R&S®CMW
GPRF Firmware Applications
User Manual

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Test & Measurement

User Manual

ROHDE&SCHWARZ

This user manual describes the R&S®CMW functionality related to the General Purpose Radio Frequency generator and measurements, including the following options:

- R&S®CMW-KWxxx or R&S®CMW-KVxxx (handling of waveform files using the ARB generator functionality of the GPRF generator)
- R&S®CMW-KM010 (Spectrum Analyzer)
- R&S®CMW-KM011 (I/Q vs. Slot Measurement)
- R&S®CMW-KM012 (Multi Evaluation List Mode)

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

Contents

1 Preface

The operation of the R&S CMW is described in several user manuals:

- The R&S CMW user manual describes the base software, common features of the firmware applications and basic principles for manual operation and remote control.
- Additional user manuals, like this document, describe the firmware applications.

Rohde & Schwarz provides registered users a "CMW Customer Web" section on GLORIS, the Global Rohde & Schwarz Information System: https://extranet.rohde-schwarz.com. From this resource you can download software updates, waveform library updates and documentation updates, e.g. updates of this document.

1.1 How to Read Firmware Application Chapters

Each firmware application is described in a separate chapter. These chapters can be read independently of each other. However, they are all organized as follows:

1. General Description
2. Application Sheets (optional)
3. GUI Reference
4. Programming Examples
5. Command Reference

The chapters "System Overview" and "Remote Control" in the R&S CMW user manual provide additional important information independent of the individual firmware applications. The most important parts are referenced by the firmware application descriptions.

1.1.1 General Description

This section provides a general description of the firmware application, independent of a specific operation mode (manual or remote control). It gives a high-level introduction to the capabilities of the firmware application. Background information related to the network standard is given as far as it is directly related to administrable parameters. For measurement applications a detailed description of measurement results and a description of configurable limits is given, including the relation to conformance requirements defined in network standard specifications.

1.1.2 Application Sheets

This optional section provides short application examples for select issues and related background information.

1.1.3 GUI Reference

The GUI reference describes the manual operation of the firmware application via the Graphical User Interface (GUI).

The description of a configuration dialog usually starts with a screenshot presenting the preset values of the parameters (sometimes preset values are modified to enable hidden parts of a dialog). Below the screenshot all shown parameters are described. For each single parameter a link to the corresponding command description in the "Command Reference" is provided. Ranges for numeric parameters and reset values are given there.

For measurement results links to the corresponding command descriptions are provided (commands to retrieve the results). The measurement results are described in detail in the "General Description".

1.1.4 Programming Examples

The programming examples show how to control and configure the firmware application via a remote-control program and how to retrieve measurement results. The examples consist of comprehensive command sequences. You can check just a single command of a sequence to get an example for the syntax of this single command. But you can also consider an entire sequence showing the commands in the context of a command script, under consideration of dependencies and required orders of the commands.

The command sequences are written with the intention to list most commands of the firmware application. They do not show the fastest way for a given configuration task. The fastest way would use many reset values and omit the corresponding commands.

The examples are referenced by the command descriptions of the "Command Reference".

1.1.5 Command Reference

The command reference provides information on the remote commands of the firmware application. The commands are grouped according to their function.

Each command description indicates the syntax of the command header and of the parameters. For input parameters the allowed ranges, reset values and default units are listed, for returned values the expected ranges and default units. Most commands have a command form and a query form. Exceptions are marked by "Setting only", "Query only" or "Event". Furthermore a link to the "Programming Examples" is provided and the first software version supporting the command is indicated.

2 GPRF Generator

The General Purpose RF (GPRF) generator provides a flexible RF signal for test purposes.

2.1 What's New in this Revision

This revision describes version 3.0.12 and later of the "GPRF Generator" firmware application. Compared to the previous software version it provides the following new/modified features:

- Max. index repetitions in list mode changed to 10000 (see "Frequency / Level List" on page 35)
- <GoToIndex> parameter added to command `SOURce:GPRF:GEN<i>:LIST:SSTop`

Software Version

To check your R&S CMW software version, open the "Setup" dialog and click "HW/SW Equipment". The initial software version for each remote control command is quoted in the reference description.

2.2 General Description

The R&S CMW provides a modulated or unmodulated RF carrier signal. The RF carrier signal and the modulating (baseband) signal can be configured independently. The RF carrier settings provide the following GPRF generator modes:

- In Constant Frequency Signals the RF generator provides an RF carrier signal at constant frequency.
- In List Mode, the RF carrier steps through a list of configurable frequencies and levels.

The baseband settings provide the following signal types:

- A "CW" signal is an unmodulated signal at the frequency and level of the TF carrier signal.
- A "Dual Tone" signal is a superposition of two CW signals.

- An "ARB" signal is based on an arbitrary baseband signal defined by a waveform file (*.wv, ARB File).

2.2.1 Output Scenarios

2.2.1.1 Standalone Scenario

The "Standalone Scenario" is available for all baseband modes. In this scenario the R&S CMW generates an RF signal and routes it to the selected RF connectors at the front panel of the instrument. RF carrier and baseband settings can be combined without restriction; see Combining RF and Baseband Modes. Moreover, it is possible to take into account a constant external output attenuation for the RF generator signal in order to compensate for a known loss or gain in the test setup.

2.2.1.2 IQ Out Scenario

The "IQ Out Scenario" is only available in combination with ARB baseband mode; see chapter 2.2.4, "Arbitrary RF Generator (Option R&S CMW-B110 A)", on page 12. In this mode the baseband signal generated from the ARB file is routed to the digital IQ out connectors at the back panel of the instrument, to be further processed by external DSP equipment such as fading generators.

2.2.2 Constant Frequency Signals

In constant-frequency mode the RF generator provides a single or dual-tone RF signal at constant frequency and output level.

- The single-tone (CW) signal is configured with its level and frequency. No further signal settings are needed.
- The two sources of the dual-tone signal can be configured separately; see below.

