduction)

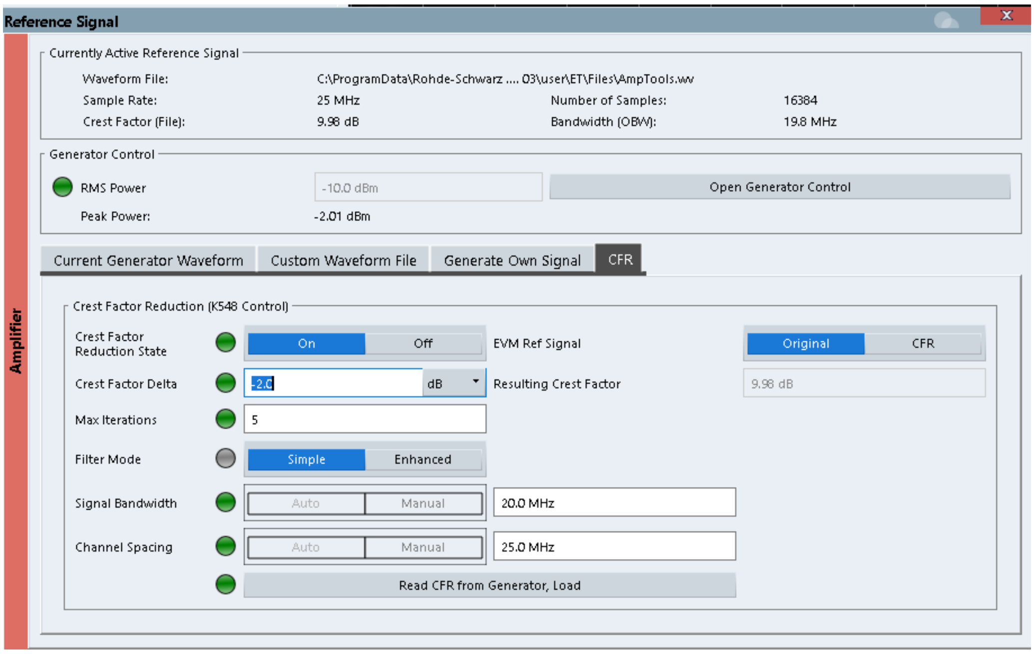
**Access** (source: K548 control): "Overview" > "Reference Signal" > "CFR"

**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).



**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 R&S VSE-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 R&S VSE-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 170
`CONFigure:CFReduction[:STATe]:LEDState?` on page 170

**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 171

**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 172
`CONFigure:CFReduction:CFDelta:LEDState?` on page 173

**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 173

**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 171
`CONFigure:CFReduction:ITERations:LEDState?` on page 171

**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 171
`CONFigure:CFReduction:FILTer:LEDState?` on page 171

**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 170
`CONFigure:CFReduction:SBANdwidth:AUTO` on page 170
`CONFigure:CFReduction:SBANdwidth:LEDState?` on page 170

**Channel Spacing ← Crest Factor Reduction (Generator Option K548)**
Sets the channel spacing.

Remote command:
`CONFigure:CFReduction:CSPacing` on page 172
`CONFigure:CFReduction:CSPacing:AUTO` on page 172
`CONFigure:CFReduction:CSPacing:LEDState?` on page 172

**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 174
`CONFigure:CFReduction:READ:LEDState?` on page 174

**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 174
`CONFigure:CFReduction:PFRequency:LEDState?` on page 175

**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 175
`CONFigure:CFReduction:SFRequency:LEDState?` on page 175

**Maximum Filter Order ← Crest Factor Reduction (Generator Option K548)**
Sets the maximum filter order. Only available for "Enhanced" filter mode.

Remote command:
`CONFigure:CFReduction:MFORder` on page 174
`CONFigure:CFReduction:MFORder:LEDState?` on page 174

# 3.3 Inputs and outputs



## 3.3.1 Input source settings

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

**Or**: "Input & Output" > "Input Source"

The R&S VSE can control the input sources of the connected instruments.



### 3.3.1.1 Radio frequency input

**Or**: "Input & Output" > "Input Source" > "Radio Frequency"

The default input source for the connected instrument is "Radio Frequency". Depending on the connected instrument, different input parameters are available.

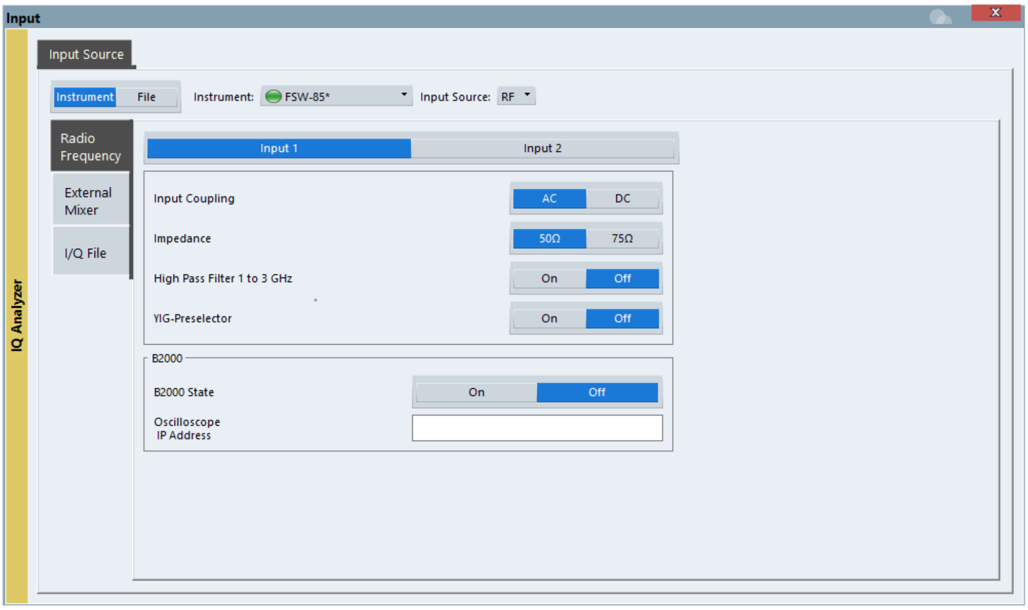



*Figure 3-1: RF input source settings for an R&S FSW with B2000 option*

If the Frequency Response Correction option (R&S VSE-K544) is installed, the Amplifier measurement application also supports frequency response correction using Touchstone (`.snp`) files or `.fres` files.



**Input Type (Instrument / File)**
Selects an instrument or a file as the type of input provided to the channel.

**Note:** External mixers are only available for input from a connected instrument.

**Note:** If the R&S VSE software is installed directly on an instrument, or integrated in Cadence®AWR®VSS, some restrictions apply on the available input type.

Remote command:
`INSTrument:BLOCk:CHANnel[:SETTings]:SOURce<si>` on page 194
`INPut:SELect` on page 193

**Instrument**
Specifies a configured instrument to be used for input.

**Input 1 / Input 2**
For instruments with two input connectors, you must define which input source is used for each measurement channel.

If an external frontend is active, select the connector the external frontend is connected to. You cannot use the other RF input connector simultaneously for the same channel. However, you can configure the use of the other RF input connector for another active channel at the same time.

| | |
|---|---|
| "Input 1" | R&S FSW85: 1.00 mm RF input connector for frequencies up to 85 GHz (90 GHz with option R&S FSW-B90G) |
| "Input2" | R&S FSW85: 1.85 mm RF input connector for frequencies up to 67 GHz |

Remote command:
`INPut:TYPE` on page 194

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

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

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 data sheet.

Remote command:
`INPut<ip>:COUPling<ant>` on page 189

**Impedance**
For some measurements, the reference impedance for the measured levels of the connected instrument can be set to 50 Ω or 75 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).

Remote command:
`INPut<ip>:IMPedance<ant>` on page 191

**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.

| | |
|---|---|
| "Auto" | (Default) The direct path is used automatically for frequencies close to zero. |
| "Off" | The analog mixer path is always used. |

Remote command:
`INPut<ip>:DPATh` on page 189

**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.

For some connected instruments, this function requires an additional hardware option on the instrument.

**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<ip>:FILTer:HPASs[:STATe]` on page 190

**YIG-Preselector**
Enables or disables the YIG-preselector.

This setting requires an additional option on the connected instrument.

An internal YIG-preselector at the input of the connected instrument 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 connected instrument, which can lead to image-frequency display.

**Note:** Note that the YIG-preselector is active only higher frequencies, depending on the connected instrument. 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 (R&S FSW-B90G), the YIG-preselector must be disabled.

To use the optional 54 GHz frequency extension (R&S FSV3-B54G), the YIG-preselector must be disabled.

Remote command:
`INPut<ip>:FILTer:YIG[:STATe]` on page 190

**B2000 State**
Activates the optional 2 GHz bandwidth extension (R&S FSW-B2000).

**Note:** The R&S VSE software supports input from a connected R&S FSW with a B2000 option installed. However, the R&S FSW interface to the oscilloscope must be set up and aligned directly on the instrument before the R&S VSE software can start analyzing the input.
The analysis bandwidth is defined in the data acquisition settings of the application as usual. Note that the maximum bandwidth cannot be restricted manually as for other bandwidth extension options.

Manual operation on the connected oscilloscope, or remote operation other than by the R&S VSE, is not possible while the B2000 option is active.

Remote command:
`SYSTem:COMMunicate:RDEVice:OSCilloscope[:STATe]` on page 195

**Oscilloscope Splitter Mode**
Activates the use of the power splitter inserted between the "IF 2 GHZ OUT" connector of the R&S FSW and the "CH1" and "CH3" input connectors of the oscilloscope. Note that this mode requires an additional alignment with the power splitter.

For details see the R&S FSW I/Q Analyzer and I/Q Input user manual.

Remote command:
`SYSTem:COMMunicate:RDEVice:OSCilloscope:PSMode[:STATe]` on page 196

**Oscilloscope IP Address**
When using the optional 2 GHz bandwidth extension (R&S FSW-B2000) with an R&S FSW as the connected instrument, the entire measurement, as well as both instruments, are controlled by the R&S VSE software. Thus, the instruments must be connected via LAN, and the TCPIP address of the oscilloscope must be defined in the R&S VSE software.

For tips on how to determine the computer name or TCPIP address, see the oscilloscope's user documentation.

Remote command:
`SYSTem:COMMunicate:RDEVice:OSCilloscope:TCPip` on page 196

**Preselector State**
Turns the preselector on and off.

When you turn on the preselector, you can configure the characteristics of the preselector and add the preamplifier into the signal path.

When you turn off the preselector, the signal bypasses the preselector and the preamplifier, and is fed into the input mixer directly.

Remote command:
`INPut<ip>:PRESelection[:STATe]` on page 191

**Preselector Mode**
Selects the preselection filters to be applied to the measurement.

"Auto" Automatically applies all available bandpass filters in a measurement.
Available with the optional preamplifier.

"Auto Wide" Automatically applies the wideband filters consecutively:

- Lowpass 40 MHz
- Bandpass 30 MHz to 2250 MHz
- Bandpass 2 GHz to 8 GHz
- Bandpass 8 GHz to 26.5 GHz

Available with the optional preselector.

"Auto Narrow" Automatically applies the most suitable narrowband preselection filters in a measurement, depending on the bandwidth you have selected.
For measurement frequencies up to 30 MHz, the connected instrument uses combinations of lowpass and highpass filters. For higher frequencies, the connected instrument uses bandpass filters.
Available with the optional preselector.

"Manual" Applies the filter settings you have defined manually.

Remote command:
`INPut<ip>:PRESelection:SET` on page 191

**10 dB Minimum Attenuation**
Turns the availability of attenuation levels of less than 10 dB on and off.

When you turn on this feature, the attenuation is always at least 10 dB. This minimum attenuation protects the input mixer and avoids accidental setting of 0 dB, especially if you measure EUTs with high RFI voltage.

When you turn it off, you can also select attenuation levels of less than 10 dB.

The setting applies to a manual selection of the attenuation as well as the automatic selection of the attenuation.

Remote command:
`INPut:ATTenuation:PROTection:RESet` on page 188

#### 3.3.1.2 I/Q file input

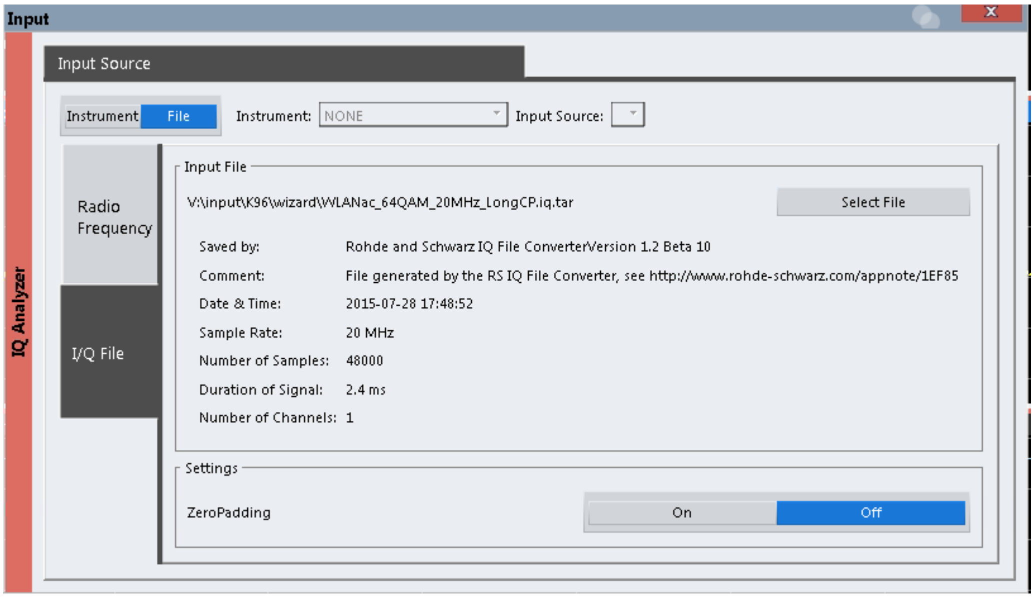
**Or**: "Input & Output" > "Input Source" > "I/Q File"

**Loading a file via drag&drop**

You can load a file simply by selecting it in a file explorer and dragging it to the R&S VSE software. Drop it into the "Measurement Group Setup" window or the channel bar for any channel. The channel is automatically configured for file input, if necessary. If the file contains all essential information, the file input is immediately displayed in the channel. Otherwise, the "Recall I/Q Recording" dialog box is opened for the selected file so you can enter the missing information.

If the file contains data from multiple channels (e.g. from LTE measurements), it can be loaded to individual input sources, if the application supports them.

The "Input Source" settings defined in the "Input" dialog box are identical to those configured for a specific channel in the "Measurement Group Setup" window.



If the Frequency Response Correction option (R&S VSE-K544) is installed, the Amplifier measurement application also supports frequency response correction using Touchstone (`.snp`) files or `.fres` files.

Encrypted `.wv` files can also be imported. Note, however, that traces resulting from encrypted file input cannot be exported or stored in a saveset.



**Input Type (Instrument / File)**
Selects an instrument or a file as the type of input provided to the channel.

**Note:** External mixers are only available for input from a connected instrument.

**Note:** If the R&S VSE software is installed directly on an instrument, or integrated in Cadence®AWR®VSS, some restrictions apply on the available input type.

Remote command:
`INSTrument:BLOCk:CHANnel[:SETTings]:SOURce<si>` on page 194
`INPut:SELect` on page 193

**Input File**
Specifies the I/Q data file to be used for input.

Select "Select File" to open the "Load I/Q File" dialog box.

**Zero Padding**
Enables or disables zero padding for input from an I/Q data file that requires resampling. For resampling, a number of samples are required due to filter settling. These samples can either be taken from the provided I/Q data, or the software can add the required number of samples (zeros) at the beginning and end of the file.

If enabled, the required number of samples are inserted as zeros at the beginning and end of the file. The entire input data is analyzed. However, the additional zeros can effect the determined spectrum of the I/Q data. If zero padding is enabled, a status message is displayed.

If disabled (default), no zeros are added. The required samples for filter settling are taken from the provided I/Q data in the file. The start time in the R&S VSE Player is adapted to the actual start (after filter settling).

**Note:** You can activate zero padding directly when you load the file, or afterwards in the "Input Source" settings.

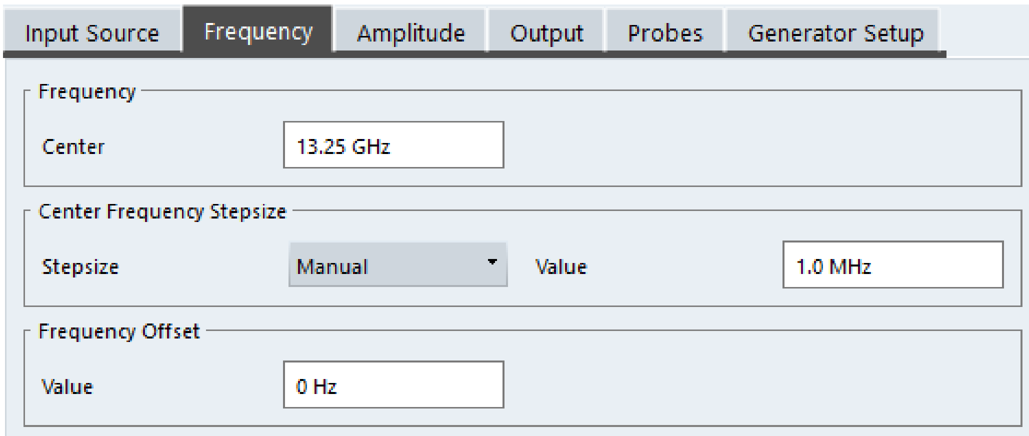
Remote command:
`INPut<ip>:FILE:ZPADing` on page 189

## 3.3.2 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 R&S VSE user manual.




The remote commands required to configure the frequency are described in Chapter 5.6.4, "Configuring the frequency", on page 205.



**Center Frequency**

Defines the frequency of the measured signal.

The possible value range depends on the R&S VSE model you have. See the data sheet for more information about the supported frequency range.

Remote command:
`[SENSe<ip>:]FREQuency:CENTer` on page 205

**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 205

**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.

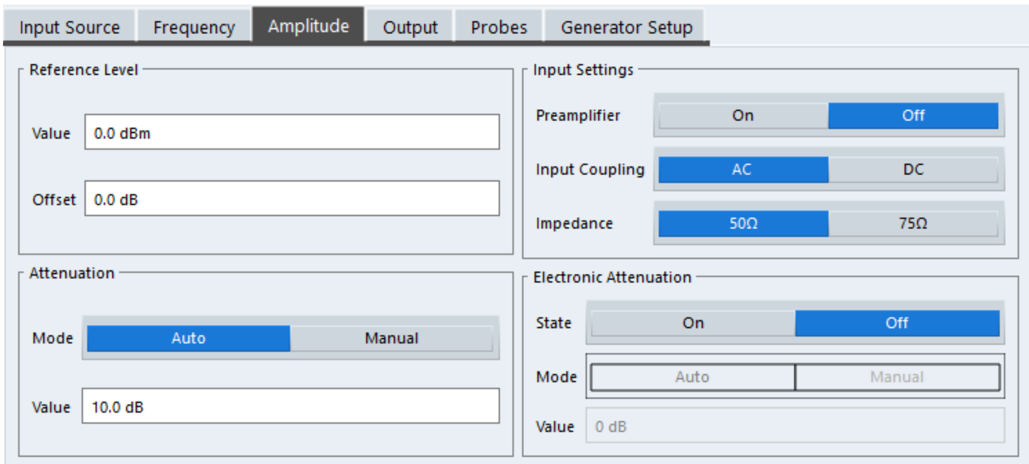
Remote command:
`[SENSe<ip>:]FREQuency:OFFSet` on page 206

### 3.3.3 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 R&S VSE user manual.




The remote commands required to configure the amplitude are described in Chapter 5.6.5, "Defining level characteristics", on page 206.

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

- "Input Coupling " on page 53
- "Impedance " on page 53

**Reference Level**
Defines the expected maximum input signal level. Signal levels above this value are possibly not measured correctly, which is indicated by the "IF Overload" status display.

Defines the expected maximum reference level. Signal levels above this value are possibly not measured correctly. Signals above the reference level are indicated by an "IF Overload" status display.

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 connected instrument 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).

Remote command:
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant> on page 206

**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 R&S VSE 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 VSE-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 R&S VSE 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<ant>:OFFSet on page 207

**Setting the Reference Level Automatically (Auto Level ) ← Reference Level**
The connected instrument automatically determines the optimal reference level for the current input data. At the same time, the internal attenuators and the preamplifier are adjusted so the signal-to-noise ratio is optimized, while signal compression, clipping and overload conditions are minimized. This function is not available on all supported instruments.

Remote command:
[SENSe<ip>:]ADJust:LEVel on page 212

**Input Coupling**

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

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

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 data sheet.

Remote command:

`INPut<ip>:COUPling<ant>` on page 189

**Impedance**

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

Remote command:

`INPut<ip>:IMPedance<ant>` on page 191

**Attenuation Mode / Value**

Defines the attenuation applied to the RF input of the R&S VSE.

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.

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 data sheet. If the defined reference level cannot be set for the defined RF attenuation, the reference level is adjusted accordingly and the warning "limit reached" is displayed.

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

Remote command:

`INPut<ip>:ATTenuation` on page 207
`INPut<ip>:ATTenuation:AUTO` on page 208

**Using Electronic Attenuation**

If the (optional) Electronic Attenuation hardware is installed on the connected instrument, 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.

**Note:** Note that restrictions can apply concerning which frequencies electronic attenuation is available for, depending on which instrument is connected to the R&S VSE software. Check your instrument documentation for details.
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.