The dual-tone signal is a superposition of two CW signals Source 1 and Source 2 at the output connector. The R&S CMW provides two independent parameter sets for the two signals. The level of the signals is set implicitly by means of the sum level "Output Level (RMS)" and the "Ratio".

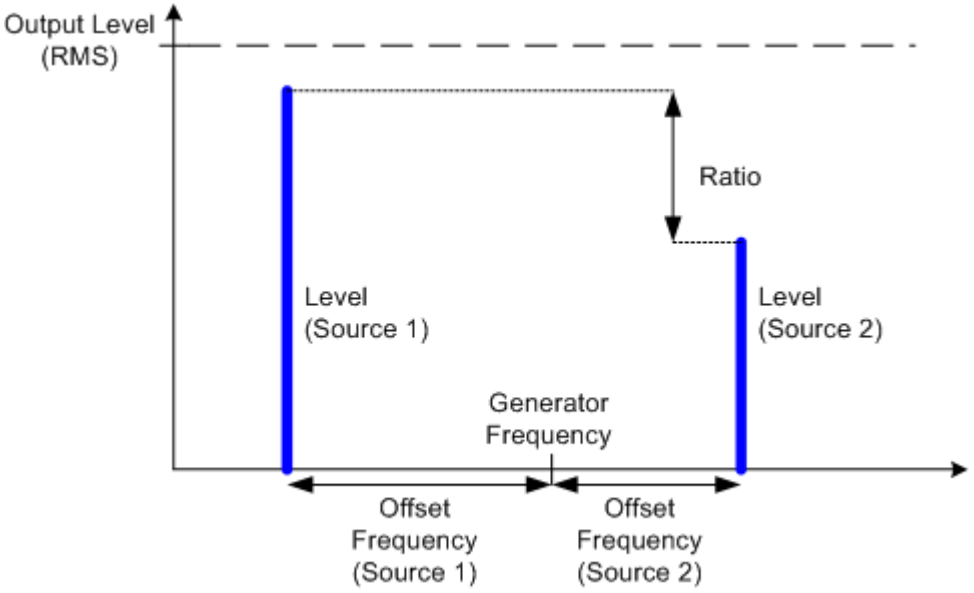


Fig. 2-1: Dual-tone signal

2.2.3 List Mode

In list mode, the RF generator steps through a list of configurable frequencies and levels.

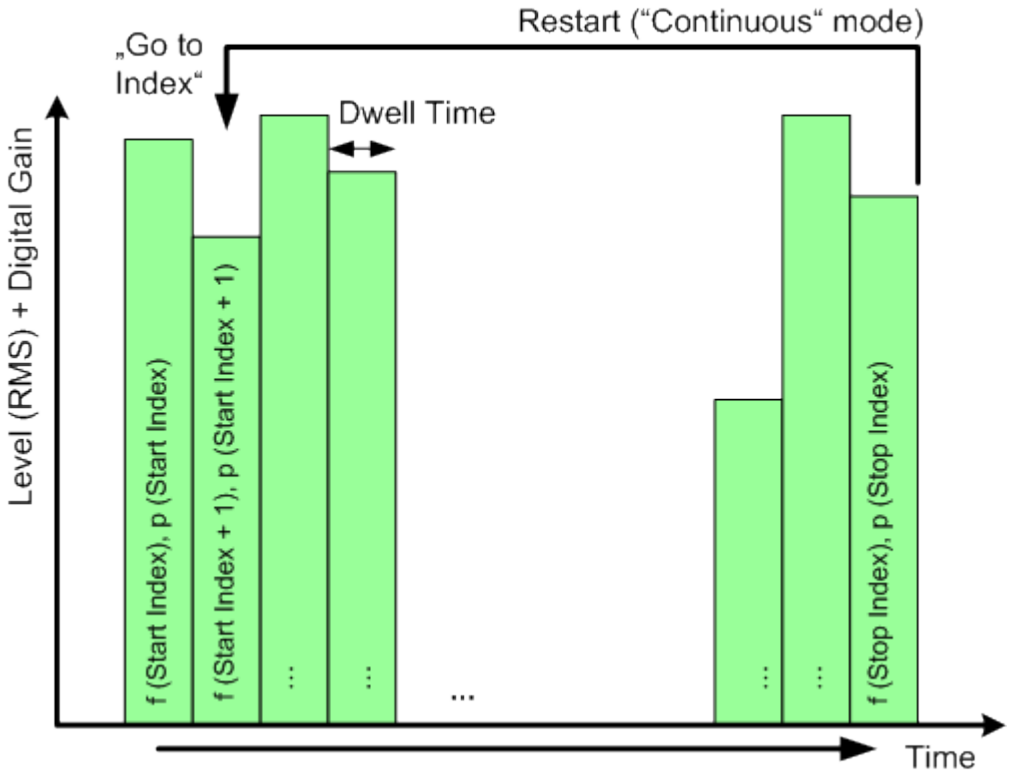


Fig. 2-2: GPRF generator settings (list mode)

It is possible to cycle through the list, to pass through the list once, or select a single frequency and level; see List Configuration. The transmission time ("Dwell Time") is variable and not necessarily equal for all frequency/level steps.

Moreover, it is possible to switch off the signal entirely at each step.

The test signal that the R&S CMW provides in list mode can be used e.g. for fast receiver or power meter adjustments over a wide range of channels and powers.

Note that you can combine the list mode with the dual tone and the ARB baseband modes.

2.2.4 Arbitrary RF Generator (Option R&S CMW-B110 A)

In arbitrary (ARB) baseband mode the R&S CMW uses an ARB waveform file (*.wv) to obtain the digital IQ data of the baseband signal; see chapter 2.2.4.1, "Available Waveforms and Options", on page 13 for details on ARB files.

The GPRF generator supports a wide range of baseband signals:

- signals in accordance with various digital network standards
- customized RF signals with various modulation schemes
- composite signals defined by multi-segment waveform files that you can alternate without delay due to loading

In standalone scenario, the GPRF generator converts the digital IQ samples to anlog I and Q (baseband) signals, which are then modulated onto the RF carrier and fed to the selected RF connector:

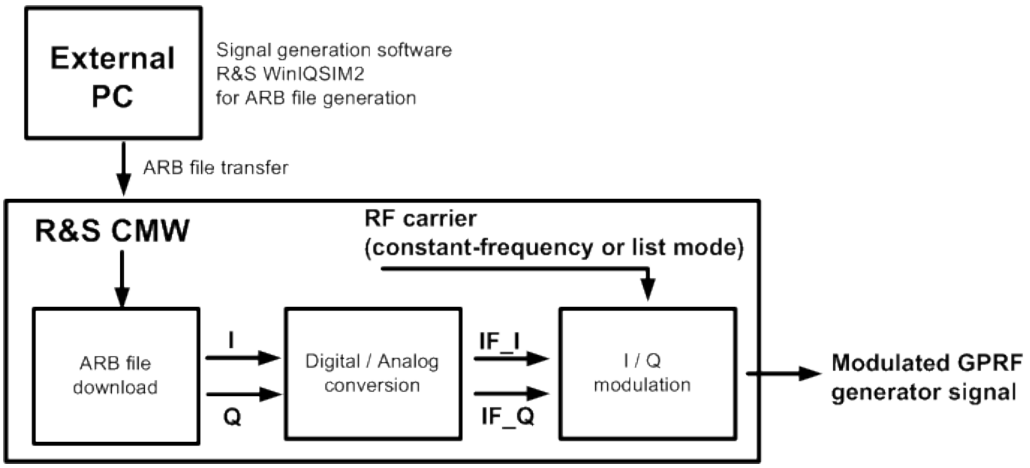


Fig. 2-3: ARB generator (Standalone Scenario)

In IQ Out scenario the digital IQ samples are fed to the selected digital IQ out at a configurable rate.

Combining list mode and ARB baseband mode

In standalone scenario it is possible to combine ARB baseband mode and list mode, which opens up many options. Note in particular that you can:

- Enable or disable the modulation for each individual power/frequency step in order to generate a signal that is discontinuously modulated; see Frequency / Level List: "Mod. On / Off".
- Trigger the list mode by means of the marker signals included in the ARB file; see List Increment.

See also ARB Generator (Option R&S CMW-B110 A).

Multi-segment waveform files

Multi-segment waveform files contain several waveforms with individual length which may pertain to different standards. The clock rates of all segments must be equal. The length of the entire file (no. of samples) is equal to the sum of all segments.

Multi-segment waveform files are used to alternate between different waveforms without delay due to loading. It is also possible to combine several waveform file into one bigger multi-segment file in order to utilize the memory size of the R&S CMW (a maximum file size of 1024 MB for waveform files is supported). The "Segment Trigger" switches between the different segments.

See also: "Real-Time and Arbitrary (ARB) Generators" in the R&S CMW user manual, chapter "System Overview"

2.2.4.1 Available Waveforms and Options

ARB generator signals are defined by waveform files. The R&S CMW processes a waveform file to generate the ARB signal.

Two types of software options are relevant in this context:

- R&S CMW-KWxxx:
  In order to process a waveform file generated by means of the signal generation software R&S WinIQSIM2, the corresponding R&S CMW-KWxxx option is required. E.g. if you purchase option R&S CMW-KW700, "WIMAX WINIQSIM2", you can process arbitrary WiMAX (IEEE 802.16) waveform files generated by R&S WinIQSIM2. Generation of waveform files and their transfer from R&S WinIQSIM2 to the R&S CMW is menu-guided; see chapter 2.3.1, "Generating and Transferring Waveform Files", on page 15.
  For most R&S CMW-KWxxx options Rohde & Schwarz provides also a library containing some already generated waveform files.
- R&S CMW-KVxxx:
  Additional waveform libraries are offered as R&S CMW-KVxxx options. Such an option allows you to process all waveform files included in the library. E.g. option R&S CMW-KV634 provides waveforms for the T-DMB standard.

Multi-segment waveform files require the options for all included network standards. For a complete list of options refer to the "SW/HW Equipment" section in the "Setup" dialog or to the R&S CMW product brochure.

If your instrument order includes R&S CMW-KVxxx or CMW-KWxxx options, the related waveform libraries are pre-installed on your instrument. Updates of waveform libraries, additional new waveform libraries, and the technical information can be downloaded from R&S CMW Customer Web.

2.2.4.2 ARB Marker Signals

A marker signal is a digital signal which is synchronized to the processed waveform file.

Markers can be used in various ways:

- Generate output triggers and synchronize external devices to the processed waveform file. The markers are fed to the TRIG A or TRIG B rear panel connectors for this purpose.
- Trigger measurements. The markers appear in the "Trigger Source" lists of the measurements.
  To address these trigger signals in remote commands, use the following strings, with <i> replaced by the instance number of the signaling application:
  – "GPRF Gen<i>: Restart Marker"
  – "GPRF Gen<i>: Waveform Marker <j>" with <j> replaced by 2, 3 or 4
  – "GPRF Gen<i>: User Defined Marker"
- Control the list modes of the "GPRF Power" measurement or the GPRF generator. The markers appear in the "Trigger Source" / "List Increment" lists.

The following marker types are available:

- **Restart Marker:** A trigger event is generated every time the waveform file is (re-)started. To account for propagation delays in the test system, the timing of the restart marker may be varied; see chapter 2.4.6, "ARB Generator (Option R&S CMW-B110 A)", on page 23.
- **Waveform Marker 2 / 3 / 4:** The marker signals in the processed waveform file define the output trigger events. To account for propagation delays in the test system, the timing of the waveform markers may be varied; see chapter 2.4.6, "ARB Generator (Option R&S CMW-B110 A)", on page 23.
- **User Defined Marker:** Up to 8 trigger events, defined relative to the processed waveform file. See chapter 2.4.6.5, "User Defined Marker", on page 29.