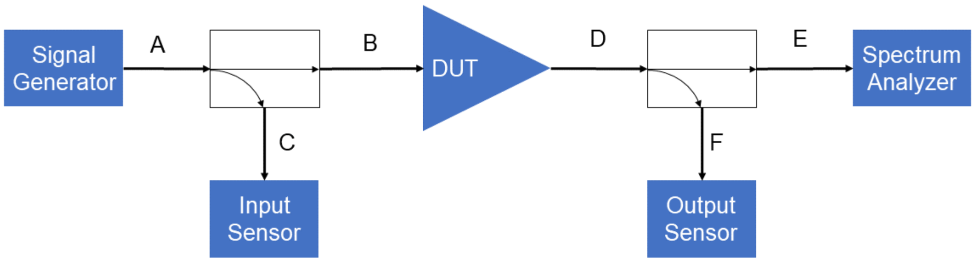
If the defined reference level cannot be set for the given attenuation, the reference level is adjusted accordingly and the warning "limit reached" is displayed in the status bar.

Remote command:
`INPut:EATT:STATe` on page 209
`INPut:EATT:AUTO` on page 209
`INPut:EATT` on page 208

## 3.3.4 Power sensors

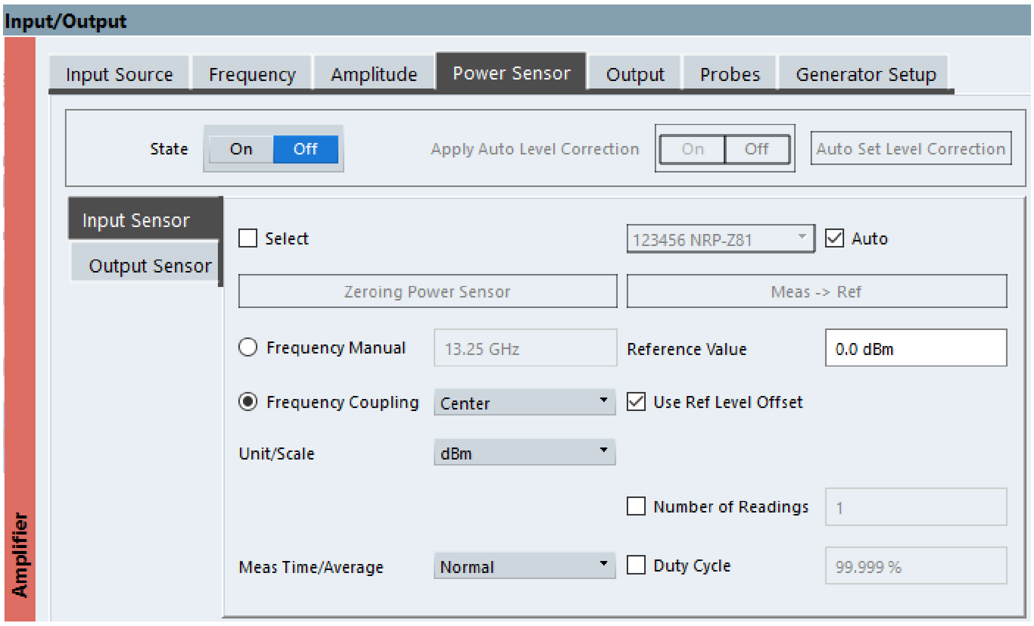
**Access**: "Overview" > "Input" > "Power Sensor" tab

A typical measurement using power sensors in the R&S VSE-K18 application is set up as shown below:




For details on working with power sensors, see the R&S VSE User Manual.

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






**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 183
`[SENSe:]PMETer:LEVel:CORRection:APPLy` on page 183

**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 182
`SYSTem:COMMunicate:RDEVice:PMETer<p>:DEFine` on page 177
`SYSTem:COMMunicate:RDEVice:PMETer<p>:CONFigure:AUTO[:STATe]` on page 176
`SYSTem:COMMunicate:RDEVice:PMETer<p>:COUNt?` on page 176

**Zeroing Power Sensor**
Starts zeroing of the power sensor.

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

Remote command:
`CALibration:PMETer<p>:ZERO:AUTO ONCE` on page 177

**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 180

**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 180

**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 184
`UNIT<n>:PMETer<p>:POWer:RATio` on page 184

**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 181
`[SENSe:]PMETer<p>:MTIMe:AVERage[:STATe]` on page 181

**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 178

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

Remote command:
`CALCulate<n>:PMETer<p>:RELative[:MAGNitude]` on page 178

**Use Ref Level Offset**
If deactivated, takes the Sensor Level Offset into account.

Remote command:
`[SENSe:]PMETer<p>:ROFFset[:STATe]` on page 182

**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 182

**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 181

**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 179
`[SENSe:]PMETer<p>:DCYCle:VALue` on page 179

**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 connected instrument.

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

Remote command:
`[SENSe:]PMETer<p>:TRIGger[:STATe]` on page 187
`TRIG:SOUR PSE`, see `TRIGger[:SEQuence]:SOURce` on page 183

**External Trigger Level ← Using the power sensor as an external trigger**
Defines the trigger level for the power sensor trigger.

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

Remote command:
`[SENSe:]PMETer<p>:TRIGger:LEVel` on page 186

**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 186

**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 185

**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 186

### 3.3.5 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 R&S VSE.

The functionality is the same as in the spectrum application. For more information about the output functions, refer to the R&S VSE user manual.

### 3.3.6 Controlling a signal generator

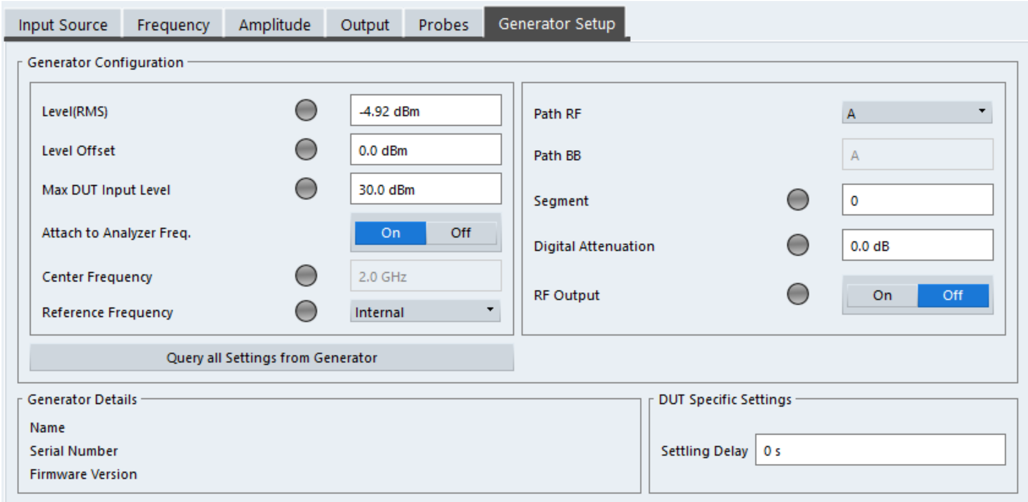
**Access**: "Overview" > "Input / Output" > "Generator Setup"

The "Generator Setup" tab of the "Input / Output" dialog box contains settings to control the signal generator from within the R&S VSE-K18. A remote control connection between the R&S VSE 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.




The remote commands required to configure the generator are described in Chapter 5.6.6, "Controlling a signal generator", on page 212.

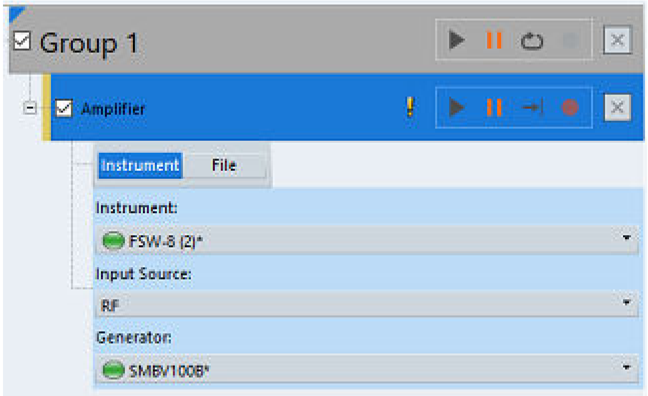
**State of operation**

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.

The "Generator Control" functions are activated, when a signal generator is selected in the RF generator selection box:




If no signal generator is selected ("NONE"), the "Generator Control" functions are turned off.

**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 VSE-K18. To restore the original settings defined within the R&S VSE-K18, use that button to restore the generator settings.

Remote command:

`CONFigure:GENerator:SETTings:UPDate` on page 219

**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 R&S VSE.

Remote command:

`CONFigure:SETTings` on page 220

**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 R&S VSE shows if the connection state, and, if the connection was successful, the connected generator type.

Remote command:
`CONFigure:GENerator:CONNection:CSTate?` on page 216

**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 VSE-K18 user interface and thus synchronize the levels of both instruments.
If you change the generator level on the signal generator, the R&S VSE-K18 does not synchronize the levels and measurement results are going to be invalid.

Remote command:
RMS level: `CONFigure:GENerator:POWer:LEVel` on page 216
`CONFigure:GENerator:POWer:LEVel:LEDState?` on page 217
Level offset: `CONFigure:GENerator:POWer:LEVel:OFFSet` on page 217
`CONFigure:GENerator:POWer:LEVel:OFFSet:LEDState?` on page 218

**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 213
`CONFigure:GENerator:DUT:INPut:MAXimum:POWer:LEDState?` on page 213

**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 215

**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 214
`CONFigure:GENerator:FREQuency:CENTer:LEDState?` on page 215

**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 R&S VSE.

Remote command:
`CONFigure:GENerator:EXTernal:ROSCillator` on page 214
`CONFigure:GENerator:EXTernal:ROSCillator:LEDState?` on page 214

**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 220
BB path: `CONFigure:GENerator:TARGet:PATH:BB?` on page 220

**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 219
`CONFigure:GENerator:SEGMent:LEDState?` on page 219

**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 216

**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 218
`CONFigure:GENerator:RFOutput:LEDState?` on page 218

**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 R&S VSE 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 213

## 3.3.7 Reference: I/Q file input



### 3.3.7.1 Basics on input from I/Q data files

The I/Q data to be evaluated in a particular R&S VSE 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.

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 R&S VSE 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.

**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.

#### 3.3.7.2 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:\ProgramData\Rohde-Schwarz\VSE\<version_no>\user\Demo\ directory on the R&S VSE.

These files are also available in the demo mode of the R&S VSE software.

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

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>R&S VSE</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 `fileFormatVersion` 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. |

| Element | Possible Values | Description |
|---|---|---|
| `<DateTime>` | yyyy-mm-ddThh:mm:ss | Contains the date and time of the creation of the file. Its type is `xs:dateTime` (see `RsIqTar.xsd`). |
| `<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:<br>● A complex number represented as a pair of I and Q values<br>● A complex number represented as a pair of magnitude and phase values<br>● A real number represented as a single real value<br>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 `unit` 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:<br>● `complex`: Complex number in cartesian format, i.e. I and Q values interleaved. I and Q are unitless<br>● `real`: Real number (unitless)<br>● `polar`: Complex number in polar format, i.e. magnitude (unitless) and phase (rad) values interleaved. Requires `DataType` = `float32` or `float64` |
| `<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 84). The following data types are allowed:<br>● `int8`: 8 bit signed integer data<br>● `int16`: 16 bit signed integer data<br>● `int32`: 32 bit signed integer data<br>● `float32`: 32 bit floating point data (IEEE 754)<br>● `float64`: 64 bit floating point data (IEEE 754) |
| `<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.<br>The attribute `unit` must be set to "`V`".<br>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 84). If the `<NumberOfChannels>` element is not defined, one channel is assumed. |

| Element | Possible Values | Description |
|---|---|---|
| <DataFilename> | | Contains the filename of the I/Q data binary file that is part of the iq-tar file.<br>It is recommended that the filename uses the following convention:<br><xyz>.<Format>.<Channels>ch.<Type><br>● <xyz> = a valid Windows file name<br>● <Format> = complex, polar or real (see Format element)<br>● <Channels> = Number of channels (see NumberOfChannels element)<br>● <Type> = float32, float64, int8, int16, int32 or int64 (see DataType element)<br>Examples:<br>● xyz.complex.1ch.float32<br>● xyz.polar.1ch.float64<br>● xyz.real.1ch.int16<br>● xyz.complex.16ch.int8 |
| <UserData> | xml | Optional: contains user, application or device-specific XML data which is not part of the iq-tar specification. This element can be used to store additional information, e.g. the hardware configuration. User data must be valid XML content. |
| <PreviewData> | 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 iq-tar file (e.g. R&S VSE). For the definition of this element refer to the RsIqTar.xsd schema. Note that the preview can be only displayed by current web browsers that have JavaScript enabled and if the XSLT stylesheet open_IqTar_xml_file_in_web_browser.xslt is available. |

### User-defined data elements

You can insert additional user, application or device-specific XML data that is not part of the iq-tar specification in the <UserData> element. User data must be valid XML content.

Rohde & Schwarz products use this element to import and export application-specific data. While some elements are mandatory in order to import the iq-tar file to the product, others are optional.

The subelements within the <UserData> element provided by the Rohde & Schwarz products are <DataImportExport_MandatoryData> and <DataImportExport_OptionalData>. To import an iq-tar file to the R&S VSE software, either both of these elements or none of them must be provided.

### Mandatory data elements

The following information is always provided by an iq-tar file export from Rohde & Schwarz products. It is contained in the <DataImportExport_MandatoryData> element. It must be available in all iq-tar files used to import data to the R&S VSE software if optional data is included (see "Optional data elements" on page 78).

*Table 3-2: Subelements of <DataImportExport_MandatoryData>*

| Element Name | Possible Values | Description |
|---|---|---|
| `<ChannelNames>` | `<ChannelName>` | Mapping of channels in `iq-tar` file to channel names in R&S VSE software.<br>CH_1 = first `<ChannelName>`<br>CH_2 = second `<ChannelName>`<br>...<br>CH_n = last `<ChannelName>` |
| `<ChannelName>` | String | Channel name in R&S VSE software |
| `<CenterFrequency>` | Double | Center frequency of captured I/Q data |

### Optional data elements

Optionally, the following information can be provided in `iq-tar` files used to import data to Rohde & Schwarz products. This information can also be provided by an `iq-tar` file export from the R&S VSE software, if selected. Note that the available information during data export depends on the connected instrument.

Optional information is contained in the `<DataImportExport_OptionalData>` element. If this element is included in the `<UserData>` element, the `<DataImportExport_MandatoryData>` element must also be included (see "Mandatory data elements" on page 77).

Optional data is included in <Key> subelements with a specific name attribute. Keys for an individual channel are provided together, i.e. first all keys for CH_1, then all keys for CH_2 etc. The channel index is provided as a prefix for the key name attribute and corresponds to the mapping defined in the `<ChannelNames>` in `<DataImportExport_MandatoryData>` (see "Mandatory data elements" on page 77).

*Table 3-3: Possible information in <DataImportExport_OptionalData>*

| <Key> element name attribute | Possible Values |
|---|---|
| Ch<n>_RefLevel[dBm] | Double |
| Ch<n>_RefLevelOffset[dB] | Double |
| Ch<n>_AttenuMech[dB] | Integer |
| Ch<n>_AttenuElecState | ON \| OFF |
| Ch<n>_AttenuElecValue[dB] | Integer |
| Ch<n>_PreampState | ON \| OFF |
| Ch<n>_PreampGain[dB] | Integer |
| Ch<n>_PreSelectorState | ON \| OFF<br>(R&S FSWT only) |
| Ch<n>_PreSelectorType | NARROW \| WIDE<br>(R&S FSWT only) |
| Ch<n>_Impedance[Ohm] | 50 \| 75 |

| <Key> element name attribute | Possible Values |
|---|---|
| Ch<n>_InputCoupling | AC \| DC |
| Ch<n>_DeviceId | String |
| Ch<n>_DeviceOptions | String |
| Ch<n>_DeviceHwInfo | String |
| Ch<n>_DeviceVersions | String |
| Ch<n>_CalibrationState | ON \| OFF |
| Ch<n>_RefOscillatorInput | OFF \| ON |
| Ch<n>_RefOscillatorFreq[Hz] | Double |
| Ch<n>_InputPath | RF |
| Ch<n>_InputSelection | INPUT1 \| INPUT2<br>(R&S FSWT only) |
| Ch<n>_HighPassFilterState | ON \| OFF |
| Ch<n>_YigPreSelectorState | ON \| OFF |
| Ch<n>_ExtMixerState | ON \| OFF |
| Ch<n>_MeasBandwidth[Hz] | Double |
| Ch<n>_FilterSettings | FLAT \| GAUSS \| OFF |
| Ch<n>_TrgSource | Extern <1 ..4> \| I/Q Power \| IF Power \| RF Power \| Power Sensor \| Time |
| Ch<n>_TrgLevel[dB] | Double |
| Ch<n>_TrgHysteresis[dB] | Double |
| Ch<n>_TrgTpis[s] | Double |
| Ch<n>_TrgOffset[s] | Double |
| Ch<n>_TrgSlope | Rising \| Falling \| Rising/Falling |
| Ch<n>_TrgHoldoff[s] | Double |
| Ch<n>_TrgDropOut[s] | Double |
| Ch<n>_NumberOfPostSamples | Integer |
| Ch<n>_NumberOfPreSamples | Integer |

**Example: Example for <DataImportExport_OptionalData>**

```
<DataImportExport_OptionalData>
<Key name="Ch1_AttenElecState">OFF</Key>
<Key name="Ch1_AttenElecValue[dB]">0</Key>
<Key name="Ch1_AttenMech[dB]">0</Key>
<Key name="Ch1_CalibrationState">ON</Key>
<Key name="Ch1_DeviceHwInfo"></Key>
<Key name="Ch1_DeviceId">Rohde-Schwarz,RTP,1320.5007k08/101011,4.15.1.0</Key>
<Key name="Ch1_DeviceOptions">B4,B10,B110</Key>
<Key name="Ch1_FilterSettings">FLAT</Key>
<Key name="Ch1_HighPassFilterState">OFF</Key>
<Key name="Ch1_Impedance[Ohm]">50</Key>
<Key name="Ch1_InputCoupling">AC</Key>
<Key name="Ch1_InputPath">RF</Key>
<Key name="Ch1_MeasBandwidth[Hz]">1000000000</Key>
<Key name="Ch1_NumberOfPostSamples">0</Key>
<Key name="Ch1_NumberOfPreSamples">0</Key>
<Key name="Ch1_PreampGain[dB]">0</Key>
<Key name="Ch1_PreampState">OFF</Key>
<Key name="Ch1_RefLevelOffset[dB]">0</Key>
<Key name="Ch1_RefLevel[dBm]">-15.0362</Key>
<Key name="Ch1_RefOscillatorInput">OFF</Key>
<Key name="Ch1_SelectedIqInputSource">CHAN1_CHAN3_WV</Key>
<Key name="Ch1_TrgSource">FREE RUN</Key>
<Key name="Ch1_YigPreSelectorState">OFF</Key>
<Key name="Ch2_AttenElecState">OFF</Key>
<Key name="Ch2_AttenElecValue[dB]">0</Key>
<Key name="Ch2_AttenMech[dB]">0</Key>
<Key name="Ch2_CalibrationState">ON</Key>
<Key name="Ch2_DeviceHwInfo"></Key>
<Key name="Ch2_DeviceId">Rohde-Schwarz,RTP,1320.5007k08/101011,4.15.1.0</Key>
<Key name="Ch2_DeviceOptions">B4,B10,B110</Key>
<Key name="Ch2_FilterSettings">FLAT</Key>
<Key name="Ch2_HighPassFilterState">OFF</Key>
<Key name="Ch2_Impedance[Ohm]">50</Key>
<Key name="Ch2_InputCoupling">AC</Key>
<Key name="Ch2_InputPath">RF</Key>
<Key name="Ch2_MeasBandwidth[Hz]">1000000000</Key>
<Key name="Ch2_NumberOfPostSamples">0</Key>
<Key name="Ch2_NumberOfPreSamples">0</Key>
<Key name="Ch2_PreampGain[dB]">0</Key>
<Key name="Ch2_PreampState">OFF</Key>
<Key name="Ch2_RefLevelOffset[dB]">0</Key>
<Key name="Ch2_RefLevel[dBm]">-15.0362</Key>
<Key name="Ch2_RefOscillatorInput">OFF</Key>
<Key name="Ch2_SelectedIqInputSource">CHAN1_CHAN3_WV</Key>
<Key name="Ch2_TrgSource">FREE RUN</Key>
<Key name="Ch2_YigPreSelectorState">OFF</Key>
```

```
<Key name="FirmwareVersion">1.80-20.5.16.0 Beta</Key>
</DataImportExport_OptionalData>
```

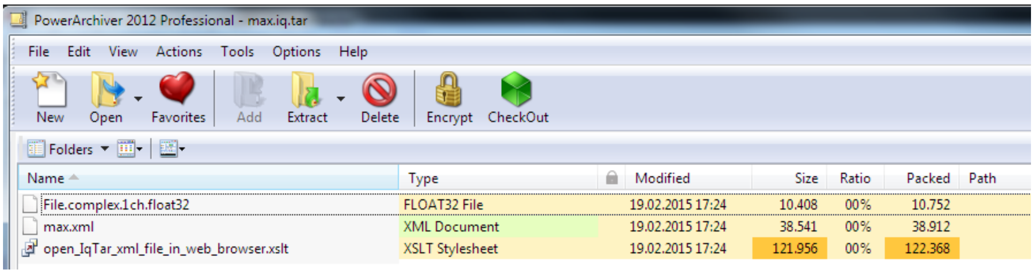
### Example: userdata for I/Q recordings by R&S VSE software

```
<UserData>
      <RohdeSchwarz>
         <DataImportExport_MandatoryData>
            <CenterFrequency unit="Hz">1e+09</CenterFrequency>
         </DataImportExport_MandatoryData>

         <DataImportExport_OptionalData>
            <Key name="Ch1_RefLevel[dBm]">11.3</Key>
            <Key name="Ch1_RefLevelOffset[dB]">15.375</Key>
            <Key name="Ch1_AttenuMech[dB]">20</Key>
            <Key name="Ch1_AttenuElecState">ON | OFF</Key>
            <Key name="Ch1_AttenuElecValue[dB]">3</Key>
            <Key name="Ch1_PreampState">ON</Key>
            <Key name="Ch1_PreampGain[dB]">15</Key>
            <Key name="Ch1_PreampGain[dB]">15</Key>

            <Key name="Ch1_Impedance[Ohm]">50</Key>
            <Key name="Ch1_InputCoupling">AC</Key>
            <Key name="Ch1_PreampGain[dB]">15</Key>
            <Key name="Ch1_PreampGain[dB]">15</Key>

            <Key name="Ch1_DeviceId">string</Key>
            <Key name="Ch1_DeviceOptions">string</Key>
            <Key name="Ch1_DeviceHwInfo">string</Key>
            <Key name="Ch1_DeviceVersions">string</Key>
            <Key name="Ch1_DeviceHwInfo">string</Key>

            <Key name="Ch1_CalibrationState">ON | OFF</Key>

            <Key name="Ch1_RefOscillatorInput">enum</Key>
            <Key name="Ch1_RefOscillatorFreq[Hz]">15</Key>
            <Key name="Ch1_InputPath">RF | AIQ | FIQ | DIQ</Key>
            <Key name="Ch1_HighPassFilterState">ON | OFF</Key>
            <Key name="Ch1_YigPreSelectorState">ON | OFF</Key>
            <Key name="Ch1_ExtMixerState">ON | OFF</Key>

            <Key name="Ch1_MeasBandwidth[Hz]">8e+06</Key>
            <Key name="Ch1_FilterSettings">FLAT | GAUSS | OFF</Key>

            <Key name="Ch1_TrgSource">enum</Key>
            <Key name="Ch1_TrgLevel[dB]">15</Key>
            <Key name="Ch1_TrgHysteresis[dB]">15</Key>
            <Key name="Ch1_TrgTpis[s]">15</Key>
            <Key name="Ch1_TrgOffset[s]">15</Key>
```