To generate an ARB output trigger signal, open the "SETUP > External Trigger" dialog, configure one of the trigger connectors as an output connector, and select the appropriate source.

2.2.5 Combining RF and Baseband Modes

The following tables give an overview of the allowed combinations of RF carrier and baseband settings, together with a brief description of the resulting signals.

RF mode: List Mode Off

Baseband Mode	Generated Signal
CW	CW signal at constant frequency and level
Dual Tone	Superposition of two CW signals at constant frequency and level
ARB	Modulated signal with constant RF carrier settings

RF mode: List Mode On

Baseband Mode	Generated Signal
CW	Sequence of unmodulated frequency/level steps
Dual Tone	Sequence of frequency/level steps, each containing a dual tone signal. The list mode settings define the center frequency and level, the baseband settings define the offset frequencies and the power ratio.
ARB	Sequence of modulated or unmodulated frequency/level steps, according to the contents of the ARB file and the list mode settings

2.3 Application Sheets

Application sheets describe short application examples for select issues and provide related background information. The following application sheets are related to the "GPRF Generator" firmware application.

2.3.1 Generating and Transferring Waveform Files

This application sheet describes the transfer of waveform files (*wav, ARB files) generated with WinIQSIM2 to the R&S CMW. Waveform files define digital baseband signals. With software versions V2.04.244.14 and higher, WinIQSIM2 can generate waveform files according to R&S CMW specifications and transfer them to the instrument's hard disk.

2.3.1.1 General Procedure

Signal generation by means of a waveform file requires the following steps:

1. Select the R&S CMW from within WinIQSIM2 in order to adjust the file properties to the tester.
2. Select the remote channel for file transfer.
3. Generate the waveform file using WinIQSIM2 functionality.
4. Transfer the file from the PC to the R&S CMW.

5. Select and download the file using the "General Purpose RF Generator" dialog.

2.3.1.2 Options and Equipment Required

Generation and download of waveform files requires an R&S CMW tester which is equipped with the following options:

- Option R&S CMW-B110A, "Arbitrary RF Generator"
- One or several of the WinIQSIM2 options for the R&S CMW, e.g. option R&S CMW-KW700 for downloading WIMAX files. For a complete list refer to the "SW/HW Equipment" section in the "Setup" dialog or to the R&S CMW product brochure.

The WinIQSIM2 software is installed on a PC which is connected with the R&S CMW via LAN or another hardware channel. The software does not require any additional hardware to generate the waveform files.

Prerequisites for file transfer

- To access the hard disk of the R&S CMW from WinIQSIM2 and select a file name and directory, you have to enable a "Remote Desktop" connection on the tester.
- To transfer the generated waveform file via LAN, you have to disable the Windows firewall.

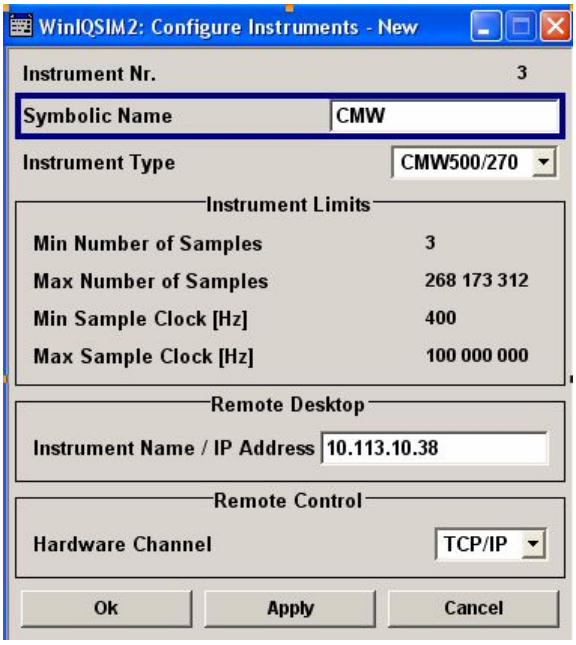
Refer to the R&S CMW help system or to the printable operating manual for more information.

2.3.1.3 WinIQSIM Operation

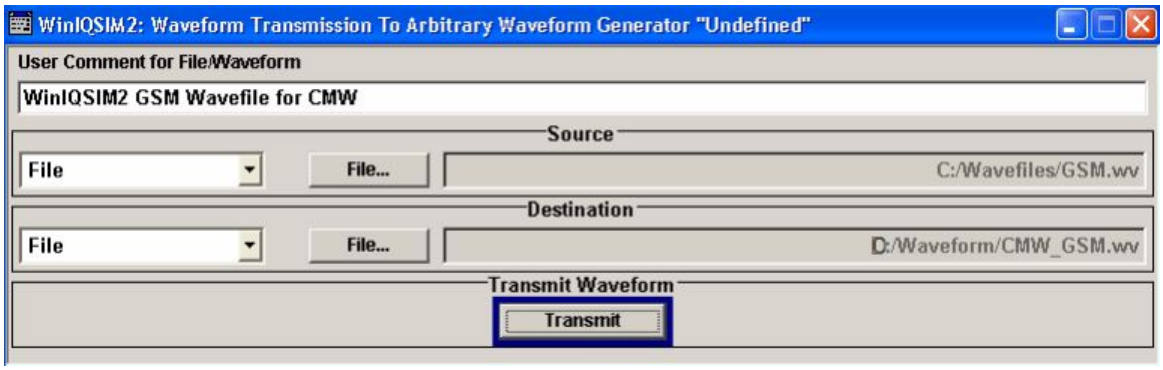
To generate and transfer a waveform file, proceed as follows:

1. Open WinIQSIM2.
2. Click "Transmission > Instruments" to open the "Configure Instruments" dialog.
3. If the R&S CMW does not appear in the list of "Available Instruments", click the "New.." button to open the "Configure Instruments - New" dialog.
4. Select the R&S CMW as an "Instrument Type" and assign a "Hardware Channel", depending on the existing connection. Enter the address of the R&S CMW for the selected channel and (if desired) a "Symbolic Name".

   The number of samples and allowed clock rates are displayed for information.



5. Click "OK" to close the dialog and generate a waveform file with the desired properties following the instructions in WinIQSIM2's manual or help system.
6. Click "Transmission > Transmit". In the dialog opened, select the generated waveform file as a source file, and a file name and location on the R&S CMW hard disk.



Tip: With an established connection between the PC and the tester, you can click the "File..." button in order to view the existing waveform files on the hard disk. The preferred file location is `D:\Rohde-Schwarz\CMW\Data\waveform`.

7. Click "Transmit" to start file transmission.

2.3.1.4 Loading and Processing Waveform Files

After transferring the waveform file to the R&S CMW you can load it using the "General Purpose RF Generator" dialog.

1. Open the "GPRF Generator" dialog from the task list.
2. Select "Baseband Mode: ARB".

3. Press the "ARB > Select ARB File..." hotkey to open a dialog from where you can select an ARB file.
4. Press "OK".

A progress bar shows that the selected file is loaded:

2.3.1.5 Possible Extensions

The R&S CMW supports multi-segment waveform files so that you can alternate between different waveforms without delay due to loading. You can also use the marker signals included in a waveform file to trigger measurements on the R&S CMW.

2.3.1.6 Additional Information

The documentation CD-ROM for WinIQSIM2, which is delivered with option R&S CMW-B110A, "Arbitrary RF Generator", provides detailed information about WinIQSIM2, the supported standards, and the generation of waveform files.

2.4 GUI Reference

The General Purpose RF (GPRF) Generator is configured using the parameters listed below.

2.4.1 Generator Control

The generator is turned on or off using the ON | OFF key.

See also: "Generator Control" in the R&S CMW user manual, chapter "System Overview"

GPRF Generator (Softkey)
The softkey shows the current generator state.

Remote command:
`SOURce:GPRF:GEN<i>:STATe`

2.4.2 Signal Routing

The following parameters are valid irrespective of the generator mode.

See also: "RF Path Settings (Generators)" in the R&S CMW user manual, chapter "System Overview"

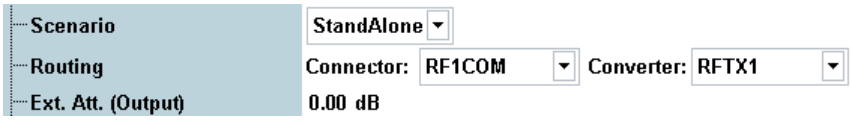


Fig. 2-4: GPRF generator settings: Routing

Scenario and Routing
This software version supports a standalone and an IQ out scenario (see chapter 2.2.1, "Output Scenarios", on page 10).

Depending on the selected scenario, different output connectors and signal converters may be selected for signal routing. Depending on your hardware configuration there may be also dependencies between both parameters: after selecting the "Connector", the "Converter" combo box offers only values compatible to the selected connector.

Remote command:
`ROUTe:GPRF:GEN<i>:SCENario:SALone`
`ROUTe:GPRF:GEN<i>:SCENario:IQOut`
`ROUTe:GPRF:GEN<i>?`

External Attenuation (Output)
Defines the value of an external attenuation (or gain, if the value is negative) in the output path. With an external attenuation of x dB, the power of the generated signal is increased by x dB. The actual generated levels are equal to the displayed values plus the external attenuation.

If a correction table for frequency-dependent attenuation is active for the chosen connector, then the table's name and a button are displayed. Press the button to display the table entries.

This applies to the standalone scenario only.

Remote command:
`SOURce:GPRF:GEN<i>:RFSettings:EATTenuation`

2.4.3 RF Settings (Standalone Scenario only)

The following RF settings are active as long as the list mode is switched off.

Fig. 2-5: GPRF generator settings: Basic RF settings

Frequency
Sets the frequency of the unmodulated RF carrier. The baseband modes "Dual Tone" and "ARB" cause a modulated signal and thus a modification of this generator frequency.

Remote command:
`SOURce:GPRF:GEN<i>:RFSettings:FREQuency`

Level (RMS)
Sets the base level of the constant-frequency RF generator. The resulting "Peak Envelope Power" (PEP) is displayed for information.

The indicated PEP corresponds to the actual peak output level at the output connector, assuming the External Attenuation (Output) is zero. For a CW signal, the PEP is equal to the base level. For the dual tone signal the PEP is equal to the power of the combined signal which corresponds to constructive (in-phase) superposition of the Source 1 and the Source 2 contributions.

The PEP is not valid for list mode signals.

Example: PEP for Dual Tone Signal

A dual-tone signal with "Ratio = 0 dB" contains two source contributions with equal power: P(Source 1) = P(Source 2) = ½ * Level(RMS). The peak voltages of the source contributions are also equal: U(Source 1) = U(Source 2) = 1/sqrt(2) U(Dual Tone). The PEP is obtained where both peak voltages are in phase so that U(PEP) = sqrt(2) * U(Dual Tone). Hence PEP = 2 * Level (RMS). If the Level(RMS) is set to 0 dBm, the R&S CMW displays a PEP of approx. +3 dBm.

Remote command:
`SOURce:GPRF:GEN<i>:RFSettings:LEVel`
`SOURce:GPRF:GEN<i>:RFSettings:PEPower?`

Digital Gain
Modifies the "Level (RMS)" by a specific value.

The "Digital Gain" parameter provides direct access to the IF levels. The relationship between the digital gain and the total RF generator level is highly linear: Use different digital gain values at equal "Level (RMS)" if you want to vary the GPRF generator power with maximum accuracy over a limited dynamic range.

The digital gain is not available in dual-tone mode.

Remote command:
`SOURce:GPRF:GEN<i>:RFSettings:DGAin`

List Mode
Enables or disables the list mode. "Off" means that the RF generator generates a constant-frequency signal; "On" means that the RF generator steps through a list of frequencies. The list mode is configured in section List Configuration.