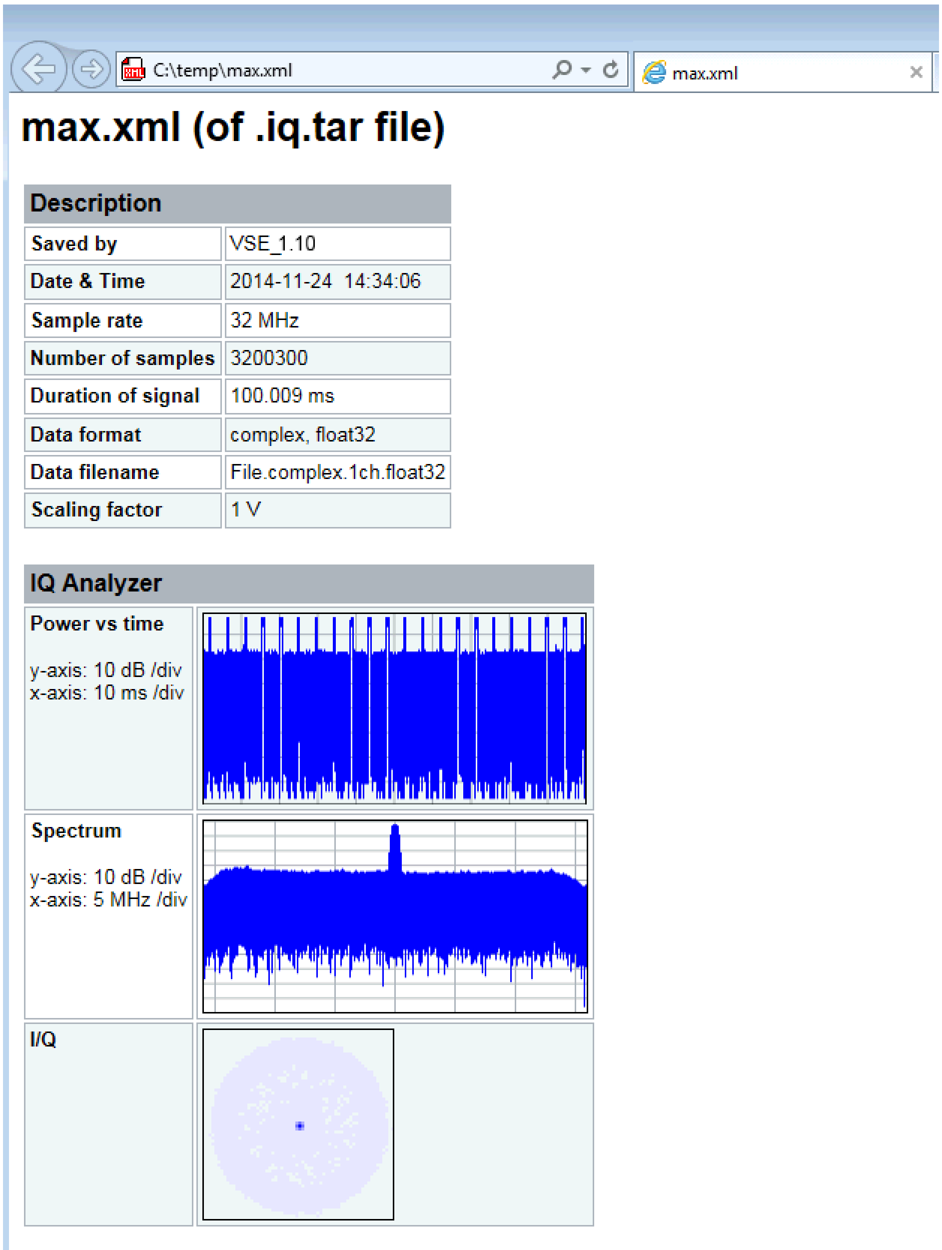
```
                <Key name="Ch1_TrgSlope">Rising | Falling</Key>
                <Key name="Ch1_TrgHoldoff[s]">15</Key>
                <Key name="Ch1_TrgDropOut[s]">15</Key>

                <Key name=" Ch1_NumberOfPreSamples">300</Key>
                <Key name=" Ch1_NumberOfPostSamples">300</Key>
            </DataImportExport_OptionalData>
        </RohdeSchwarz>
</UserData>
```