Remote command:
`SOURce:GPRF:GEN<i>:LIST`

2.4.4 DIG IQ Settings (IQ Out Scenario only)

With respect to digital IQ out, the only configurable parameter is the sampling rate. The other parameters are derived from the content of the loaded ARB file and are displayed for informational purpose

Sample Rate
The sample rate of the digital IQ out signal.

Remote command:
`SOURce:GPRF:GEN<i>:IQSettings:SRATe`

Baseband Power and Crest Factor
As soon as the generator starts to play back the ARP file, the RMS power, peak envelope power and crest factor of the IQ signal are displayed.

Remote command:
`SOURce:GPRF:GEN<i>:IQSettings:LEVel?`
`SOURce:GPRF:GEN<i>:IQSettings:PEP?`
`SOURce:GPRF:GEN<i>:IQSettings:CRESt?`

2.4.5 Baseband Configuration (Standalone Scenario only)

The generator signal is modified/modulated according to the selected "Baseband Configuration".

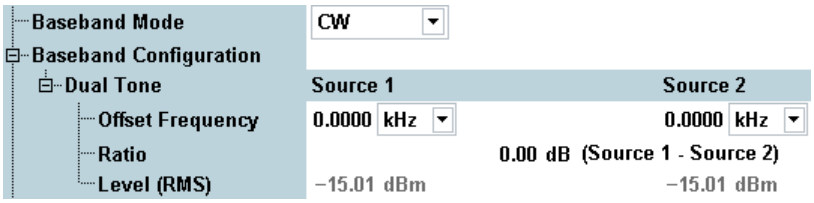


Fig. 2-6: GPRF generator settings: Baseband

Baseband Mode
Defines the baseband settings for the RF generator. These settings define a possible modulation of the RF signal.

"CW" The RF signal is a CW signal, i.e. a signal at constant "Frequency" and "Level (RMS)". No further signal settings are required.

"Dual Tone" The RF signal is a superposition of two CW signals with individual offset frequencies from the carrier and a definite power ratio; see "Dual Tone" parameters below.

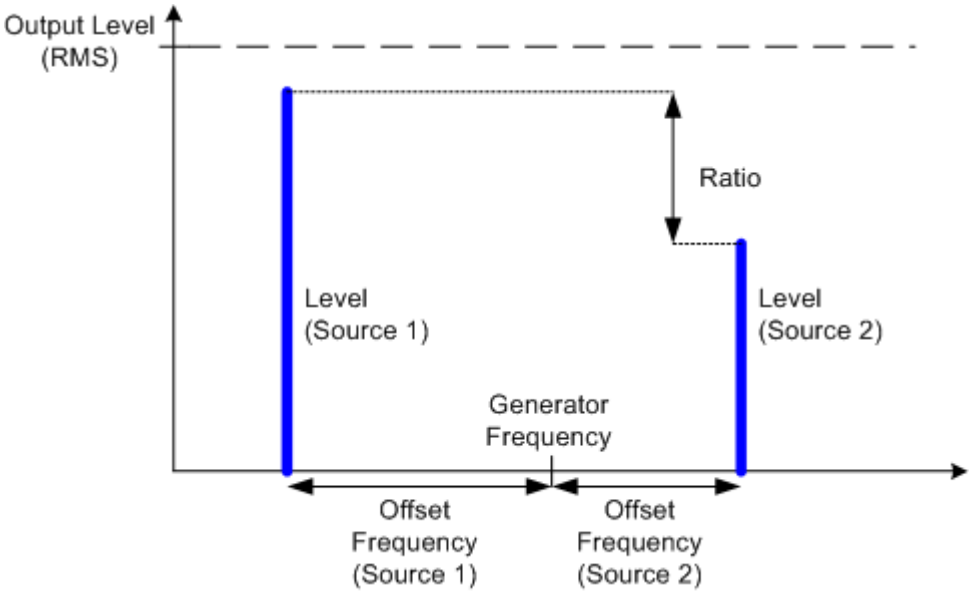
"ARB" The RF signal is based on an arbitrary baseband signal defined by a waveform file (*.wv, ARB File); see ARB Generator (Option R&S CMW-B110 A).

Remote command:

`SOURce:GPRF:GEN<i>:BBMode`

Baseband Configuration > Dual Tone

This section provides parameters for the two generator signals "Source 1" and "Source 2". The two signals are superimposed at the selected output connector if "Dual Tone" baseband mode is active.



Baseband Configuration > Dual Tone > Offset Frequency

Positive or negative offset frequency. The frequency of the modulated signal is equal to the Generator Frequency plus the "Offset Frequency".

Remote command:

`SOURce:GPRF:GEN<i>:DTONe:OFRequency<source>`

Baseband Configuration > Dual Tone > Ratio / Level (RMS)

Ratio in dB between the RMS levels of the "Source 1" and "Source 2" signals (Ratio = $Level_{Source\ 1}$ – $Level_{Source\ 2}$). The individual levels are calculated from the total generator level "Level (RMS)" and the ratio.

Remote command:

`SOURce:GPRF:GEN<i>:DTONe:RATio`

`SOURce:GPRF:GEN<i>:DTONe:LEVel<source>?`

2.4.6 ARB Generator (Option R&S CMW-B110 A)

In the arbitrary (ARB) baseband mode, the baseband signal is defined by a waveform file (*.wv, ARB File). See also Arbitrary RF Generator (Option R&S CMW-B110 A). The following sections are related to ARB generator settings:

2.4.6.1 Basic Settings

The parameters in the "ARB" section show information about the selected ARB file and define how often it is processed.

Loading an ARB file

To select a waveform file that is stored on the internal hard disk, press "ARB > Select ARB File..."". See also section chapter 2.4.6.1, "Basic Settings", on page 23.

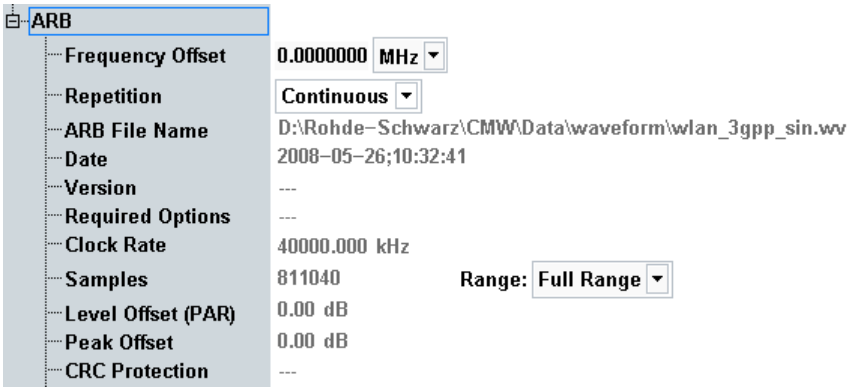


Fig. 2-7: GPRF generator settings: ARB

Baseband Configuration > ARB > Frequency Offset
Defines a frequency offset to be imposed at the baseband. In standalone scenario this will result in an equivalent frequency offset at the RF.

Remote command:
`SOURce:GPRF:GEN<i>:ARB:FOFFset`

Baseband Configuration > ARB > Repetition
Defines how often the selected ARB File is processed:

- In "Continuous" mode, the GPRF generator cycles through the file according to the ARB trigger settings until the generator is switched off. The "Cycles" and "Additional Samples" are hidden and ignored.

- In "Single Shot" mode, the file is processed N times where N is the selected number of "Cycles". The multi-segment repetition mode is automatically adjusted to "Auto". The "Additional Samples" extend the processing time.
  The total number of samples in the waveform file is displayed below. n additional samples extend the processing time by n/<Samples> cycles.

Remote command:

```
SOURce:GPRF:GEN<i>:ARB:REPetition
SOURce:GPRF:GEN<i>:ARB:CYCLes
SOURce:GPRF:GEN<i>:ARB:ASAMples
```

Baseband Configuration > ARB > ARB File

Shows the selected waveform file and the file properties (Date, Version, Clock Rate, ...).

The GPRF generator can load all samples or a proper subrange starting at the first sample.

The "Level Offset (PAR)" and "Peak Offset" parameters can be specified in WinIQSIM2. The PAR is equal to the absolute value of the difference between the "RMS Offset" and the "Peak Offset" defined in WinIQSIM2 (crest factor).

To select a waveform file that is stored on the internal hard disk, press "ARB > Select ARB File..." softkey:

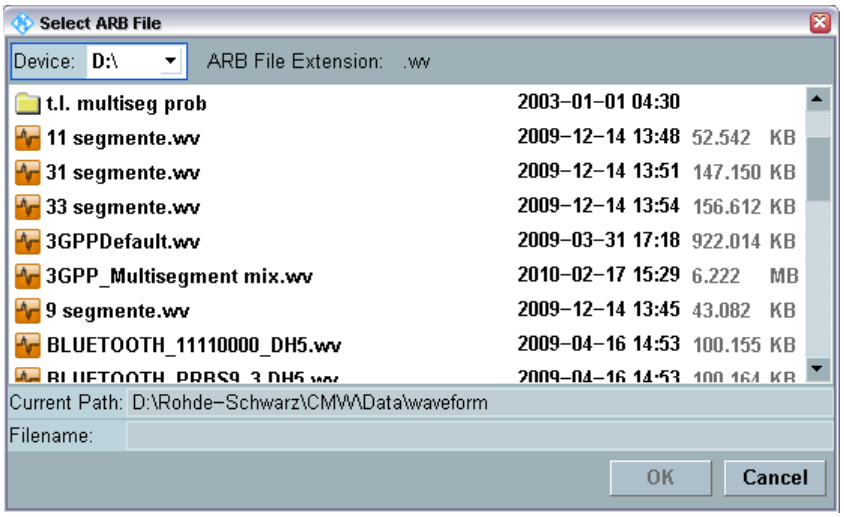
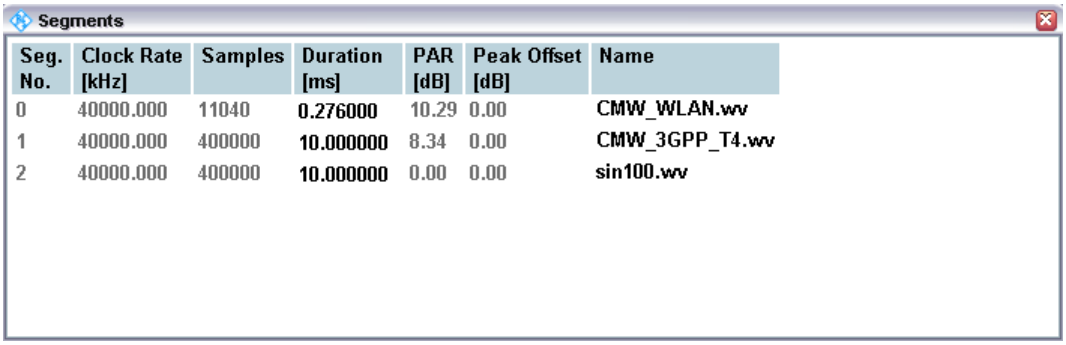


Fig. 2-8: Waveform file selection

If you load a multi-segment waveform file, an additional hotkey "ARB > Segments..." opens the segment list:



Conditions for processed waveform files

To process a multi-segment waveform file, the clock rates of all segments must be equal. The waveform files require the options for all included network standards.

The R&S CMW supports waveform files with a size up to 1024 MB. The maximum number of processed segments is 32; further segments will not be processed.

The "Required Options" property displays the R&S CMW-KVxxx and R&S CMW-KWxxx options that are required to run the loaded ARB file.

Generation of the files and their transfer from R&S WinIQSIM2 to the R&S CMW is menu-guided; see chapter 2.3.1, "Generating and Transferring Waveform Files", on page 15.