### 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<br>y-axis: 10 dB /div<br>x-axis: 10 ms /div | |
| Spectrum<br>y-axis: 10 dB /div<br>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 / $2^{15}$ = 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. iqiqiq...
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>
```


## 3.4 Triggering

**Access**: "Overview" > "Trigger"

The R&S VSE-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
- Time
  If the time trigger is used, the R&S VSE automatically sets the repetition interval to match the length of the reference file. "Auto Time Trigger" sets the trigger offset to the current trigger to sync (TTS) value.

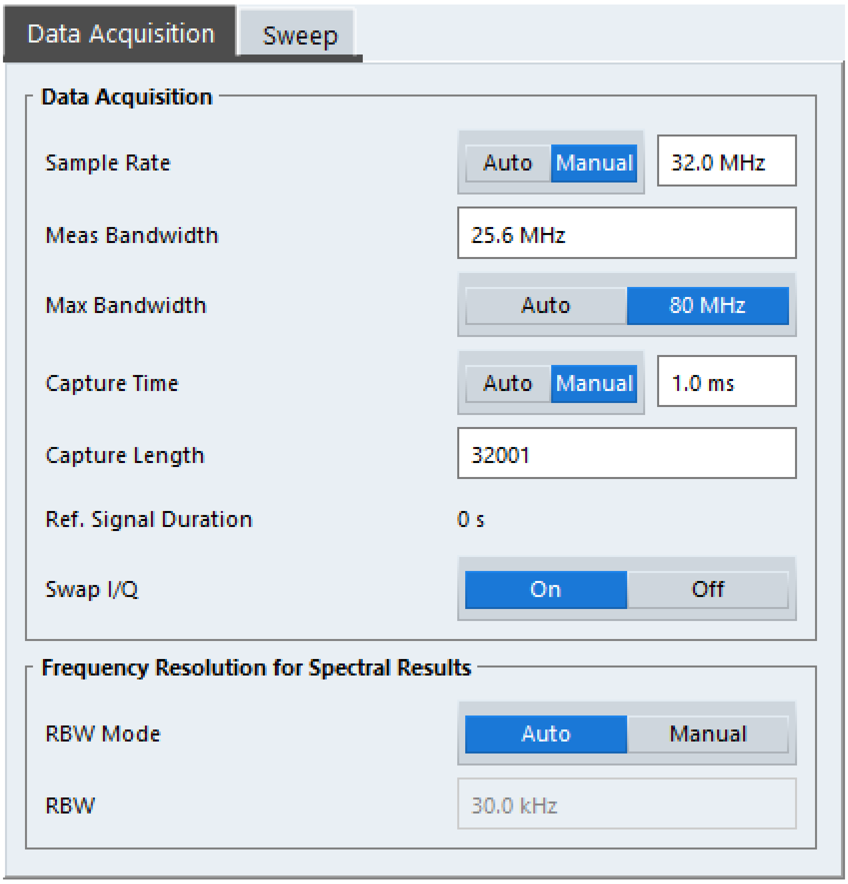
The time trigger is not supported in the R&S VSE Amplifier measurement application.

The trigger settings are similar to those in the spectrum application. For a comprehensive description of the trigger functionality, refer to the R&S VSE user manual.

## 3.5 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 221.



**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 3.2, "Reference signals", on page 40.

Remote command:
Mode: `TRACe:IQ:SRATe:AUTO` on page 224

**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 224
Bandwidth: `TRACe:IQ:BWIDth` on page 223

**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.

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 R&S VSE I/Q Analyzer.

Remote command:
`TRACe:IQ:WBANd[:STATe]` on page 225
`TRACe:IQ:WBANd:MBWidth` on page 225

**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 3.2, "Reference signals", on page 40.

Remote command:
Mode: `[SENSe:]SWEep:TIME:AUTO` on page 223
Reference signal: `[SENSe:]REFSig:TIME?` on page 222

**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 223
Capture length: `[SENSe:]SWEep:LENGth` on page 222

**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 222

**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.

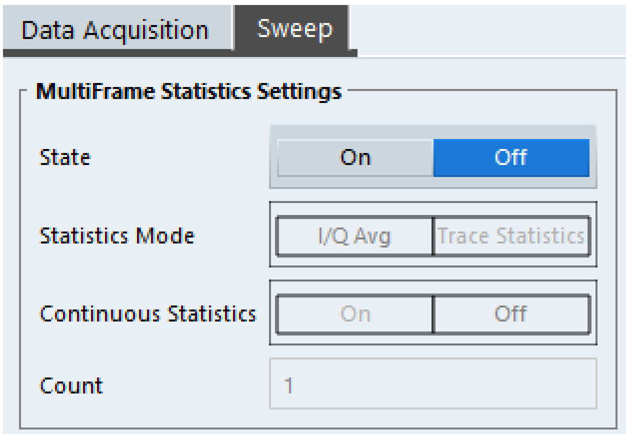
The amplifier measurement application supports any bandwidth between 1 Hz and 10 MHz.

Remote command:
`[SENSe:]BANDwidth[:RESolution]:AUTO` on page 222
`[SENSe:]BANDwidth[:RESolution]` on page 221

## 3.6 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 225.

**Statistics State**

Turns the sweep statistics calculation on and off.

Remote command:
`[SENSe:]SWEep:STATistics[:STATe]` on page 227

**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 227

**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 227

**Statistics Count**

Defines the number of single data captures the application uses to average the data.

Remote command:
`[SENSe:]SWEep:STATistics:COUNt` on page 227

**Select Result Rng**

Sets the result range.

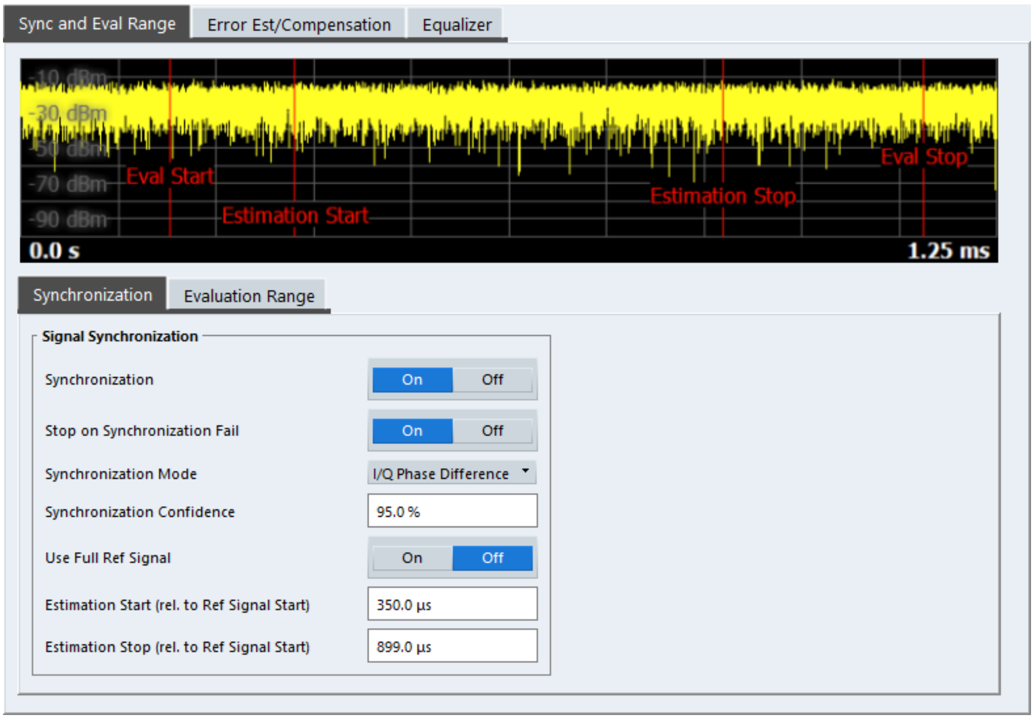
Remote command:
`CONFigure:RESult:RANGe[:SELected]` on page 227

## 3.7 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 remote commands required to configure signal synchronization are described in Chapter 5.6.9, "Synchronizing measurement data", on page 228.



**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 231
`CONFigure:SYNC:SOFail` on page 230

**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 that 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 230

**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 229

**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 230

**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.

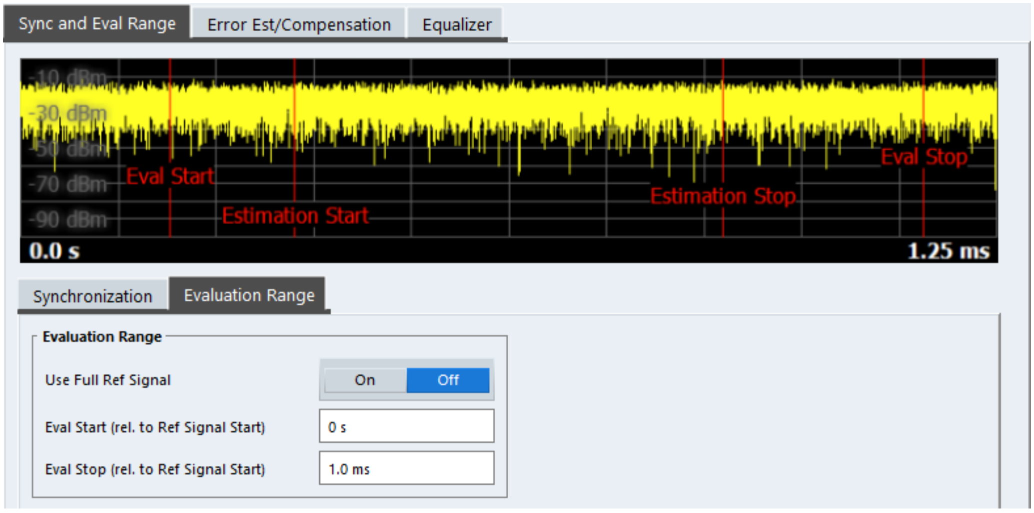
**Tip:** You can also use the touchscreen to move the lines to a new position in the preview pane. However, this way is not as accurate as entering a number into the input field.

Remote command:
`CONFigure:ESTimation:FULL` on page 228
`CONFigure:ESTimation:STARt` on page 229
`CONFigure:ESTimation:STOP` on page 229

## 3.8 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 232.



**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.

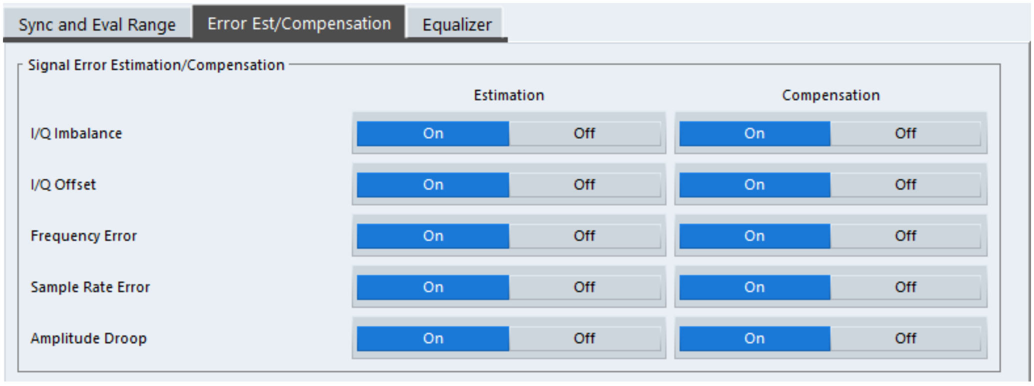
**Tip:** You can also use the touchscreen to move the lines to a new position in the preview pane. However, this way is not as accurate as entering a number into the input field.

Remote command:
`CONFigure:EVALuation:FULL` on page 232
`CONFigure:EVALuation:RANGe` on page 232
`CONFigure:EVALuation:STARt` on page 233
`CONFigure:EVALuation:STOP` on page 233

## 3.9 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.




The remote commands required to configure error compensation and equalization are described in Chapter 5.6.11, "Estimating and compensating signal errors", on page 233.

### 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

Combined effect of amplitude and phase error.

Remote command:
`CONFigure:SIGNal:ERRor:ESTimation:IQIMbalance[:STATe]` on page 236
`CONFigure:SIGNal:ERRor:COMPensation:IQIMbalance[:STATe]`
on page 234

#### I/Q Offset

Shift of the constellation points in a particular direction.

Remote command:
`CONFigure:SIGNal:ERRor:ESTimation:IQOFfset[:STATe]` on page 236
`CONFigure:SIGNal:ERRor:COMPensation:IQOFfset[:STATe]` on page 235

#### Frequency Error

Difference between measured and reference center frequency.

Remote command:
`CONFigure:SIGNal:ERRor:ESTimation:FERRor[:STATe]` on page 235
`CONFigure:SIGNal:ERRor:COMPensation:FERRor[:STATe]` on page 234

#### 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 236
`CONFigure:SIGNal:ERRor:COMPensation:SRATe[:STATe]` on page 235

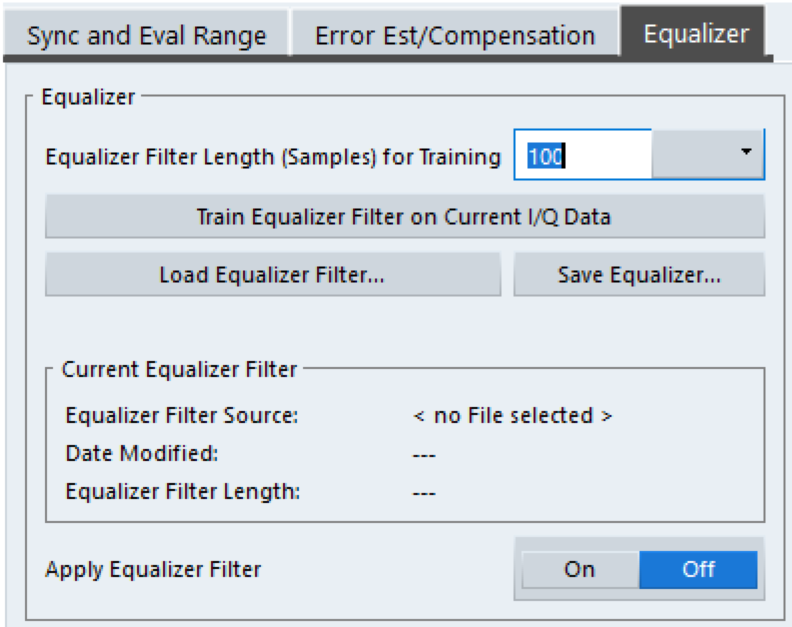
#### Amplitude Droop

Decrease of the signal power over time in the transmitter.

Remote command:
`CONFigure:SIGNal:ERRor:ESTimation:ADRoop[:STATe]` on page 235
`CONFigure:SIGNal:ERRor:COMPensation:ADRoop[:STATe]` on page 234

## 3.10 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 R&S VSE, or use one that you already have.

Training (or creating) the equalizer filter is a process in which the R&S VSE 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 R&S VSE 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 R&S VSE 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 R&S VSE 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.

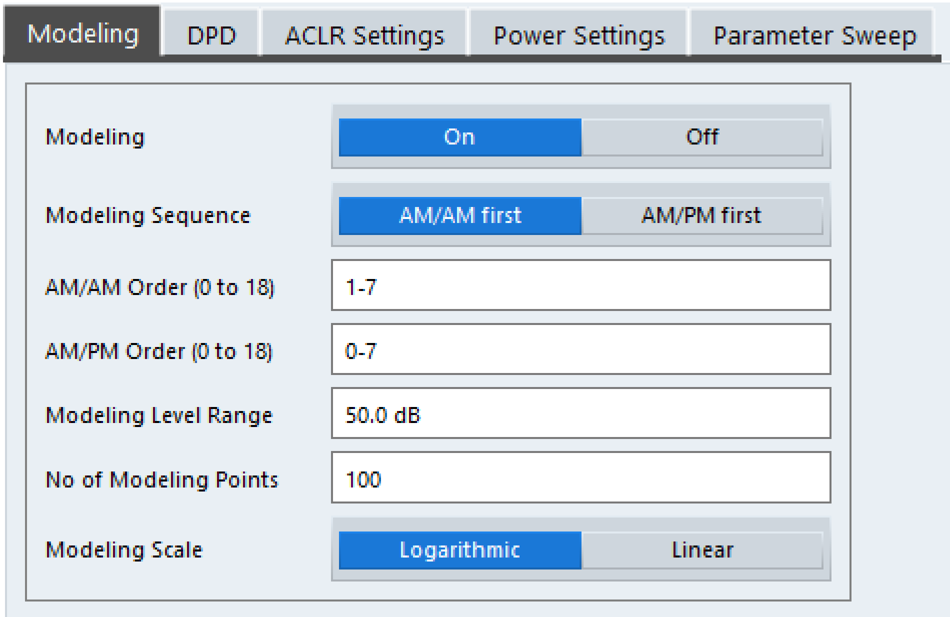
`TRACe:IQ:EQUalized?` on page 355

Remote command:
Filter length: `CONFigure:EQUalizer:FILTer:LENGth` on page 237
Start training: `CONFigure:EQUalizer:TRAin` on page 238
Store filter: `MMEMory:STORe<n>:EQUalizer:FILTer:COEFficient` on page 239
File format: `CONFigure:EQUalizer:FILTer:FILE:FORMat` on page 237
Restore filter: `MMEMory:LOAD:EQUalizer:FILTer:COEFficient` on page 238
Equalizer state: `CONFigure:EQUalizer[:STATe]` on page 238
Manual filter definition: `CONFigure:EQUalizer:FPARameters` on page 237

## 3.11 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.




The remote commands required to configure system models are described in Chapter 5.6.12, "Applying a system model", on page 239.



**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 VSE-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 241
`CONFigure:MODeling:SEQuence` on page 241

**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 $N^{th}$ degree looks like this:

$y = a_0 + a_1x + a_2x^2 + \ldots + a_Nx^N$

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 239
"AM/PM": `CONFigure:MODeling:AMPM:ORDer` on page 240

**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 240
Points: `CONFigure:MODeling:NPOints` on page 240

**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 241

## 3.12 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 R&S VSE 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 R&S VSE 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 3.3.6, "Controlling a signal generator", on page 67.

**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.

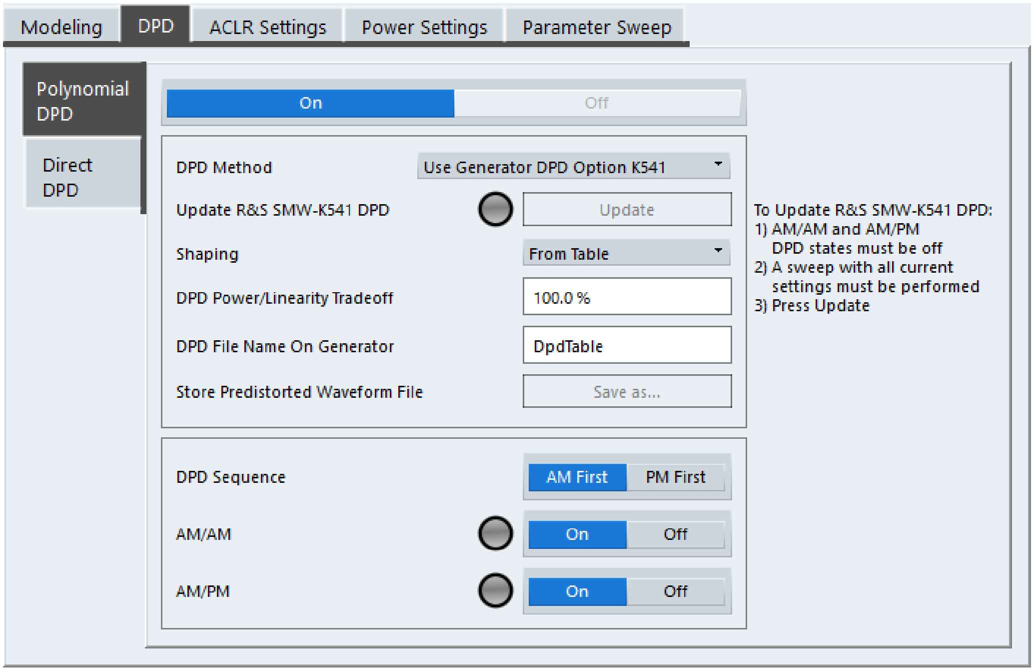
Remote command:

`CONFigure:DDPD[:STATe]` on page 246

## 3.12.1 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 R&S VSE 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 242.



**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 R&S VSE with the "Update" button. (The button is only available when data has been captured on the R&S VSE 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 R&S VSE 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 250

**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 3.11, "System models", on page 99.

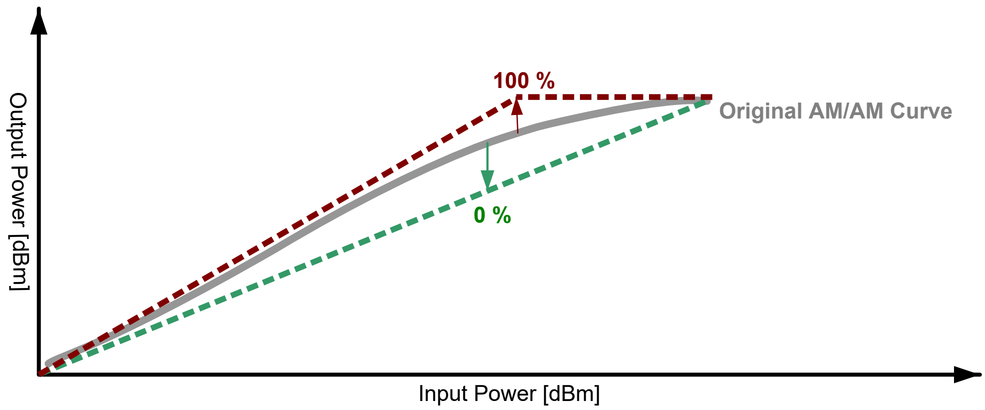
You can update the DPD shaping on the signal generator comfortably with the "Update" button.

Remote command:
Mode: CONFigure:DPD:SHAPing:MODE on page 251
Table name: CONFigure:DPD:FNAMe on page 250

**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 252

**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 248
"AM/PM" state: CONFigure:DPD:AMPM[:STATe] on page 248

Both: CONFigure:DPD:AMXM[:STATe] on page 249
Calculation order: CONFigure:DPD:SEQuence on page 251

### 3.12.2 Direct DPD (R&S VSE-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 R&S VSE 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, R&S VSE-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.

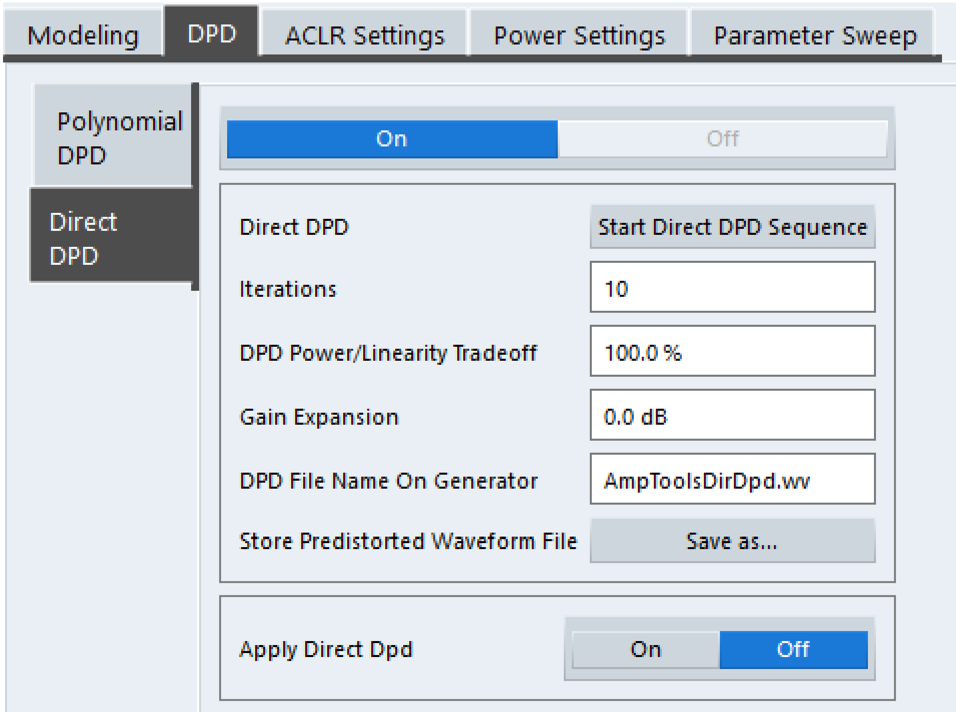
**Continuous statistics during direct DPD calculation**

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 242.



**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 R&S VSE 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 R&S VSE 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 244
Start sequence: `CONFigure:DDPD:STARt` on page 246
Gain expansion: `CONFigure:DDPD:GEXPansion` on page 245
File name: `CONFigure:DDPD:FNAMe` on page 245
Save DPD: `MMEMory:STORe<n>:DDPD` on page 259
Apply DPD: `CONFigure:DDPD:APPLy[:STATe]` on page 243
Wrap-around smoothing: `CONFigure:DDPD:APPLy:WRAP[:STATe]` on page 244
Query I/Q values: `TRACe:IQ:DDPD[:DATA]?` on page 281

**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 R&S VSE 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.

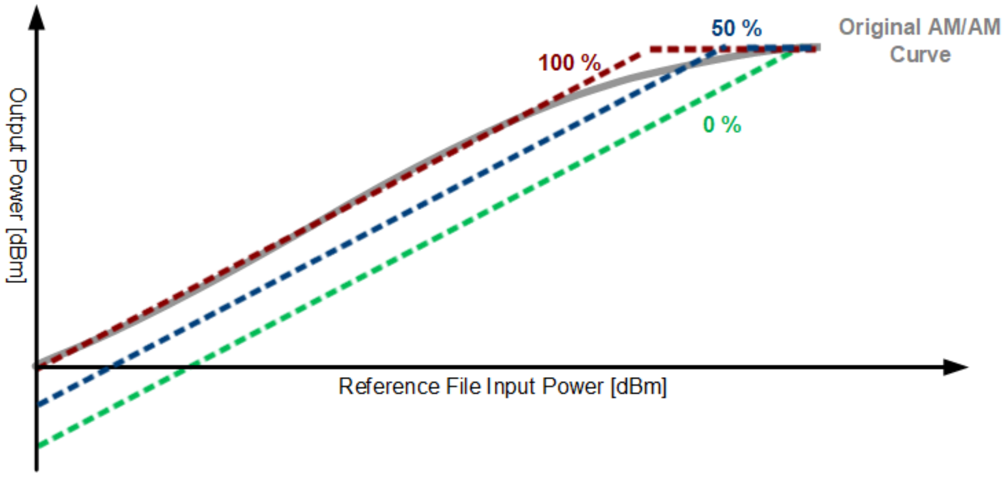
You can also follow the process of the DPD sequence in the channel bar. The "DPD Count" label shows the current iteration and the complete number of iterations of the DPD sequence. If you are using averaging, the "Count" label shows the process of the current iteration. The first number is the current 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 244
Query finished iterations: `CONFigure:DDPD:COUNt:CURRent?` on page 244
Start sequence: `CONFigure:DDPD:STARt` on page 246
Gain expansion: `CONFigure:DDPD:GEXPansion` on page 245
Wrap-around smoothing: `CONFigure:DDPD:APPLy:WRAP[:STATe]` on page 244
Continue direct DPD: `CONFigure:DDPD:CONTinue` on page 244
Query RMS power: `CONFigure:MDPD:RMS[:CURRent]?` on page 256
Query RMS power (online mode): `CONFigure:DDPD:RMS[:CURRent]?` on page 246
Query I/Q values: `TRACe:IQ:DDPD[:DATA]?` on page 281
Query file name and path: `FETCh:DDPD:WAVeform:PATH?` on page 257

**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 247

### 3.12.3 Memory polynomial DPD (R&S VSE-K18M)

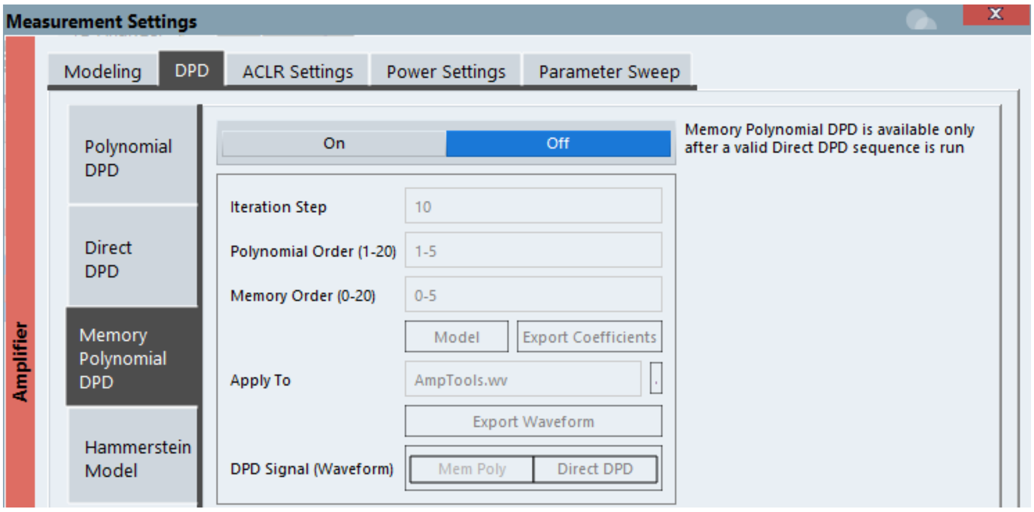
The R&S VSE-K18M application is an extension to the R&S VSE-K18D Direct DPD application. It is only available after a valid automated or manual Direct DPD sequence is run. In R&S VSE-K18M the application derives a memory polynomial equation that transfers the reference signal (ideal waveform) into the pre-distorted waveform (K18D waveform).

$$\tilde{P}(nT) = \sum_{p=1}^{P} \sum_{m=0}^{M} k_{p,m} A(nT - \tau_m) \, |A(nT - \tau_m)|^{p-1}$$

A is the reference signal, scaled to Volt. The coefficients $k_{p,m}$ are shown in the Memory DPD coefficients display, or directly exported into a `csv` file using the export coefficients function. 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.

For an example on how to apply the coefficients to the reference signal, refer to an exemplary Matlab implementation shown in Chapter 5.11, "Programming example R&S VSE-K18M", on page 358.




The remote commands required to configure the memory polynomial DPD are described in Chapter 5.6.13, "Applying digital predistortion", on page 242.



**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" 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" 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" 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.

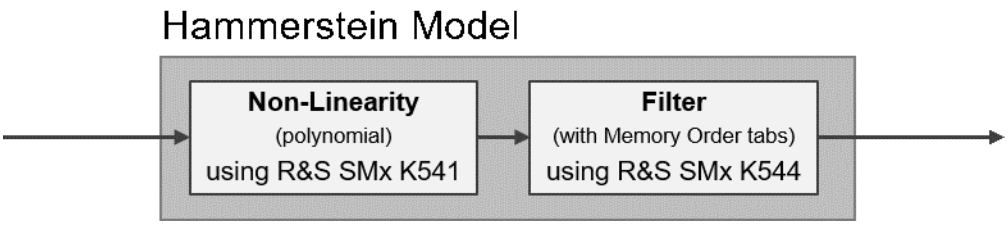
Remote command:
State: `CONFigure:MDPD[:STATe]` on page 255
Iteration Step: `CONFigure:MDPD:ITERation` on page 255
Polynomial Order: `CONFigure:MDPD:ORDer:POLYnomial` on page 256
Memory Order: `CONFigure:MDPD:ORDer:MEMory` on page 256
Apply To: `CONFigure:MDPD:APPLy:MODel` on page 255
Model: `CALCulate:MDPD:MODel` on page 256
Export Waveform (only available when generator control is OFF): `MMEMory:STORe:MDPD:WAVeform` on page 260
Export Coefficients: `MMEMory:STORe:MDPD:COEFficient` on page 259
Waveform Type: `CONFigure:MDPD:WAVeform:SELect` on page 257
Send Waveform to Generator: `CONFigure:MDPD:WAVeform:UPDate` on page 257

### 3.12.4 Hammerstein model (R&S VSE-K18M)

The Hammerstein model is a DPD approach that is, like the Memory Polynomial Model, available in R&S VSE-K18M. Both are based on the results of the R&S VSE-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 R&S VSE-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.

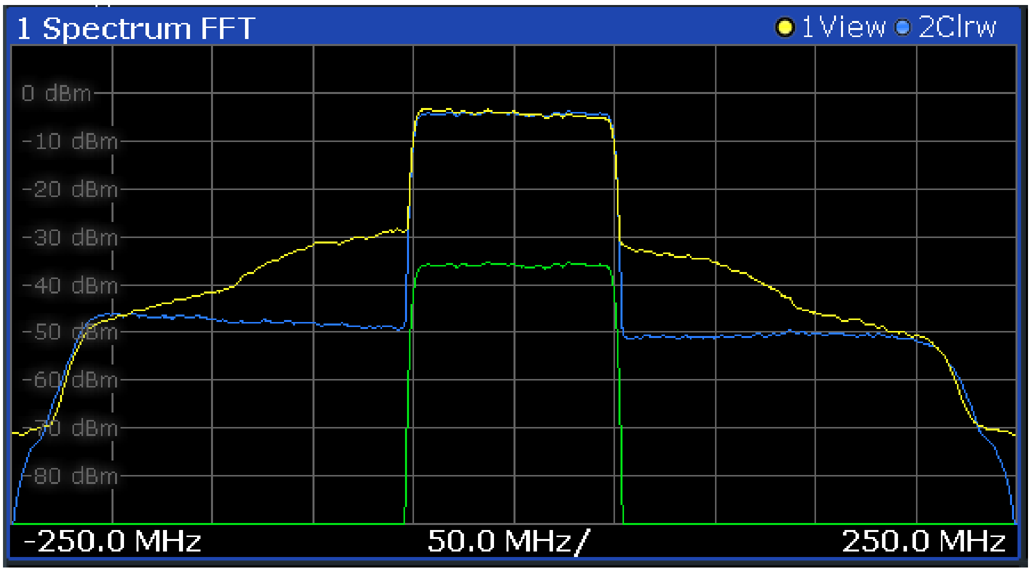
The parameters of the Hammerstein model are calculated based on the reference waveform (ideal waveform) and the pre-distorted waveform (K18D waveform), similar to the Memory Polynomial DPD. After a valid Direct DPD sequence, the Hammerstein model parameters can be computed. The Hammerstein model parameters are then used to configure R&S SMx-K541 and K544 at a connected R&S generator.



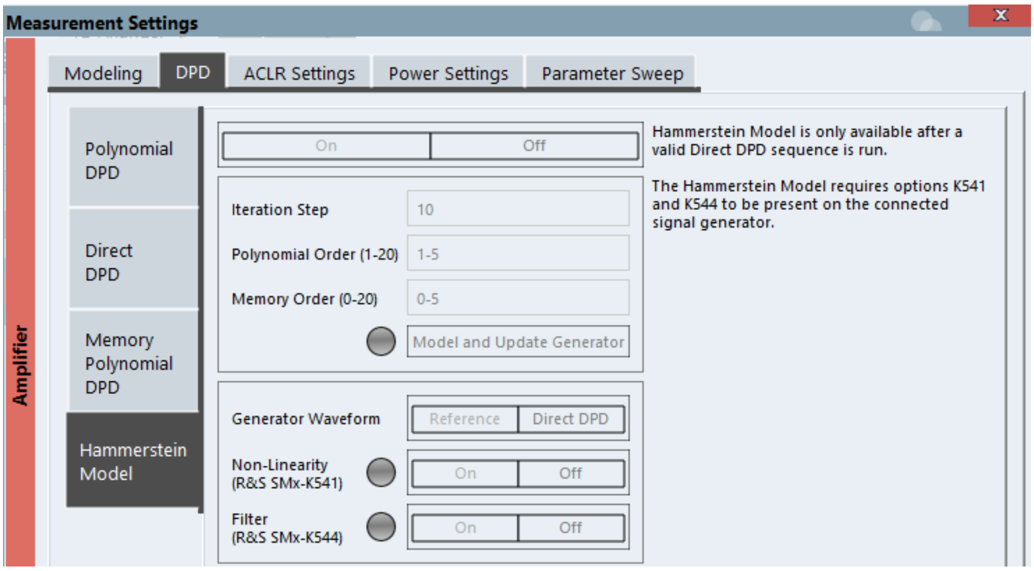

The advantage of the Hammerstein model is that by using R&S SMx-K541 and K544, the predistortion is applied in real time on the signal in an R&S generator. Real-time means that the pre-distortion is added to the undistorted signal by the signal generator as the undistorted signal is being created or 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 242.



**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 253
Iteration Step: `CONFigure:HAMMerstein:ITERation` on page 253
Polynomial Order: `CONFigure:HAMMerstein:ORDer:POLYnomial` on page 254
Memory Order: `CONFigure:HAMMerstein:ORDer:MEMory` on page 254
Model and Update Generator:`CONFigure:HAMMerstein:MUPGenerator` on page 254
Generator Waveform: `CONFigure:HAMMerstein:GENWaveform[:SELect]` on page 254
Non-Linearity: `CONFigure:HAMMerstein:NONLinearity[:STATe]` on page 255
Filter: `CONFigure:HAMMerstein:FILTer[:STATe]` on page 255

## 3.13 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.

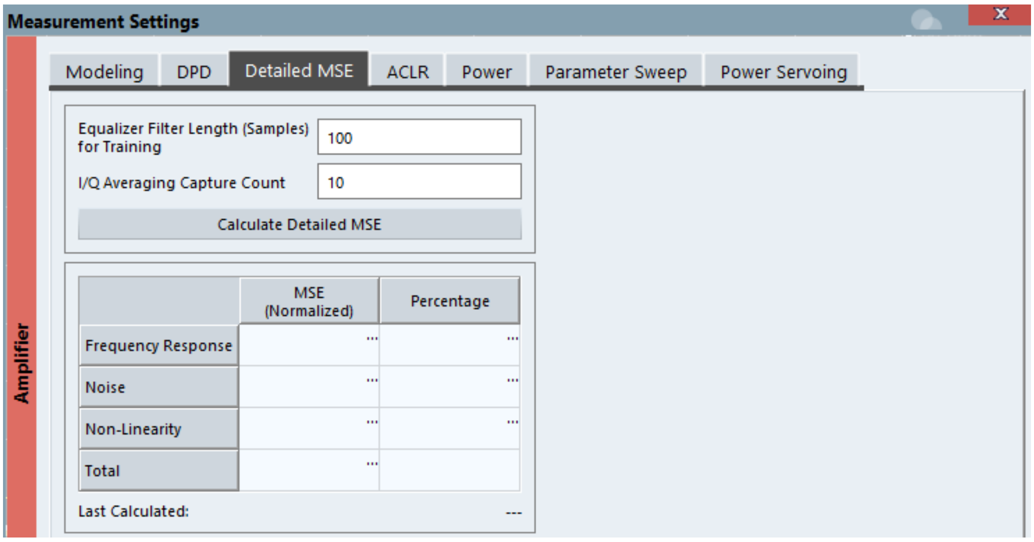
To measure the MSE values of the noise, non-linearities and the frequency response, IQ averaging and equalizer are used. The measurement sequence starts, when the button "Calculate Detailed MSE" is pressed.

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 116 is executed and not updated automatically for every new measurement.






**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 237

**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 226

**Calculate Detailed MSE**

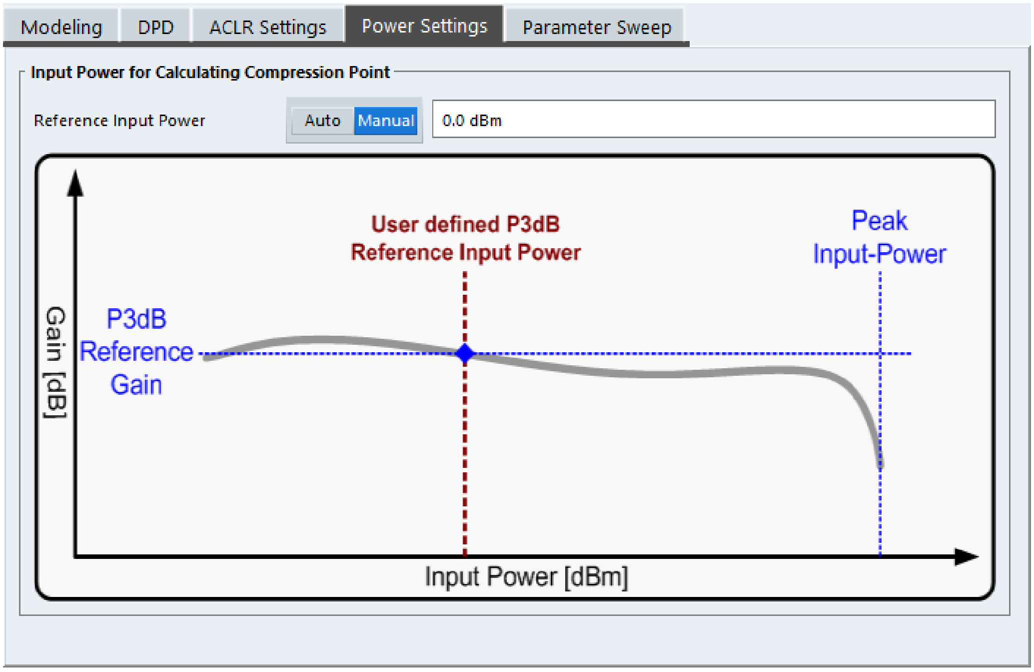
Runs the detailed MSE calculation.

Remote command:
`CALCulate:MSERror?` on page 260

## 3.14 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 5.6.17, "Configuring power measurements", on page 268.



**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 R&S VSE-K18 application tries to automatically find the constant gain (linear range) section using a dedicated algorithm.

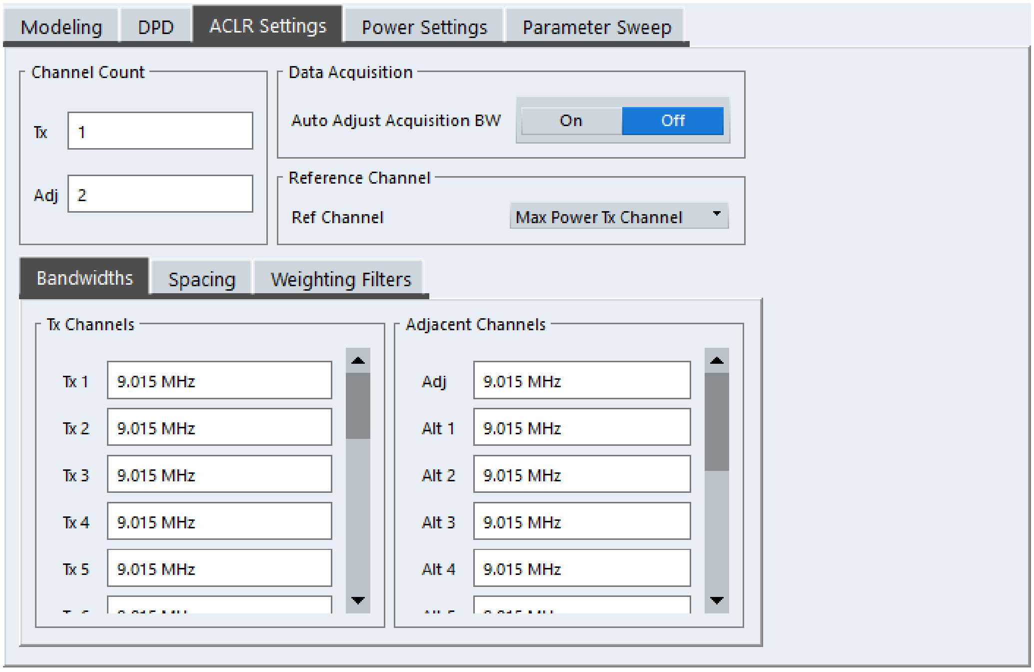
In the "Gain Compression" result display, the reference point is indicated by a red line.

Remote command:
Method: `CONFigure:POWer:RESult:P3DB[:STATe]` on page 268
Input power: `CONFigure:POWer:RESult:P3DB:REFerence` on page 268

## 3.15 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.




The remote commands required to configure the ACLR measurements are described in Chapter 5.6.16, "Configuring ACLR measurements", on page 262.



**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 119).

Remote command:
Number of Tx channels:
`[SENSe:]POWer:ACHannel:TXCHannel:COUNt` on page 267
Number of Adjacent channels:
`[SENSe:]POWer:ACHannel:ACPairs` on page 263

**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.

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 R&S VSE does not evaluate measurement results. Also make sure that the R&S VSE 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 263

**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.<br>(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 266
`[SENSe:]POWer:ACHannel:REFerence:TXCHannel:AUTO` on page 266

**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 264
`[SENSe:]POWer:ACHannel:BANDwidth:ACHannel` on page 263
`[SENSe:]POWer:ACHannel:BANDwidth:ALTernate<ch>` on page 264

**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 266
`[SENSe:]POWer:ACHannel:SPACing[:ACHannel]` on page 267
`[SENSe:]POWer:ACHannel:SPACing:ALTernate<ch>` on page 267

**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 266
`[SENSe:]POWer:ACHannel:FILTer[:STATe]:ACHannel` on page 265
`[SENSe:]POWer:ACHannel:FILTer[:STATe]:ALTernate<ch>` on page 265
Alpha value:
`[SENSe:]POWer:ACHannel:FILTer:ALPHa:CHANnel<ch>` on page 265
`[SENSe:]POWer:ACHannel:FILTer:ALPHa:ACHannel` on page 264
`[SENSe:]POWer:ACHannel:FILTer:ALPHa:ALTernate<ch>` on page 265

## 3.16 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.

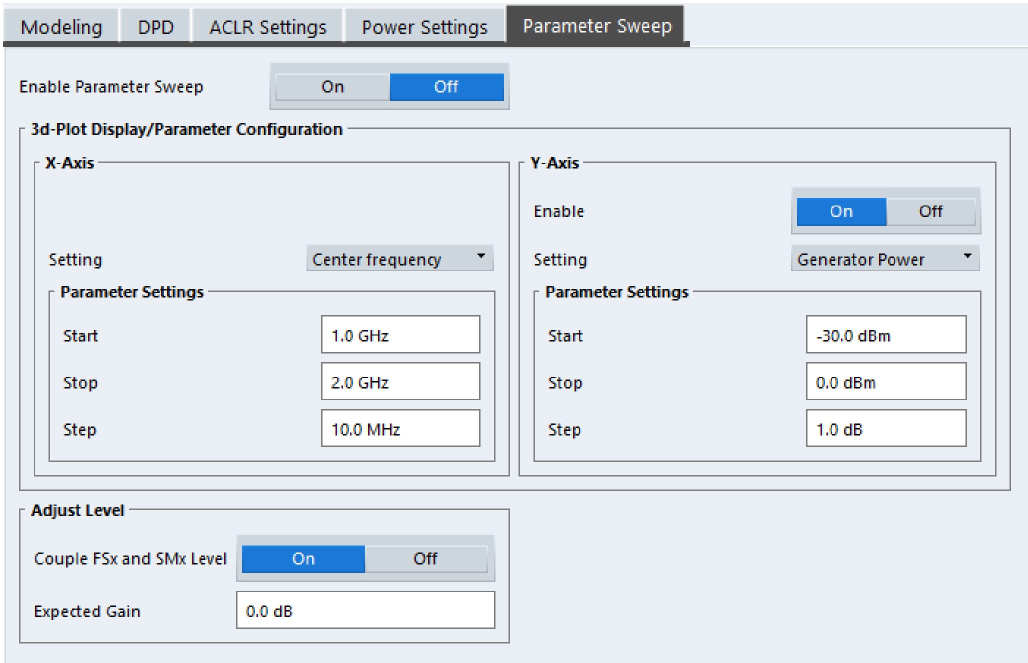
In that case, the R&S VSE first performs a measurement on the first frequency for each generator output level in the defined range. When this measurement is done, the R&S VSE continues to measure all power levels on the second frequency and so on.

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 3.3.6, "Controlling a signal generator", on page 67.




The remote commands required to configure the parameter sweep are described in Chapter 5.6.18, "Configuring parameter sweeps", on page 268.



**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 R&S VSE 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 269

**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 R&S VSE 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 R&S VSE 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 R&S VSE 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 5.6.18, "Configuring parameter sweeps", on page 268

**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 R&S VSE 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.

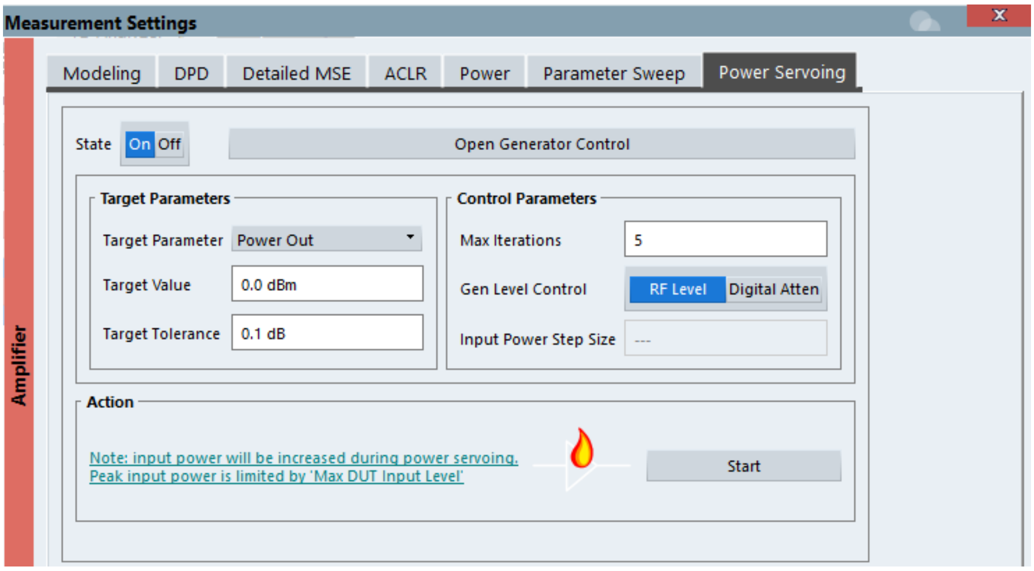
With a correct "Expected Gain" value, however, the application is able to attenuate the signal accordingly.

Remote command:
Synchronization state: `CONFigure:PSWeep:ADJust:LEVel[:STATe]` on page 269
Expected gain: `CONFigure:PSWeep:EXPected:GAIN` on page 269

## 3.17 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 5.6.19, "Configuring power servoing", on page 272.



**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 R&S VSE 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.

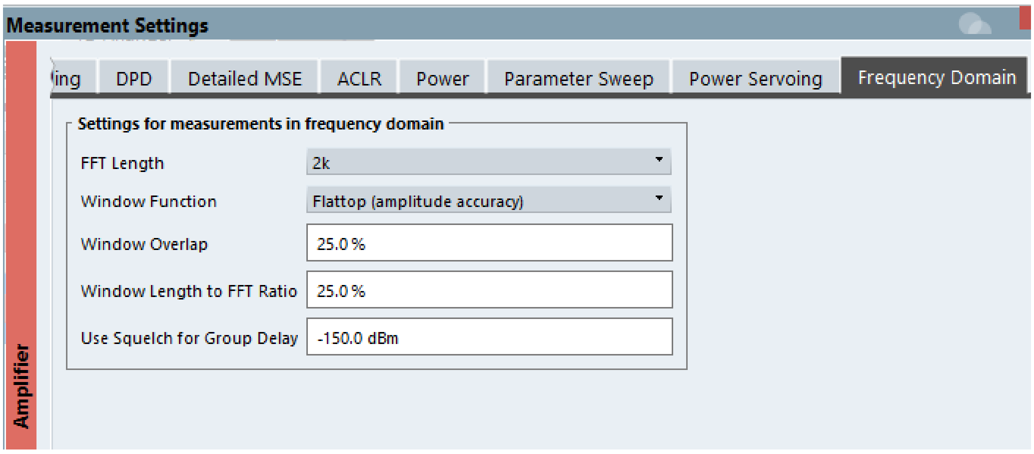
Remote command:
State: `[SENSe:]PSERvoing:STATe` on page 273
Target Parameter: `[SENSe:]PSERvoing:TARGet:PARameter` on page 273

Target Value: [SENSe:]PSERvoing:TARGet:VALue on page 274
Target Tolerance: [SENSe:]PSERvoing:TARGet:TOLerance on page 274
Max Iterations: [SENSe:]PSERvoing:MAX:ITERation on page 274
Gen Level Control: [SENSe:]PSERvoing[:GLC] on page 274
Input Power Step Size: [SENSe:]PSERvoing:INPut:STEP on page 274
Start: [SENSe:]PSERvoing:STARt on page 275
Status: FETCh:PSERvoing:OPERation:STATus? on page 275

## 3.18 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

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 275

### 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 276

**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 276

**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 276

**Use Squelch for Group Delay**
For group delay results (requires R&S VSE-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 276

# 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 R&S VSE user manual.



## 4.1 Traces

The amplifier application provides several tools to configure and evaluate traces.

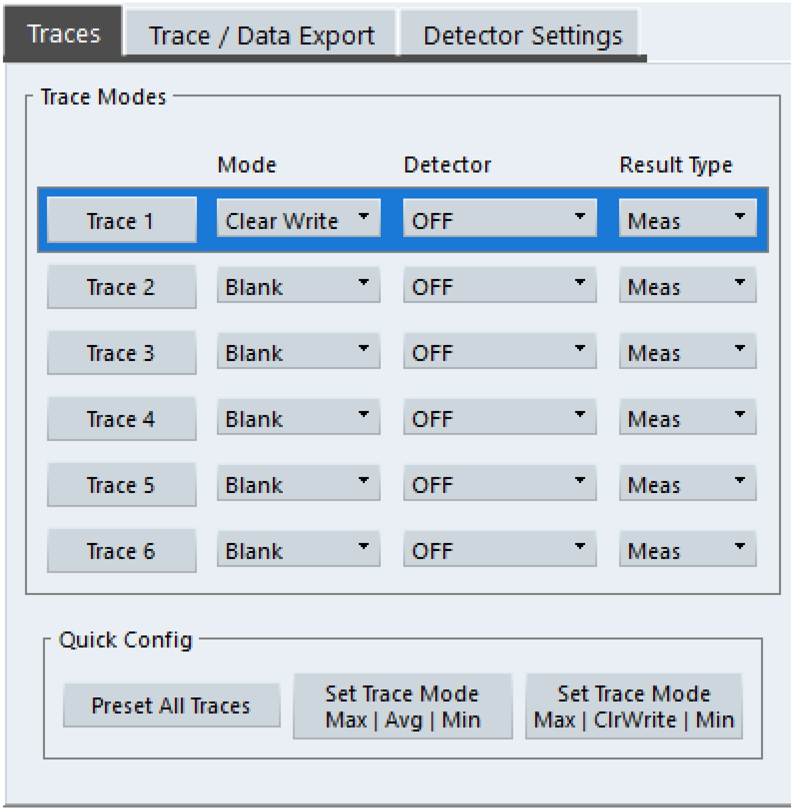


### 4.1.1 Trace information

**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.




**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 R&S VSE saves each trace point in the trace memory only if the new value is greater than the previous one. |
| Min Hold | The minimum value is determined from several measurements and displayed. The R&S VSE 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 277

**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 281

**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 280

**Predefined Trace Settings - Quick Config**
Commonly required trace settings have been predefined and can be applied very quickly by selecting the appropriate button.

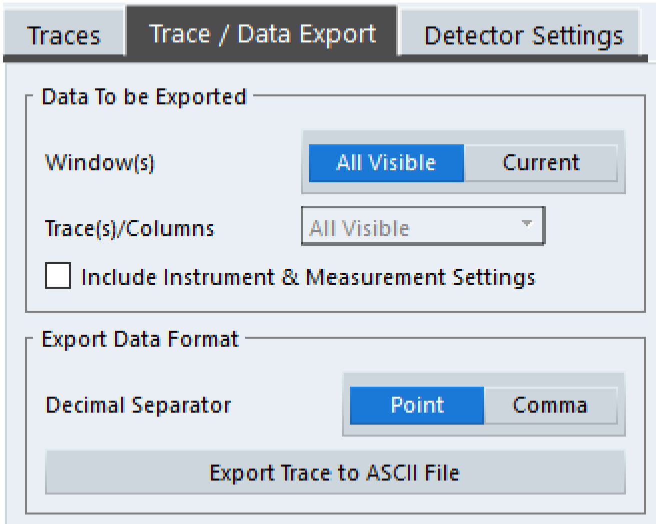
| Function | Trace Settings | |
|---|---|---|
| Preset All Traces | Trace 1: | Clear Write |
| | | Blank |
| Set Trace Mode<br>Max \| Avg \| Min | Trace 1: | Max Hold |
| | Trace 2: | Average |
| | Trace 3: | Min Hold |
| | | Blank |
| Set Trace Mode<br>Max \| ClrWrite \| Min | Trace 1: | Max Hold |
| | Trace 2: | Clear Write |
| | Trace 3: | Min Hold |
| | | Blank |

Remote command:
`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:PRESet` on page 280

## 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 R&S VSE 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 277.



**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 279

**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 278

**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 278

**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.

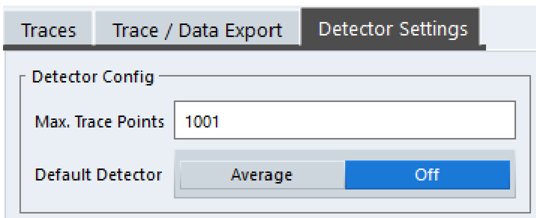
**Note:** Secure user mode.
In secure user mode, settings that are stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "memory limit reached" error can occur although the hard disk indicates that storage space is still available.

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 VSE base software user manual.

Remote command:
MMEMory:STORe<n>:TRACe on page 279

## 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 280

**Default Detector**
Selects the default detector for R&S VSE-K18 result displays.

Note that changing the default detector to "Average" changes all traces with "Detector Off" to "Detecor Average". Setting "Off" will change all traces with "Detector Average" to "Detector Off"

Remote command:
[SENSe:]DETector<t>:DEFault[:FUNCtion] on page 279

## 4.2 Markers

The amplifier application provides four markers in most result displays.



### 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**
Defines how the marker information is displayed.

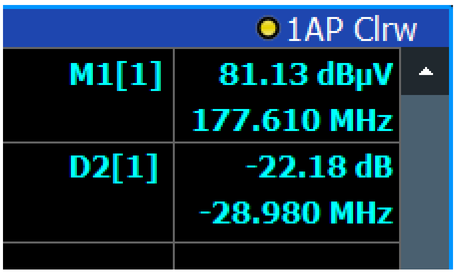
"On" Displays the marker information in a table in a separate area beneath the diagram.

"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 283

**Marker Info**
Turns the marker information displayed in the diagram on and off.




Remote command:
`DISPlay[:WINDow<n>]:MINFo[:STATe]` on page 283

**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 282

## 4.2.2 Individual marker settings

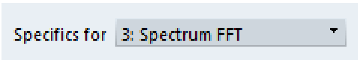
**Access**: "Overview" > "Result Config" > "Markers"

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**
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 287
CALCulate<n>:DELTamarker<m>[:STATe] on page 285

**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 288
CALCulate<n>:DELTamarker<m>:X on page 286

**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 287
CALCulate<n>:DELTamarker<m>[:STATe] on page 285

**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 285

**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).

Remote command:
CALCulate<n>:MARKer<ms>:LINK:TO:MARKer<md> on page 287
CALCulate<n>:DELTamarker<ms>:LINK:TO:MARKer<md> on page 284
CALCulate<n>:DELTamarker<m>:LINK on page 284

**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 288

**All Markers Off**

Deactivates all markers in one step.

Remote command:
`CALCulate<n>:MARKer<m>:AOFF` on page 287

**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 283

## 4.2.3 Marker positioning



**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 292
`CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]` on page 290

**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 291
CALCulate<n>:MARKer<m>:MAXimum:RIGHt on page 292
CALCulate<n>:MARKer<m>:MAXimum:LEFT on page 291
CALCulate<n>:DELTamarker<m>:MAXimum:NEXT on page 289
CALCulate<n>:DELTamarker<m>:MAXimum:RIGHt on page 290
CALCulate<n>:DELTamarker<m>:MAXimum:LEFT on page 289

**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 293
CALCulate<n>:DELTamarker<m>:MINimum[:PEAK] on page 291

**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.

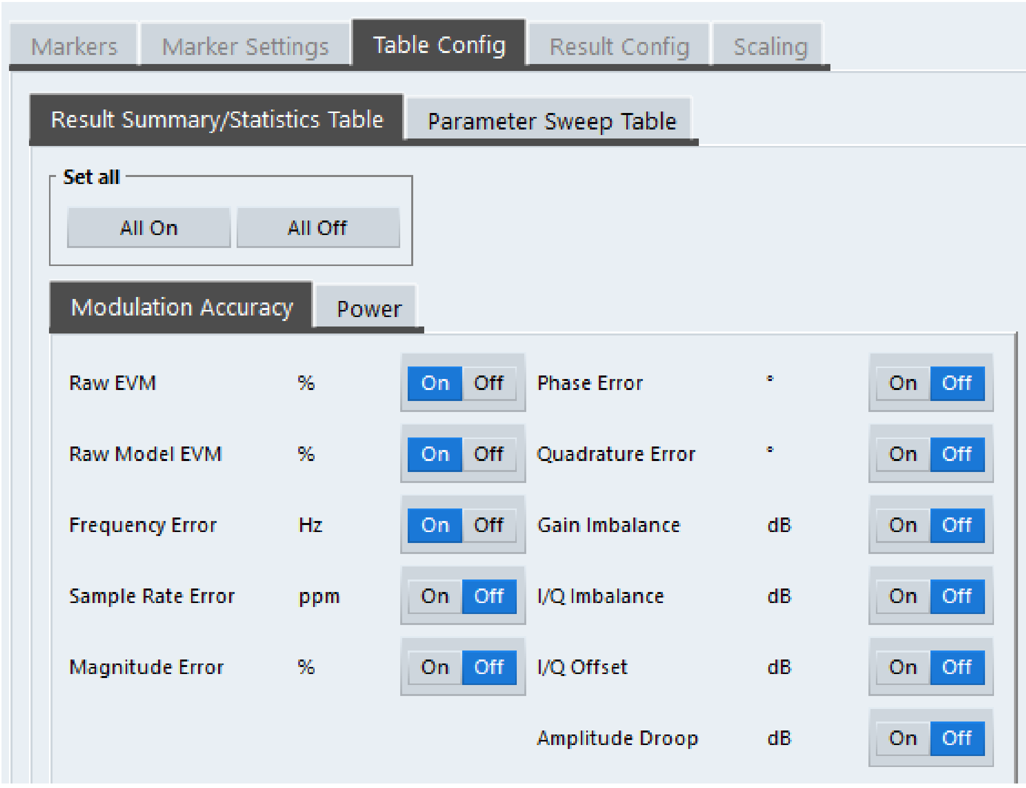
,

Remote command:
CALCulate<n>:MARKer<m>:MINimum:NEXT on page 292
CALCulate<n>:MARKer<m>:MINimum:LEFT on page 292
CALCulate<n>:MARKer<m>:MINimum:RIGHt on page 293
CALCulate<n>:DELTamarker<m>:MINimum:NEXT on page 290
CALCulate<n>:DELTamarker<m>:MINimum:LEFT on page 290
CALCulate<n>:DELTamarker<m>:MINimum:RIGHt on page 291

## 4.3 Numerical result tables

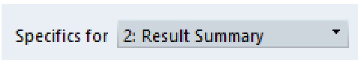
**Access**: "Overview" > "Result Config" > "Table Config"

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.




**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.

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 294

Individual parameter sweep items: `DISPlay[:WINDow<n>]:PTABle:ITEM` on page 293

All modulation accuracy items: `DISPlay[:WINDow<n>]:TABLe:ITEM:MACCuracy:ALL` on page 295

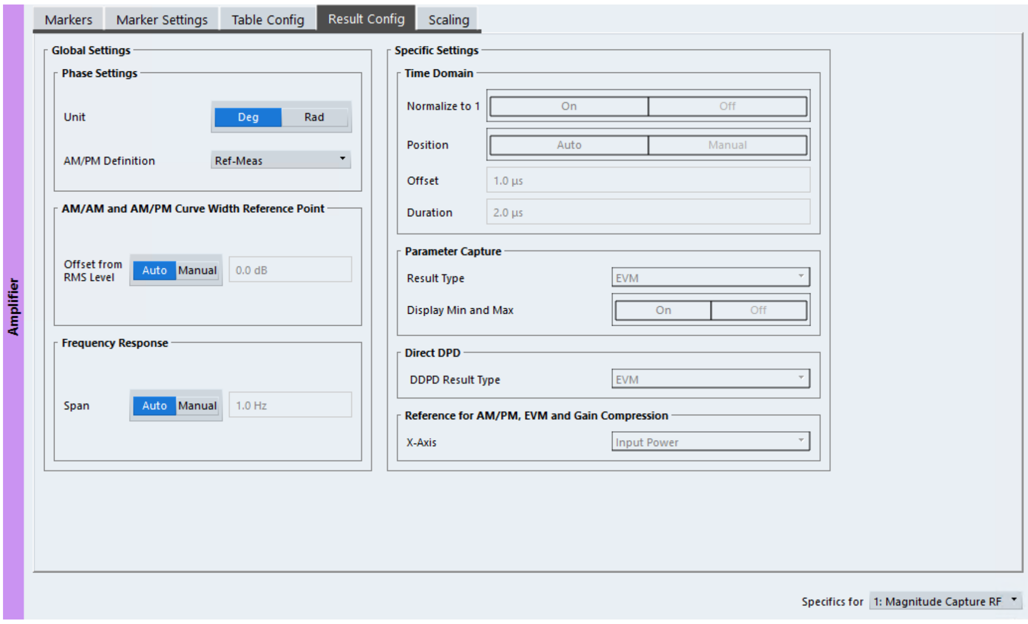
All power items: `DISPlay[:WINDow<n>]:TABLe:ITEM:POWer:ALL` on page 295

All parameter sweep items: `DISPlay[:WINDow<n>]:PTABle:ITEM:ALL` on page 294

## 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**

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 298

**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 297

**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 302
`CONFigure:AMPM:CWIDth:REFerence` on page 302

**Frequency Response**
Selects the span that the frequency response is applied to for R&S VSE-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 298
`CONFigure:FRSPan:AUTO` on page 299

**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 301

**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 301

**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 139).

Remote command:
`DISPlay[:WINDow<n>]:TDOMain:X[:SCALe]:OFFSet` on page 301

**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 139).

Remote command:
`DISPlay[:WINDow<n>]:TDOMain:X[:SCALe]:DURation` on page 300

**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"

For details on the parameters, see Chapter 2.2, "Amplifier parameters", on page 28.

Remote command:
`CONFigure:PSWeep:Z<n>:RESult` on page 299

**Direct DPD Result Type**
Selects the result type for direct DPD measurements.

For a description of the supported result types, see "DDPD Results (R&S VSE-K18D)" on page 16.

Remote command:
`CONFigure:DDPD:WINDow<n>:RESult` on page 247

**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

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".

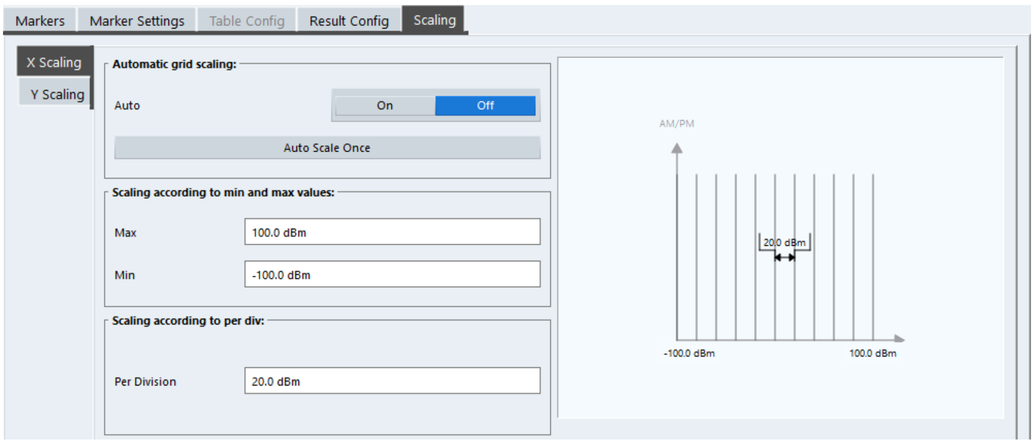
To analyze the signal against the output power, select "Output Power".

Remote command:
`CALCulate<n>:PREFerence:X` on page 298

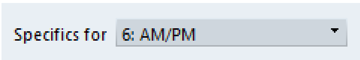
## 4.5 X-axis scaling

**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**
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 303

**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.

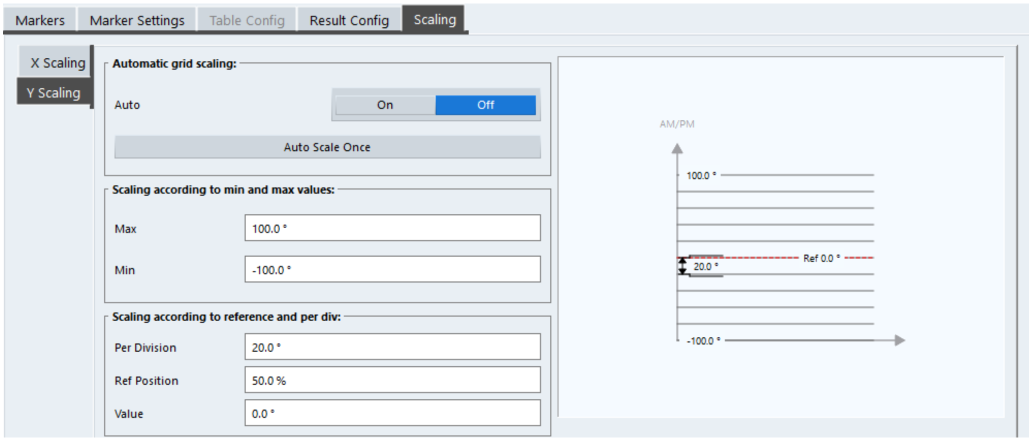
- Scaling according to minimum and maximum values
  The scale is defined by the values at the lower and upper end of the x-axis.
- Scaling according to the distance between two grid lines
  The scale is defined by the value range within two grid lines in the diagram (→ per division). The distance between 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 303
Maximum: DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALe]:MAXimum on page 303
Distance: DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:X[:SCALe]:PDIVision on page 304

## 4.6 Y-axis scaling

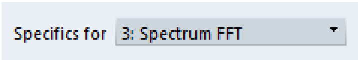
**Access**: "Overview" > "Result Config" > "Scaling" > "Y Scaling"

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

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 305

### 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 305
Maximum: `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:MINimum` on page 306
Reference value: `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RVALue` on page 307
Position: `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RPOSition` on page 307
Distance: `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:PDIVision` on page 306

# 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 R&S VSE 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 R&S VSE 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).



## 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 R&S VSE.

**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 R&S VSE 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.



### 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 146.

#### 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**) |
| <t> | 1..6 | Trace |
| <li> | 1 to 8 | Limit line |

## 5.3 Selecting the application



**SYSTem:PRESet:CHANnel[:EXEC]**

Restores the default software settings in the current channel.

Use `INST:SEL` to select the channel.

**Example:** `INST:SEL 'Spectrum2'`
Selects the channel for "Spectrum2".
`SYST:PRES:CHAN:EXEC`
Restores the factory default settings to the "Spectrum2" channel.

**Usage:** Event

**Manual operation:** See "Preset Channel" on page 39

## 5.4 Configuring the result display

The commands required to configure the screen display in a remote environment are described here.



### 5.4.1 Global layout commands

The following commands are required to change the evaluation type and rearrange the screen layout across measurement channels as you do in manual operation.

For compatibility with other Rohde & Schwarz Signal and Spectrum Analyzers, the layout commands described in Chapter 5.4.2, "Working with windows in the display", on page 154 are also supported. Note, however, that the commands described there only allow you to configure the layout within the *active* measurement channel.



---

**LAYout:GLOBal:ADD[:WINDow]?**
<ExChanName>,<ExWinName>,<Direction>,<NewChanName>,<NewWinType>

Adds a window to the display next to an existing window. The new window may belong to a different channel than the existing window.

To replace an existing window, use the `LAYout:GLOBal:REPLace[:WINDow]` command.

**Parameters:**

<ExChanName> string

Name of an existing channel

<ExWinName> string

Name of the existing window within the <ExChanName> channel 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:GLOBal:IDENtify[:WINDow]?` query.

<Direction> LEFT | RIGHt | ABOVe | BELow | TAB

Direction the new window is added relative to the existing window.

**TAB**
The new window is added as a new tab in the specified existing window.

<NewChanName> string

Name of the channel for which a new window is to be added.

<NewWinType> string

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:** `LAYout:GLOBal:ADD:WINDow? 'IQ Analyzer','1',RIGH,'IQ Analyzer2','FREQ'`
Adds a new window named 'Spectrum' with a Spectrum display to the right of window 1 in the channel 'IQ Analyzer'.

**Usage:** Query only

**LAYout:GLOBal:CATalog[:WINDow]?**

Queries the name and index of all active windows from top left to bottom right for each active channel. The result is a comma-separated list of values for each window, with the syntax:

<ChannelName_1>: <WindowName_1>,<WindowIndex_1>..<WindowName_n>,<WindowIndex_n>

..

<ChannelName_m>: <WindowName_1>,<WindowIndex_1>..<WindowName_n>,<WindowIndex_n>

**Return values:**
<ChannelName> String containing the name of the channel. The channel name is displayed as the tab label for the measurement channel.

<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:GLOB:CAT?
```
Result:
```
IQ Analyzer: '1',1,'2',2
Analog Demod: '1',1,'4',4
```
For the I/Q Analyzer channel, two windows are displayed, named '2' (at the top or left), and '1' (at the bottom or right).
For the Analog Demodulation channel, two windows are displayed, named '1' (at the top or left), and '4' (at the bottom or right).

**Usage:** Query only

---

**LAYout:GLOBal:IDENtify[:WINDow]?** <ChannelName>,<WindowName>

Queries the **index** of a particular display window in the specified channel.

**Note**: to query the **name** of a particular window, use the LAYout:WINDow<n>:IDENtify? query.

**Parameters:**

<ChannelName> String containing the name of the channel. The channel name is displayed as the tab label for the measurement channel.

**Query parameters:**

<WindowName> String containing the name of a window.

**Return values:**

<WindowIndex> Index number of the window.

**Example:**
```
LAYout:GLOBal:ADD:WINDow? IQ,'1',RIGH,
'Spectrum',FREQ
```
Adds a new window named 'Spectrum' with a Spectrum display to the right of window 1.

**Example:**
```
LAYout:GLOBal:IDENtify? 'IQ Analyzer',
'Spectrum'
```
Result:
```
2
```
Window index is: 2.

**Usage:** Query only

---

**LAYout:GLOBal:REMove[:WINDow]** <ChannelName>, <WindowName>

**Setting parameters:**

<ChannelName>

<WindowName>

**Usage:** Setting only

**LAYout:GLOBal:REPLace[:WINDow]** <ExChannelName>, <WindowName>, <NewChannelName>, <WindowType>

**Setting parameters:**
<ExChannelName>

<WindowName>

<NewChannelName>

<WindowType>

**Usage:** Setting only

## 5.4.2 Working with windows in the display

Note that the suffix <n> always refers to the window *in the currently selected channel*.

The following commands are required to change the evaluation type and rearrange the screen layout for a channel as you do in manual operation. Since the available evaluation types depend on the selected application, some parameters for the following commands also depend on the selected channel.

Note that the suffix <n> always refers to the window *in the currently selected channel*.

To configure the layout of windows across channels, use the Chapter 5.4.1, "Global layout commands", on page 151.



**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.
Note that the window type must be valid for the active channel. To create a window for a different channel, use the `LAYout:GLOBal:REPLace[:WINDow]` command.

**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

---

**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>

To query the name and index of all windows in all channels, use the `LAYout:GLOBal:CATalog[:WINDow]?` command.

**Return values:**

<WindowName> string

Name of the window.
In the default state, the name of the window is its index.

<WindowIndex> **numeric value**
Index of the window.

**Example:** `LAY:CAT?`
Result:
`'2',2,'1',1`
Two windows are displayed, named '2' (at the top or left), and '1' (at the bottom or right).

**Usage:** Query only

---

**LAYout:IDENtify[:WINDow]?** <WindowName>

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.

To query the index of a window in a different channel, use the `LAYout:GLOBal:IDENtify[:WINDow]?` command.

**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:MOVE[:WINDow]** <WindowName>, <WindowName>, <Direction>

**Setting parameters:**

<WindowName> String containing the name of an existing window that is to be moved.
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.

<WindowName> String containing the name of an existing window the selected window is placed next to or replaces.
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.

<Direction> LEFT | RIGHt | ABOVe | BELow | REPLace
Destination the selected window is moved to, relative to the reference window.

**Example:** `LAY:MOVE '4','1',LEFT`
Moves the window named '4' to the left of window 1.

**Example:** `LAY:MOVE '1','3',REPL`
Replaces the window named '3' by window 1. Window 3 is deleted.

**Usage:** Setting 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 154 for a list of available window types.
Note that the window type must be valid for the active channel. To create a window for a different channel, use the `LAYout:GLOBal:REPLace[:WINDow]` command.

**Example:** `LAY:REPL:WIND '1',MTAB`
Replaces the result display in window 1 with a marker table.

**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 154 for a list of available window types.
Note that the window type must be valid for the active channel. To create a window for a different channel, use the `LAYout:GLOBal:ADD[:WINDow]?` command.

**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`<br>Result:<br>`'2'`<br>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.<br>In the default state, the name of the window is its index. |
| **Example:** | `LAY:WIND2:IDEN?`<br>Queries the name of the result display in window 2.<br>Response:<br>`'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.

To remove a window in a different channel, use the `LAYout:GLOBal:REMove[:WINDow]` command.

**Suffix:**

| | |
|---|---|
| <n> | Window |
| **Example:** | `LAY:WIND2:REM`<br>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 154 for a list of available window types.
Note that the window type must be valid for the active channel. To create a window for a different channel, use the `LAYout:GLOBal:REPLace[:WINDow]` command.

**Example:** `LAY:WIND2:REPL MTAB`
Replaces the result display in window 2 with a marker table.

**Usage:** Setting only

## 5.4.3 General window commands

The following commands are required to work with windows, independently of the application.

Note that the suffix <n> always refers to the window *in the currently selected measurement channel*.



**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`

## 5.5 Performing amplifier measurements



### 5.5.1 Activating Amplifier measurements

Amplifier measurements require a special application in the R&S VSE. The common commands for configuring and controlling measurement channels, as well as blocks and sequences, are also used in the Amplifier measurement application.

They are described in the R&S VSE base software user manual.

## 5.6 Configuring amplifier measurements



### 5.6.1 Designing a reference signal

**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 42

---

**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 42

---

**CONFigure:REFSignal:CGW:READ**

This command transfers a reference signal designed on a signal generator into the R&S VSE-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 42

---

**CONFigure:REFSignal:CWF:DPIPower** <Power>

This command defines the peak input power of the DUT.

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 44

---

**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 44

---

**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.

**GREY**
Unknown processing state.

**RED**
The reference signal could not have been loaded into the application.

**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 44

**CONFigure:REFSignal:CWF:WRITe**

This command loads a reference signal based on a waveform file into the 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:** //Load the reference signal into the application and, if the feature has been turned on, transfer the reference signal to the generator
`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 44

**CONFigure: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 46

**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 47

**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 46

---

**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 VSE-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 VSE-K18" on page 45

**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 48

**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 47

**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:\ProgramData\Rohde-Schwarz\VSE\<version_no>\user\K18\ReferenceFiles`.

**Parameters:**

<FileName> String containing the path of the file.

**Example:** //Enable generator control
`CONF:GEN:CONT ON`
//Define waveform file name
`CONFigure: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
`CONFigure: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 47

---

**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 47

---

**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 (.wv) is added automatically.

**Example:** //Define name for the waveform file
`CONF:REFS:GOS:WNAM 'RefSignal'`

**Manual operation:** See "Waveform File Name" on page 47

---

**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 VSE-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 VSE-K18. In addition, the waveform file that has been created is transferred into the signal generator.
`CONF:REFS:GOS:WRIT;*WAI`

**Usage:** Event

**Manual operation:** See "Designing a reference signal within the R&S VSE-K18" on page 45

---

**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 waveform file.
*RST: 0

**Example:** //Select a segment
`CONF:REFS:SEGM 3`

**Manual operation:** See "Using multi-segment waveform files" on page 41

---

**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 40

---

**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 40

---

**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 40

---

**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 40

---

**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 40

**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 49

**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 49

**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 50

**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 50

**CONFigure:CFReduction:SBANdwidth:LEDState?**

Reads the LED status of the signal bandwith.

**Return values:**
<State> GREY | RED | GREen

**Example:** `CONFigure:CFReduction:SBANdwidth:LEDState`

**Usage:** Query only

**Manual operation:** See "Signal Bandwidth" on page 50

---

**CONFigure:CFReduction:RSORignal** <State>

Switches the EVM reference signal.

**Parameters:**
<State>

**Example:** `CONFigure:CFReduction:RSORignal ON`

**Manual operation:** See "EVM Ref. Signal" on page 49

---

**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 49

---

**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 49

---

**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 49

---

**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 49

---

**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 50

---

**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 50

---

**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 50

---

**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 49

---

**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 49

---

**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 49

---

**CONFigure:CFReduction:APPLy**

Applies crest factor reduction on the connected signal generator.

Only available for backward compatibility, use `CONFigure:CFReduction:READ` on page 174 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 174 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 50

**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 50

**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 50

**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 50

**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 50

---

**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 50

---

**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 50

---

**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 50

### 5.6.2 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 data sheet.

### 5.6.2.1 Configuring power sensor measurements



---

**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 64

---

**SYSTem:COMMunicate:RDEVice:PMETer<p>:COUNt?**

Queries the number of power sensors currently connected to the R&S VSE.

**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 64

---

**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:** `SYST:COMM:RDEV:PMET2:DEF '','NRP-Z81','', '123456'`
Assigns the power sensor with the serial number '123456' to the configuration "Power Sensor 2".
`SYST:COMM:RDEV:PMET2:DEF?`
Queries the sensor assigned to "Power Sensor 2".
Result:
`'','NRP-Z81','USB','123456'`
The NRP-Z81 power sensor with the serial number '123456' is assigned to the "Power Sensor 2".

**Manual operation:** See "Select" on page 64

---

**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 64

**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 65

**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 Meas -> Ref " on page 65

**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 66

---

**[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 66

---

**[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 data sheet 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 64

---

**[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 64

**[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 65

**[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 66

**[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 65

---

**[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 65

---

**[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 65

---

**[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 64

---

**[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 63

---

**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 63

---

**TRIGger[:SEQuence]:SOURce** <Source>

Selects the trigger source.

Note that the availability of trigger sources depends on the connected instrument.

**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.

**MAGNitude**
For (offline) input from a file, rather than an instrument.
The trigger level is specified by `TRIGger[:SEQuence]:LEVel:MAPower`.

**MAIT**
For trigger information stored as markers in an `.iqx` file.

**MANual**
Only available for a connected R&S RTP:
Any trigger settings in the R&S VSE software are ignored; only trigger settings defined on the connected instrument are considered. Thus, you can use the more complex trigger settings available on an R&S RTP.

*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 66

---

**TRIGger[:SEQuence]:LEVel:MAPower** <TriggerLevel>

Defines the power level that must be exceeded to cause a trigger event for (offline) input from a file.

**Parameters:**

<TriggerLevel> For details on available trigger levels and trigger bandwidths, see the data sheet.
Default unit: DBM

**Example:** `TRIG:LEV:MAP -30DBM`

---

**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 65

---

**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 65

### 5.6.2.2 Triggering with power sensors



---

**[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 66

**[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 66

**[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 66

**[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 67

---

**[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 66

## 5.6.3 Configuring data input

The following commands are required to configure data input.

Data output is described in the R&S VSE Base Software User Manual.



### 5.6.3.1 RF input

**Remote commands exclusive to configuring RF input:**

**INPut<ip>:ATTenuation:PROTection[:STATe]** <State>

Turns the availability of attenuation levels of 10 dB or less on and off.

**Suffix:**

<ip> 1..n

**Parameters:**

<State> ON | OFF | 1 | 0

**ON | 1**
Attenuation levels of 10 dB or less are not allowed to protect the RF input connector of the connected instrument.

**OFF | 0**
Attenuation levels of 10 dB or less are not blocked. Provide appropriate protection for the RF input connector of the connected instrument yourself.

*RST: 1

**Example:** `INP:ATT:PROT ON`
Turns on the input protection.

**INPut:ATTenuation:PROTection:RESet** [<DeviceName>]

Resets the attenuator and reconnects the RF input with the input mixer for the connected instrument after an overload condition occurred and the protection mechanism intervened. The error status bit (bit 3 in the `STAT:QUES:POW` status register) and the `INPUT OVLD` message in the status bar are cleared.

The command works only if the overload condition has been eliminated first.

For details on the protection mechanism, see the instrument's documentation.

**Setting parameters:**

<DeviceName> string

Name of the instrument for which the RF input protection is to be reset.

**Example:** `INP:ATT:PROT:RES 'MyDevice'`

**Manual operation:** See "10 dB Minimum Attenuation" on page 55

---

**INPut<ip>:COUPling<ant>** <CouplingType>

Selects the coupling type of the RF input.

**Suffix:**

<ip> 1 | 2
irrelevant

<ant> Input source (for MIMO measurements only)

**Parameters:**

<CouplingType> AC | DC

**AC**
AC coupling

**DC**
DC coupling

*RST: AC

**Example:** `INP:COUP DC`

**Manual operation:** See "Input Coupling " on page 53

---

**INPut<ip>:DPATh** <DirectPath>

Enables or disables the use of the direct path for frequencies close to 0 Hz.

**Suffix:**

<ip> 1..n

**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 53

---

**INPut<ip>:FILE:ZPADing** <State>

Enables or disables zeropadding for input from an I/Q data file that requires resampling. For resampling, a number of samples are required due to filter settling. These samples can either be taken from the provided I/Q data, or the software can add the required number of samples (zeros) at the beginning and end of the file.

**Suffix:**
<ip> 1..n

**Parameters:**
<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

*RST: 0

**Example:** `INP:FILE:ZPAD ON`

**Manual operation:** See "Zero Padding" on page 57

---

**INPut<ip>: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 connected instrument 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.)

**Suffix:**
<ip> 1..n

**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 53

---

**INPut<ip>:FILTer:YIG[:STATe]** <State>

Enables or disables the YIG filter.

**Suffix:**
<ip> 1 | 2
irrelevant

**Parameters:**
<State> ON | OFF | 0 | 1

**Example:** `INP:FILT:YIG OFF`
Deactivates the YIG-preselector.

**Manual operation:** See "YIG-Preselector " on page 54

---

**INPut<ip>:IMPedance<ant>** <Impedance>

Selects the nominal input impedance of the RF input. In some applications, only 50 Ω are supported.

**Suffix:**

<ip> 1 | 2
irrelevant

<ant> Input source (for MIMO measurements only)

**Parameters:**

<Impedance> 50 | 75
*RST: 50 Ω
Default unit: OHM

**Example:** `INP:IMP 75`

**Manual operation:** See "Impedance " on page 53

---

**INPut<ip>:PRESelection:SET** <Mode>

Selects the preselector mode.

The command is available with the optional preselector.

**Suffix:**

<ip> 1..n

**Parameters:**

<Mode> **NARRow**
Performs a measurement by automatically applying all available combinations of low and high pass filters consecutively. These combinations all have a narrow bandwidth.

**WIDE**
Performs a measurement by automatically applying all available bandpass filters consecutively. The bandpass filters have a wide bandwidth.

**Manual operation:** See "Preselector Mode" on page 55

---

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

Turns the preselector on and off.

**Suffix:**

<ip> 1 | 2
irrelevant

**Manual operation:** See "Preselector State" on page 55

---

**INPut<ip>:RF:CAPMode** <CAPMode>

Determines how data from an oscilloscope is input to the R&S VSE software.

Is only available for connected oscilloscopes.

**Suffix:**
<ip> 1..n

**Parameters:**
<CAPMode> AUTO | IQ | WAVeform

**IQ**
The measured waveform is converted to I/Q data directly on the R&S oscilloscope (requires option K11), and input to the R&S VSE software as I/Q data.

**WAVeform**
The data is input in its original waveform format and converted to I/Q data in the R&S VSE software. No additional options are required on the R&S oscilloscope.

**AUTO**
Uses "I/Q" mode when possible, and "Waveform" only when required by the application (e.g. Pulse measurement).

*RST: IQ

**Example:** `INP:RF:CAPM WAV`

---

**INPut<ip>:RF:CAPMode:IQ:SRATe** <SamplingRate>

Determines the sample rate used by the connected oscilloscope for I/Q capture mode (see `INPut<ip>:RF:CAPMode` on page 192).

This setting is only available if an R&S oscilloscope is used to obtain the input data.

**Suffix:**
<ip> 1..n

**Parameters:**
<SamplingRate> 20 GHz | 40 GHz

No other sample rate values are allowed.

**20 GHz**
Achieves a higher decimation gain, but reduces the record length by half.
Only available for R&S oscilloscope models that support a sample rate of 20 GHz (see data sheet).

**40 GHz**
Provides a maximum sample rate.
Only available for R&S RTP13/RTP16 models that support a sample rate of 40 GHz (see data sheet).

*RST: 20 GHz
Default unit: HZ

**Example:**
```
INP:RF:CAPM IQ
INP:RF:CAPM:IQ:SRAT 40 GHZ
```

---

**INPut<ip>:RF:CAPMode:WAVeform:SRATe** <SamplingRate>

Determines the sample rate used by the connected oscilloscope for waveform capture mode (see INPut<ip>:RF:CAPMode on page 192).

This setting is only available if an R&S oscilloscope is used to obtain the input data, either directly or via the R&S FSW.

**Suffix:**
<ip> 1..n

**Parameters:**
<SamplingRate> 10 GHz | 20 GHz

No other sample rate values are allowed.

**10 GHz**
Default ; provides maximum record length

**20 GHz**
Achieves a higher decimation gain, but reduces the record length by half.
Only available for R&S oscilloscope models that support a sample rate of 20 GHz (see data sheet).
For R&S oscilloscopes with an analysis bandwidth of 4 GHz or larger, a sample rate of 20 GHZ is always used.

*RST: 10 GHz
Default unit: HZ

**Example:**
```
INP:RF:CAPM WAV
INP:RF:CAPM:WAVE:SRAT 10000000
```

---

**INPut:SELect** <Source>

Selects the signal source for measurements, i.e. it defines which connector is used to input data to the R&S VSE.

If no additional input options are installed, only RF input or file input is supported.

**Parameters:**
<Source>

**RF**
Radio Frequency ("RF INPUT" connector)

**FIQ**
I/Q data file

*RST: RF

**Manual operation:** See "Input Type (Instrument / File)" on page 52

**INPut:TYPE** <Input>

The command selects the input path for R&S FSW85 models.

**Parameters:**

<Input>

**INPUT1**
Selects RF input 1.

**INPUT2**
Selects RF input 2.

*RST: INPUT1

**Example:** //Select input path
`INP:TYPE INPUT1`

**Manual operation:** See "Input 1 / Input 2" on page 52

**INSTrument:BLOCk:CHANnel[:SETTings]:SOURce<si>** <Type>

Selects an instrument or a file as the source of input provided to the channel.

**Suffix:**

<si> 1 to 99
LTE-MIMO only: input source number

**Parameters:**

<Type> FILE | DEVice | NONE

**FILE**
A loaded file is used for input.

**DEVice**
A configured device provides input for the measurement

**NONE**
No input source defined.

**Manual operation:** See "Input Type (Instrument / File)" on page 52

**INSTrument:BLOCk:CHANnel[:SETTings]:SOURce<si>:CONFig** <Port>

Configures the port to be used for input on the selected instrument.

Is only available if an oscilloscope is connected.

**Suffix:**

<si> 1 to 99
LTE-MIMO only: input source number

**Parameters:**

<Port>

**INSTrument:BLOCk:CHANnel[:SETTings]:SOURce<si>:TYPE** <Source>

Configures the source of input to be used from the selected instrument.

Not all input sources are supported by all R&S VSE applications.

**Suffix:**
<si> 1 to 99
LTE-MIMO only: input source number

**Parameters:**
<Source>

**RF**
Radio Frequency ("RF INPUT" connector)

**'Channel 1' | 'Channel 2' | 'Channel 3' | 'Channel 4'**
Oscilloscope input channel 1, 2, 3, or 4

**'Channel 1,2 (I+Q)'**
I/Q data provided by oscilloscope input channels 1 and 2 (for oscilloscopes with 2 channels only)

**'Channel 1,3 (I+Q)' | 'Channel 2,4 (I+Q)'**
I/Q data provided by oscilloscope input channels 1 and 3, or 2 and 4 (for oscilloscopes with 4 channels only)

**'Channels 1-4 (diff. I+Q)'**
Differential I/Q data provided by oscilloscope input channels (for oscilloscopes with 4 channels only):
Channel 1: I (pos.)
Channel 2: $\bar{I}$ (neg.)
Channel 3: Q (pos.)
Channel 4: $\bar{Q}$ (neg.)

**'Channels 1,3 (Waveform)'**
Waveform data provided by oscilloscope input channels 1 and 3 (for oscilloscopes with 2 channels only)

**'Channels 2,4 (Waveform)'**
Waveform data provided by oscilloscope input channels 2 and 4 (for oscilloscopes with 2 channels only)

**'Channels 1-4 (Waveform)'**
Waveform data provided by oscilloscope input channels 1 to 4 (for oscilloscopes with 4 channels only)

*RST: RF

**Example:** INST:BLOC:CHAN:SOUR:TYPE 'Channel 2,4 (I+Q)'
I/Q data is provided by oscilloscope input channels 2 and 4

---

**SYSTem:COMMunicate:RDEVice:OSCilloscope[:STATe]** <State>

Activates the optional 2 GHz bandwidth extension (R&S FSW-B2000).

**Note**: Manual operation on the connected oscilloscope, or remote operation other than by the R&S VSE, is not possible while the B2000 option is active.

**Parameters:**
<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

**Example:** `SYST:COMM:RDEV:OSC ON`

**Manual operation:** See "B2000 State" on page 54

---

**SYSTem:COMMunicate:RDEVice:OSCilloscope:TCPip** <Address>

Defines the TCPIP address or computer name of the oscilloscope connected to the R&S VSE via LAN.

**Note**: The IP address is maintained after a [PRESET], and is transferred between applications.

**Parameters:**
<Address> computer name or IP address

**Example:** `SYST:COMM:RDEV:OSC:TCP '192.0.2.0'`

**Example:** `SYST:COMM:RDEV:OSC:TCP 'FSW43-12345'`

**Manual operation:** See "Oscilloscope IP Address" on page 55

---

**SYSTem:COMMunicate:RDEVice:OSCilloscope:PSMode[:STATe]** <State>

Activates the use of the power splitter inserted between the "IF 2 GHZ OUT" connector of the R&S VSE and the "CH1" and "CH3" input connectors of the oscilloscope. Note that this mode requires an additional alignment with the power splitter.

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

**Parameters:**
<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

**Example:** `SYST:COMM:RDEV:OSC:PSM ON`

**Manual operation:** See "Oscilloscope Splitter Mode" on page 54

---

**SYSTem:COMMunicate:RDEVice:OSCilloscope:SRATe** <Rate>

Determines whether the 10 GHz mode (default) or 20 GHz mode of the connected oscilloscope is used. The 20 GHZ mode achieves a higher decimation gain, but reduces the record length by half.

**Parameters:**

<Rate> 10 GHz | 20 GHz

No other sample rate values are allowed.

*RST: 10 GHz
Default unit: HZ

**Example:**

```
TRAC:IQ:SRAT?
//Result: 100000000
TRAC:IQ:RLEN?
//Result: 3128
SYST:COMM:RDEV:OSC:SRAT 20GHZ
TRAC:IQ:SRAT?
//Result: 200000000
TRAC:IQ:RLEN?
//Result: 1564
```

**SYSTem:COMMunicate:RDEVice:OSCilloscope:VDEVice?**

Queries whether the connected instrument is supported by the 2 GHz bandwidth extension option(B2000).

**Return values:**

<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

**Example:** `SYST:COMM:RDEV:OSC:VDEV?`

**Usage:** Query only

**SYSTem:COMMunicate:RDEVice:OSCilloscope:VFIRmware?**

Queries whether the firmware on the connected oscilloscope is supported by the 2 GHz bandwidth extension (B2000) option.

**Return values:**

<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

**Example:** `SYST:COMM:RDEV:OSC:VFIR?`

**Usage:** Query only

### 5.6.3.2 Remote commands for external frontend control

The following commands are available and required only if the optional external frontend control is installed on the connected instrument.

Further commands for external frontend control described elsewhere:

- `INPut:SELect RF`; see `INPut:SELect` on page 193
- `[SENSe<ip>:]FREQuency:CENTer` on page 205
- `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>` on page 206
- `INPut<ip>:ATTenuation:AUTO` on page 208
- `INPut<ip>:ATTenuation` on page 207



#### Commands for initial configuration

The following commands are required when you initially set up a measurement with an external frontend on the connected instrument. Note that some commands are not available for all connected instruments, or only as queries.



---

**[SENSe:]EFRontend: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<br>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 198.

**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: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 200.

**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 R&S VSE remain untouched.

**ON | 1**
Frontend connection enabled.
The frontend is reserved for exclusive use by the R&S VSE.

*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
R&S VSE.
EFR:CONN ON
```

---

**[SENSe:]EFRontend:CONNection:CONFig** <Type>, <IPAddress>[, <DeviceID>, <SymbolicName>]

Configures the connection to the external frontend.

**Parameters:**

<Type> 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 R&S VSE 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 R&S VSE.

<SymbolicName> string in double quotes

Symbolic name of the external frontend.
Not required or relevant for the R&S VSE.

**Example:**

```
//Global activation of external frontend
EFR ON
//Configure frontend
EFR:CONN:CONF "FE44S","123.456.789"
//Activate exclusive use of frontend by
R&S VSE.
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<b>:LOWer?**

Queries the start of the frequency range supported by the selected frontend frequency band.

**Suffix:**

<b> 1..n

Band for multi-band frontends

Use `[SENSe:]EFRontend:FREQuency:BAND:COUNt?` on page 201 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<b>:UPPer?**

Queries the end of the frequency range supported by the selected frontend frequency band.

**Suffix:**

<b> 1..n

Band for multi-band frontends

Use `[SENSe:]EFRontend:FREQuency:BAND:COUNt?` on page 201 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 202.

**ON | 1**
Configures the frequency band automatically

*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"**
A higher intermediate frequency is used on the external frontend, resulting in a higher input frequency at the R&S VSE.

**"IF HIGH"**
A lower intermediate frequency is used on the external frontend, resulting in a lower input frequency at the R&S VSE.

**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 connected instrument.

**"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 connected instrument.

**"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: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 204.

**Parameters:**

<Frequency> Default unit: HZ

**Example:**

```
//Query the available reference levels
EFR:FREQ:REF:LIST?
//Result: 10000000,640000000,1000000000
//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 identifcation 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[: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 R&S VSE.

**ON | 1**
The R&S VSE 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`

### 5.6.4 Configuring the frequency



---

**[SENSe<ip>:]FREQuency:CENTer** <Frequency>

Defines the center frequency.

**Suffix:**
<ip> 1..n

**Parameters:**
<Frequency> The allowed range and $f_{max}$ is specified in the data sheet.

*RST: fmax/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 58

---

**[SENSe:]FREQuency:CENTer:STEP** <StepSize>

Defines the center frequency step size.

**Parameters:**
<StepSize> $f_{max}$ is specified in the data sheet.

Range: 1 to fMAX
*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 58

**[SENSe<ip>:]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.

**Suffix:**
<ip> 1..n

**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 58

### 5.6.5 Defining level characteristics



**DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>** <ReferenceLevel>

Defines the reference level (for all traces in all windows).

With a reference level offset ≠ 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

<ant> Input source (for MIMO measurements only)

**Parameters:**

<ReferenceLevel> The unit is variable.

Range: see datasheet
*RST: 0 dBm
Default unit: DBM

**Example:** `DISP:TRAC:Y:RLEV -60dBm`

**Manual operation:** See "Reference Level " on page 60

---

**DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>: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

<ant> Input source (for MIMO measurements only)

**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 60

---

**INPut<ip>: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.

**Suffix:**

<ip> 1..n

**Parameters:**

| | | |
|---|---|---|
| <Attenuation> | Range: | see data sheet |
| | 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 61

---

**INPut<ip>:ATTenuation:AUTO** <State>

Couples or decouples the attenuation to the reference level. Thus, when the reference level is changed, the R&S VSE determines the signal level for optimal internal data processing and sets the required attenuation accordingly.

**Suffix:**
<ip> 1..n

**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 61

---

**INPut<ip>:ATTenuation:AUTO:MODE** <OptMode>

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

**Suffix:**
<ip> 1..n

**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`

---

**INPut:EATT** <Attenuation>

Defines an electronic attenuation manually. Automatic mode must be switched off (`INP:EATT:AUTO OFF`, see `INPut:EATT:AUTO` on page 209).

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 data sheet
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 61

---

**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 61

---

**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 61

**INPut<ip>:EGAin[:STATe]** <State>

Before this command can be used, the external preamplifier must be connected to the R&S VSE. See the preamplifier's documentation for details.

When activated, the R&S VSE 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.

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

**Suffix:**

<ip> 1..n

**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`

**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 210

*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 210).

**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`

---

**INPut<ip>:GAIN<ant>:STATe** <State>

Turns the internal preamplifier on the connected instrument on and off. It requires the additional preamplifier hardware option on the connected instrument.

**Suffix:**
<ip> 1 | 2
irrelevant

<ant> Input source (for MIMO measurements only)

**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.

---

**INPut<ip>:GAIN<ant>[:VALue]** <Gain>

Selects the "gain" if the preamplifier is activated (`INP:GAIN:STAT ON`, see `INPut<ip>:GAIN<ant>:STATe` on page 211).

The command requires the additional preamplifier hardware option.

**Suffix:**
<ip> 1 | 2
irrelevant

<ant> Input source (for MIMO measurements only)

**Parameters:**
<Gain> 15 dB and 30 dB
All other values are rounded to the nearest of these two.
30 dB

Default unit: DB

**Example:**
`INP:GAIN:STAT ON`
`INP:GAIN:VAL 30`
Switches on 30 dB preamplification.

**[SENSe<ip>:]ADJust:LEVel**

Initiates a single (internal) measurement that evaluates and sets the ideal reference level for the current input data and measurement settings. Thus, the settings of the RF attenuation and the reference level are optimized for the signal level. The R&S VSE is not overloaded and the dynamic range is not limited by an S/N ratio that is too small.

**Suffix:**
<ip> 1..n

**Example:** `ADJ:LEV`

**Manual operation:** See "Setting the Reference Level Automatically (Auto Level )" on page 60

## 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** <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 72

**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 71

**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 71

---

**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 R&S VSE).

**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 71

---

**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 71

---

**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 71

---

**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 71

---

**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 R&S VSE is changed

`CONF:GEN:FREQ:CENT:SYNC ON;*WAI`

**Manual operation:** See "Attach to Analyzer Frequency" on page 71

**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 70

**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 70

**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 72

**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 70

**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 70

---

**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 70

---

**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 72

---

**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 72

**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 waveform file.

*RST: 0

**Example:** //Select the 3rd segment of a waveform file
`CONF:GEN:SEGM 3;*WAI`

**Manual operation:** See "Segment" on page 71

**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 71

**CONFigure:GENerator:SETTings:UPDate**

This command updates the generator settings as defined within the R&S VSE-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 71

---

**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 71

---

**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 221 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 R&S VSE-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 220 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]** <Bandwidth>

**Example:** //Select resolution bandwidth
```
BAND:AUTO OFF
BAND 100KHZ
```

**Manual operation:** See "Defining the resolution bandwidth for spectrum measurements" on page 90

**[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 90

**[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 89

**[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 90

**[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 89

---

**[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 89

---

**[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 89

---

**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 88

---

**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 88

---

**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 88

---

**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 R&S VSE.

The command is available when you turn on `TRACe:IQ:WBANd[:STATe]`.

**Manual operation:** See "Maximum bandwidth" on page 88

---

**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 R&S VSE.

**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 88

## 5.6.8 Sweep configuration

**[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 116

**[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 91

**[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 91

**[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 91

**[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 91

**CONFigure:RESult:RANGe[:SELected]** <ResultRange>

Sets and querys the selected result range.

**Parameters:**

<ResultRange> <numeric value>

**Example:** `CONFigure:RESult:RANGe`

**Manual operation:** See "Statistics Table" on page 27
See "Select Result Rng" on page 91

## 5.6.9 Synchronizing measurement data



---

**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 94

---

**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 229
- `CONFigure:ESTimation:STOP` on page 229

**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 94

---

**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 94

---

**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 93

---

**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 94

---

**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 93

---

**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 92

---

**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 92

---

**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



---

**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 µs 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 95

---

**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 233
- `CONFigure:EVALuation:STOP` on page 233

**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 µs of the reference signal, beginning at 5 µs 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 95

---

**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 95

---

**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 95

## 5.6.11 Estimating and compensating signal errors



### 5.6.11.1 Error estimation and compensation

**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 97

**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 97

**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 97

---

**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 97

---

**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 97

---

**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 97

---

**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 97

---

**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 97

---

**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 97

---

**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 97

### 5.6.11.2 Equalizer



---

**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 98

---

**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 98
See "Equalizer Filter Length For Training" on page 116

---

**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 98

---

**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:TRAin`
  - `MMEMory:LOAD:EQUalizer:FILTer: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 98

---

**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 98

---

**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 98

---

**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:TRAin`).

**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 98

### 5.6.12 Applying a system model



---

**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 101

---

**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 101

---

**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 101

---

**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 101

---

**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 102

---

**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 100

---

**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 100

## 5.6.13 Applying digital predistortion

**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 246).
- Initiate a DPD sequence (`CONFigure:DDPD:STARt` on page 246).

**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 107

---

**CONFigure:DDPD:APPLy:WRAP[:STATe]** <State>

Smoothes 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 107
See "Manual direct DPD sequence" on page 108

---

**CONFigure:DDPD:CONTinue**

Ccontinues direct DPD in manual mode.

**Example:** `CONFigure:DDPD:CONTinue`

**Usage:** Event

**Manual operation:** See "Manual direct DPD sequence" on page 108

---

**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 107
See "Manual direct DPD sequence" on page 108

---

**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 108

---

**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 `.wv`).

**Example:** //Define file name of direct DPD file
`CONF:DDPD:FNAM 'DirectDPD.wv'`

**Manual operation:** See "Automated direct DPD sequence" on page 107

---

**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 107
See "Manual direct DPD sequence" on page 108

---

**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 246).

**Example:** //Initiate direct DPD sequence
`CONF:DDPD:STAR`

**Usage:** Event

**Manual operation:** See "Automated direct DPD sequence" on page 107
See "Manual direct DPD sequence" on page 108

---

**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 108

**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 109

**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**
AClrLower1

**ACU1**
AClrUpper1

**ACB1**
AClrBalanced1

**Example:** `CONFigure:DDPD:WIND1:RESult EVM`

**Manual operation:** See "DDPD Results (R&S VSE-K18D)" on page 16
See "Direct DPD Result Type" on page 140

**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 105

**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 105

---

**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 105

---

**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 249

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:FNAM 'DPDTable'
```

**Manual operation:** See "Selecting the DPD shaping method" on page 104

---

**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 WFIL`

**Manual operation:** See "Selecting the DPD method" on page 103

---

**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 105

---

**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 104

---

**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 105

---

**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 252
  and
- `CONFigure:DPD:AMXM[:STATe]` on page 249

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

---

**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 114

---

**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 114

---

**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 114

---

**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 114

---

**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 114

---

**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 114

**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 114

**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 114

**CONFigure:MDPD:APPLy:MODel** <Channel>

Selects the waveform to which the model should be applied.

**Parameters:**

<Channel>

**Manual operation:** See "Running a Memory Polynomial DPD sequence" on page 111

**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 111

**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 111

---

**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 111

---

**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 111

---

**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 111

---

**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 108

**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.

**Example:** `CONFigure:MDPD:WAVeform:SELect MDPD`

**Manual operation:** See "Running a Memory Polynomial DPD sequence" on page 111

**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 111

**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 108

**FETCh:DPD:POLYnomial?**

This command queries the polynomial factors of the correctional polynomial.

Prerequisites for this command

- Turn on polynomial DPD (`CONFigure:DDPD[:STATe]`).
- Run polynomial DPD (`CONFigure: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
`FETC: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

**FETCh:MDPD:COEFficients?**

Fetches the MDPD coefficient values.

**Example:** `FETCh:MDPD:COEFficients?`

**Usage:** Query only

**Manual operation:** See "Memory DPD Coefficients" on page 20

**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<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 246).
- Run a DPD sequence (`CONFigure:DDPD:STARt` on page 246).

**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 107

**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 (`CONFigure:DPD:METHod` = WFILe)
- The DPD calculation has been initiated with `CONFigure:DPD:FILE:GENerate`.

**Suffix:**

| | |
|---|---|
| <n> | 1..n |

**Setting parameters:**

| | |
|---|---|
| <FileName> | String containing the file name. |

**Example:**

```
CONF:DPD:METH WFIL
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

**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 111

---

**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 111

### 5.6.14 Detailed MSE



---

**CALCulate:MSERror?**

Calculates the detailed MSE and returns the result.

**Example:** `CALC:MSER?`

**Usage:** Query only

**Manual operation:** See "Calculate Detailed MSE" on page 116

---

**CALCulate:MSERror:CONFigure:EQUalizer:FILTer:LENGth** <Length>

**Parameters:**
<Length>

---

**CALCulate:MSERror:IQAVg:COUNt** <Count>

**Parameters:**
<Count>

### 5.6.15 Configuring envelope tracking



---

**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`

## 5.6.16 Configuring ACLR measurements

**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 118

**[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 118

**[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 R&S VSE 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 119

---

**[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 119

---

**[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 119

---

**[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 120

**[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 120

**[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 120

**[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 120

**[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 120

**[SENSe:]POWer:ACHannel:FILTer[:STATe]:CHANnel<ch>** <State>

Turns the weighting filter for a transmission channel on and off.

**Suffix:**

| | |
|---|---|
| <ch> | 1..n<br>Tx channel number |

**Parameters:**

| | |
|---|---|
| <State> | ON \| OFF \| 1 \| 0<br>*RST: 0 |

**Manual operation:** See "Weighting Filters " on page 120

**[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 119

**[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<br>*RST: 1 |

**Manual operation:** See "Reference Channel " on page 119

**[SENSe:]POWer:ACHannel:SPACing:CHANnel<ch>** <Spacing>

Defines the distance between transmission channels.

If you set the channel spacing for a transmission channel, the R&S VSE 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 120

---

**[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 120

---

**[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 120

---

**[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 118

## 5.6.17 Configuring power measurements



---

**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 117

---

**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 117

## 5.6.18 Configuring parameter sweeps

**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 123

**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 123

**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 122

---

**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`:<br>• Hz in case of the center frequency<br>• dBm in case of the output level<br>• s in case of the delay between envelope and RF signal<br>• 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**<br>Controls the envelope bias.<br>**DELay**<br>Controls the delay between envelope and RF signal.<br>**FREQuency**<br>Controls the frequency.<br>**POWer**<br>Controls the output level. |
| **Example:** | //Configure the second parameter with start, stop and stepsize values<br>`CONF:PSW:Y:STAT ON`<br>`CONF:PSW:Y:SETT FREQ`<br>`CONF:PSW:Y:STAR 10MHZ`<br>`CONF:PSW:Y:STOP 100MHZ`<br>`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`:<br>• Hz in case of the center frequency<br>• dBm in case of the output level<br>• s in case of the delay between envelope and RF signal<br>• 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.

## 5.6.19 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** <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 124

---

**[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 124

**[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 124

**[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 124

**[SENSe:]PSERvoing:MAX:ITERation** <MaxIterations>

Sets and queries the maximum number of iteratons during the power servoing sequence.

**Parameters:**

<MaxIterations> <numeric value>

**Example:** PSER:MAX:ITER 5

**Manual operation:** See "Power Servoing sequence" on page 124

**[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 124

**[SENSe:]PSERvoing:INPut:STEP** <InputPowerStep>

Defines the input power step size.

**Parameters:**
<InputPowerStep> <numeric value>

**Manual operation:** See "Power Servoing sequence" on page 124

---

**[SENSe:]PSERvoing:STARt**

Starts the power servoing sequence.

**Example:** `PSER:STAR`

**Usage:** Event

**Manual operation:** See "Power Servoing sequence" on page 124

---

**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 124

## 5.6.20 Frequency domain measurements



---

**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 125

**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 126

**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 125

**CONFigure:FDOMain:WLFRatio** <WLength Ratio>

Defines the window length as a percentage of the FFT length (see `CONFigure:FDOMain:FFTLength` on page 275).

**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 126

**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 126

## 5.7 Analyzing results



### 5.7.1 Configuring traces



---

**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 R&S VSE 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 R&S VSE 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 128

---

**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 131

---

**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.

Trace data resulting from encrypted file input cannot be queried.

**Parameters:**

<State> ON | OFF | 0 | 1

*RST: 1

**Manual operation:** See "Include Instrument & Measurement Settings " on page 130

**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 130
See "Export Trace" on page 131

**[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 131

---

**[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 131

---

**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

**Example:** `DISP:WIND:TRAC:RES MEAS`

**Manual operation:** See "Result Type" on page 129

---

**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 129

---

**[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 128

---

**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 107
See "Manual direct DPD sequence" on page 108

---

**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



### 5.7.2.1 General marker settings



**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 133

**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 132

**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 132

### 5.7.2.2 Configuring individual markers

**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 134

**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 134

---

**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 134

---

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

Turns delta markers on and off.

If necessary, the command activates the delta marker first.

No suffix at DELTamarker 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 133
See "Marker Type " on page 134

**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.<br>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 134

**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.<br>The unit is variable and depends on the one you have currently set.<br>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 135

---

**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 134

---

**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 133
See "Marker Type " on page 134

---

**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 135

---

**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 134

**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**

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 136

**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 136

---

**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 135

---

**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 136

---

**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 136

---

**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 136

**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 136

**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 136

**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 136

**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 136

**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 135

**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 136

**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 136

**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 136

**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 136

**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 136

### 5.7.3 Configuring numerical result displays



**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:TABL:ITEM GIMB,OFF`
//Query if frequency error result is calculated
`DISP:WIND2:TABL:ITEM? FERR`
would return, e.g.
`1`

| SCPI parameter | Result |
|---|---|
| AMWidth | AM curve width |
| CFIN | Crest factor in |
| CFOU | Crest factor out |
| FERRor | Frequency error |

| SCPI parameter | Result |
|---|---|
| GAIN | Gain |
| GIMBalance | Gain Imbalance |
| IQIMbalance | I/Q imbalance |
| IQOFfset | 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 |
| PERRor | Phase error |
| PINPut | Power in |
| PMWidth | PM curve width |
| POUTput | Power out |
| QERRor | Quadrature error |
| REVM | "Raw EVM" |
| RMEVm | Raw model EVM |
| SRERror | Sample rate error |

**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

## 5.7.4 Configuring the statistics table



---

**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 desription of `DISPlay[:WINDow<n>]:TABLe:ITEM` on page 294 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

### 5.7.5 Configuring result display characteristics



---

**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:AMPM:DEF?`
would return, e.g.
`REFM`

**Manual operation:** See "AM/PM Definition" on page 139

---

**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 141

---

**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 138

---

**CONFigure:FRSPan** <Time>

Sets or queries the the frequency response span for R&S VSE-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 139

---

**CONFigure:FRSPan:AUTO** <State>

Defines how the span is determined that the frequency response is applied to for R&S VSE-K18F result displays.

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**
Defines the span manually using `CONFigure:FRSPan` on page 298.

**ON | 1**
Defines the span automatically according to the calculated OBW of the reference file.

*RST: 0

**Manual operation:** See "Frequency Response" on page 139

---

**CONFigure:POWer:UNIT** <Result>

Switches the unit for power results from dBm (default) to Watts.

**Parameters:**

<Result> DBM | WATT

---

**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 140

| | |
|---|---|
| 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 |
| 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 |

**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 140

**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 139

**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 139

**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 139

---

**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 139

---

**CONFigure:AMPM:CWIDth:REFerence:AUTO** <State>

Sets and queries the curve width computation refrence 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 139

### 5.7.6 Scaling the diagram axes

**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 142

**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 142

**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 142

---

**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 142

---

**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 143

---

**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 143

---

**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 143

---

**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 143

**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 143

**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 143

**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.



### 5.8.1 Retrieving graphical measurement results



**FORMat[:DATA]** <Format>[, <BitLength>]

Selects the data format that is used for transmission of trace data from the R&S VSE to the controlling computer.

Note that the command has no effect for data that you send to the R&S VSE. The R&S VSE 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".

<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 "DDPD Results (R&S VSE-K18D)" on page 16
See "EVM vs Power" on page 17
See "Error Vector Spectrum" on page 17
See "Gain Compression" on page 18
See "Gain Deviation vs Time" on page 19
See "Magnitude Capture" on page 20
See "Parameter Sweep: Diagram" on page 22
See "Phase Deviation vs Time" on page 22
See "Raw EVM" on page 23
See "Spectrum FFT" on page 25
See "Time Domain" on page 25

---

**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.



### 5.8.2.1 Retrieving general numeric results



**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:** `FETC:TTF:CURR?`
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



**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



**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 28

**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 29

**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 28

**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:CURR?`
would return, e.g.
`0.02`

**Usage:** Query only

**Manual operation:** See "I/Q Imbalance" on page 29

---

**FETCh:MACCuracy:IQOFfset:MAXimum[:RESult]?**
**FETCh:MACCuracy:IQOFfset:MINimum[:RESult]?**
**FETCh:MACCuracy:IQOFfset: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 29

---

**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 30

---

**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 30

---

**FETCh:MACCuracy:POFFset[:RESult]?**

Queries the absolute phase value between reference signal and measured signal.

Note that the absolute phase is not relevant for R&S VSE-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 31

**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 31

**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 32

**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 32

### Retrieving power results

**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 33

**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 34

---

**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 34

---

**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 34

---

**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 35

**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 35

**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 35

---

**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 36

---

**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 36

---

**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 36

---

**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 34

---

**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 36

---

**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 37

### Retrieving baseband characteristics



**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:** `FETC:APAE:CURR?`
would return, e.g.
`1.231`

**Usage:** Query only

---

**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:** `FETC:BBP:CURR?`
would return, e.g.
`0.75`

**Usage:** Query only

---

**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

---

**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

---

**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:CURR?`
would return, e.g.
`1.42`

**Usage:** Query only

---

**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:CURR?`
would return, e.g.
`0.4`

**Usage:** Query only

### 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.

**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 28.

**Return values:**

<Results> <numeric value>

The value depends on the parameter selected for the x-axis (see `CONFigure:PSWeep:X:SETTing` on page 270).

**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 28.

**Return values:**

<Results> <numeric value>

The value depends on the parameter selected for the y-axis (see `CONFigure:PSWeep:Y:SETTing` on page 271).

**Example:** `FETC:PTAB:VCC:MAX:Y:RES?`

**Usage:** Query only

---

**FETCh:PTABle:ACP:ACHannel<ch>:BALanced:MAXimum[:RESult]?**
**FETCh:PTABle:ACP:BALanced:MAXimum[:RESult]?**
**FETCh:PTABle:ACP:MAXimum[:RESult]?**
**FETCh:PTABle:ACP:ACHannel<ch>:LOWer:MAXimum[:RESult]?**
**FETCh:PTABle:ACP:ACHannel<ch>:UPPer: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 28.

**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:BALanced: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 28.

**Return values:**

<Results> <numeric value>

The value depends on the parameter selected for the x-axis (see `CONFigure:PSWeep:X:SETTing` on page 270).

**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 28.

**Return values:**

<Results> <numeric value>

The value depends on the parameter selected for the y-axis (see `CONFigure:PSWeep:Y:SETTing` on page 271).

**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 28.

**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).

**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 28

**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 33

**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 34

**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 35

**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 35

**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 29

**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 35

**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 28

**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 29

**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 29

**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 30

**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 34

**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 36

**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 34

**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 36

**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 34

**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 36

**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 30

**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 36

**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 36

**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 36

---

**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 36

---

**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 36

---

**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 36

---

**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 31

---

**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 31

---

**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 31

---

**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 31

---

**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:AVERage: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 32

---

**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 32

---

**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 32

---

**FETCh:STABle:SRERor:SELected[: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 32

## 5.8.3 Retrieving I/Q data



---

**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 40

---

**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> **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** <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.

For details, see "Protecting Data Using the Secure User Mode" in the "Data Management" section of the R&S VSE base software 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\Amplfier.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 VSE-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 | |

## 5.11 Programming example R&S VSE-K18M

The following programming example for the R&S VSE-K18M application shows you how to apply a memory polynomial to an input vector, scaled to Volts, and return the resulting output vector, also scaled to Volts.

```
function [vfcOutput,fRMSLevelOffsetdB] = MemApply(vfcInput, viMemoryOrder,
 viPolyOrder, vfcCoeffs)

    % =======================================================================
    % Copyright 2023 Rohde & Schwarz GmbH & Co. KG
    % Rohde & Schwarz products and services are supplied to customers subject
    % to certain contractual terms and conditions.
    % In addition, there are some requirements that apply especially to certain
    % products, customers or circumstances.
    % Detailed legal information for customers and users can be found here:
    %     http://www.termsofuse.rohde-schwarz.com
    % ========================================================================
```

```
% This function applies a memory polynomial to an input vector and returns
% the resulting output vector.

% Input variables:
%   vfcInput:       complex input vector in Volts
%   iMemLength:     Vector of all the expected time shifts
%   iPolyDegree:    Vector of all the used polynomial degrees
%   vfcCoeffs:      complex coefficients, where entries are sorted in the
%                   following order [c(m1,p1) c(m2,p1) .vfcInputAbs..
%                   c(miMemLength,p1), c(m1,p2), c(miMemLength,
%                   piPolyDegree)], in Volts


%computation of needed constants
iPolyOrder = length(viPolyOrder);
iMemoryOrder = length(viMemoryOrder);
iNofSamples=length(vfcInput);

% get the enevelope of the samples to model
vfcInputAbs = abs(vfcInput);

%Buffer for the computation with the Input Signal
vfcInputBuffer=vfcInput;


%Calculate output
vfcOutput=zeros(iNofSamples,1);
iCPoly = 0;
if (viPolyOrder(1) == 0) %special case for PolyOrder 0
%(for this the Output depends only on the coeffs and not the input signal)

    for  iCMemory = 0: iMemoryOrder-1

        iCCoeff = iMemoryOrder - 1 - iCMemory + iCPoly * iMemoryOrder;
        fcCoeff = vfcCoeffs(iCCoeff+1); %selecting the Coeff for this iteration
        iNofOverlappingSamples = iMemoryOrder - (iMemoryOrder + 1) / 2 - iCMemory;
        %time shift for memory

        if (0 > iNofOverlappingSamples)

            iNofOverlappingSamples =iNofOverlappingSamples+ iNofSamples;
        end

        vfcOutput(1: iNofSamples - iNofOverlappingSamples)
        =vfcOutput(1: iNofSamples - iNofOverlappingSamples)+ fcCoeff;
    end

    iCPoly = 1;
end
```

```
        iAccPoly = 1;
        for iCPoly=iCPoly: iPolyOrder-1 % all cases where the PolyOrder is greater than 0

            iPoly = viPolyOrder(iCPoly+1);

            while (iAccPoly < iPoly)

                vfcInputBuffer=vfcInputBuffer.* vfcInputAbs;
                %multiply the Input Signal with the envelope to get the required
                %polynomial order
                iAccPoly=iAccPoly+1;
            end

            for iCMemory = 0: iMemoryOrder-1

                iCCoeff = iMemoryOrder - 1 - iCMemory + iCPoly * iMemoryOrder;
                fcCoeff = vfcCoeffs(iCCoeff+1); %selecting the Coeff for this iteration
                iNofOverlappingSamples = iMemoryOrder - floor((iMemoryOrder + 1) / 2)
                - iCMemory; %time shift for memory

                if (0 > iNofOverlappingSamples)

                    iNofOverlappingSamples =iNofOverlappingSamples+ iNofSamples;
                end

                vfcOutput(iNofOverlappingSamples+1:iNofSamples )
                = vfcOutput(iNofOverlappingSamples +1:iNofSamples)
                + vfcInputBuffer(1: iNofSamples - iNofOverlappingSamples)
                .* fcCoeff;
                vfcOutput(1: iNofOverlappingSamples) =vfcOutput(1:iNofOverlappingSamples)
                + vfcInputBuffer(iNofSamples - iNofOverlappingSamples+1: iNofSamples)
                .* fcCoeff;

            end
        end


        %Compute the change of the RMS level for the new waveform in comparison to the input
        fInputNorm=norm(vfcInput);
        fOutputNorm=norm(vfcOutput);

        fRMSLevelOffsetdB = 20*log10(fOutputNorm / fInputNorm);
        disp(['RMS Level Change required at the generator:',
        num2str(fRMSLevelOffsetdB),' dBm.'])

    end
```

# List of Commands (Amplifier)

# Index

## A



## B



## C



## D