Note: The "CRC protection" property indicates whether the loaded ARB file contains a CRC checksum, which could be used for an integrity check (see `SOURce:GPRF:GEN<i>:RELiability:ALL?` on page 43).
In order to get a valid result, the related ARB file has to be loaded into memory, i.e. the baseband mode must be ARB and the generator state must be ON.

Remote command:

```
SOURce:GPRF:GEN<i>:ARB:FILE
SOURce:GPRF:GEN<i>:ARB:FILE:DATE?
SOURce:GPRF:GEN<i>:ARB:FILE:VERSion?
SOURce:GPRF:GEN<i>:ARB:FILE:OPTion?
SOURce:GPRF:GEN<i>:ARB:CRATe?
SOURce:GPRF:GEN<i>:ARB:SAMPles?
SOURce:GPRF:GEN<i>:ARB:LOFFset?
SOURce:GPRF:GEN<i>:ARB:POFFset?
SOURce:GPRF:GEN<i>:ARB:CRCProtect?
SOURce:GPRF:GEN<i>:ARB:MSEGment:NUMBer?
SOURce:GPRF:GEN<i>:ARB:MSEGment:CRATe?
SOURce:GPRF:GEN<i>:ARB:MSEGment:SAMPles?
SOURce:GPRF:GEN<i>:ARB:SAMPles:RANGe
SOURce:GPRF:GEN<i>:ARB:MSEGment:DURation?
SOURce:GPRF:GEN<i>:ARB:MSEGment:NAME?
SOURce:GPRF:GEN<i>:ARB:MSEGment:PAR?
SOURce:GPRF:GEN<i>:ARB:MSEGment:POFFset?
```

2.4.6.2 Trigger Settings

The ARB trigger system controls the start of the selected waveform file.

Fig. 2-9: ARB trigger settings

Progress of ARB file processing

The position of the currently processed sample within the ARB file can be monitored using the sample count command `SOURce:GPRF:GEN<i>:ARB:SCOunt?`.

Baseband > ARB > Trigger > Retrigger

Enables or disables the retrigger system for waveform files. With disabled retrigger, the waveform file is started by the first trigger event; the following trigger events are ignored.

Remote command:

`TRIGger:GPRF:GEN<i>:ARB:RETRigger`

Baseband > ARB > Trigger > Autostart

Enables or disables the automatic start of the loaded waveform file whenever the generator is turned on. With disabled autostart, the file must be started manually ("Execute") or using an external trigger.

Remote command:

`TRIGger:GPRF:GEN<i>:ARB:AUTostart`

Baseband > ARB > Trigger > Source

Selects the source of the trigger events used to (re-)start the waveform file. In addition to the sources described below, the ARB generator provides various output trigger signals to control internal measurements or external devices; see chapter 2.2.4, "Arbitrary RF Generator (Option R&S CMW-B110 A)", on page 12.

"Manual"	The file is (re-)started from the beginning every time you click the "Execute" button.
"Base1: External TRIG A|B"	The first trigger pulse fed in via TRIG A or TRIG B at the rear panel of the instrument causes a re-start; additional external trigger events are ignored. "Retrigger" and "Autostart" are disabled.
"Base1: User Trigger 1|2"	The Base Software provides user trigger events 1 and 2 that can be raised manually or via remote command. The trigger mechanism is similar to "Base1: External TRIG A|B": Only the first trigger event causes a re-start, "Retrigger" and "Autostart" are disabled.

"Other trigger sources" — Other R&S CMW firmware applications, e.g. "GSM Signaling" (option R&S GSM-KS200) provide additional trigger sources to synchronize the ARB generator. The available sources depend on the installed options. The trigger mechanism is similar to "Base1: External TRIG A|B": Only the first trigger event causes a re-start, "Retrigger" and "Autostart" are disabled.

Remote command:

```
TRIGger:GPRF:GEN<i>:ARB:CATalog:SOURce?
TRIGger:GPRF:GEN<i>:ARB:SOURce
TRIGger:GPRF:GEN<i>:ARB:MANual:EXECute
```

Baseband > ARB > Trigger > Delay
Sets/gets the trigger delay, i.e. the time delaying the start of the measurement relative to the selected trigger event. This does not apply to "Manual" execution.

Remote command:

```
TRIGger:GPRF:GEN<i>:ARB:DELay
```

2.4.6.3 Marker Delay Settings

The marker settings define delay times for the output trigger events relative to the waveform and restart marker events. Delays are typically used to compensate for propagation times in the test setup.

The trigger signals can be used to control internal measurements or external devices; see chapter 2.2.4.2, "ARB Marker Signals", on page 14.

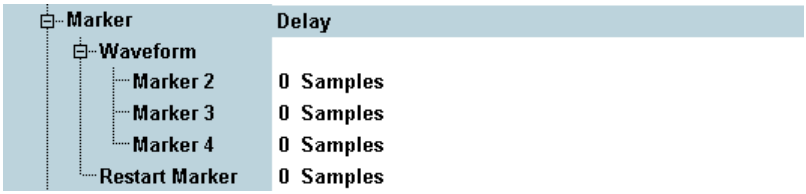


Fig. 2-10: ARB marker delay settings

Baseband > ARB > Marker > Waveform > Marker 2 ...
Delay of the "GPRF Gen1: Waveform Marker 2" ... trigger signals relative to the rising edge of the "Marker 2", "Marker 3" ... signals in the waveform file. The total number N of samples in the waveform file is displayed in the ARB section. A delay of n samples delays the marker by n/N processing periods.

Remote command:

```
SOURce:GPRF:GEN<i>:ARB:MARKer:DELays
```

Baseband > ARB > Marker > Waveform > Restart Marker
Analogous to "Marker 1" ..., but related to the restart marker. This marker is not stored in the waveform file but generated by the ARB generator when the file is processed. It represents a single pulse with its rising edge at the (re-)start time of the waveform file. See also "Restart markers and user defined markers in multi segment mode" on page 28.

Remote command:
`SOURce:GPRF:GEN<i>:ARB:MARKer:DELays`

2.4.6.4 Multi Segment Settings

The following settings control how an ARB file containing several segments is processed.

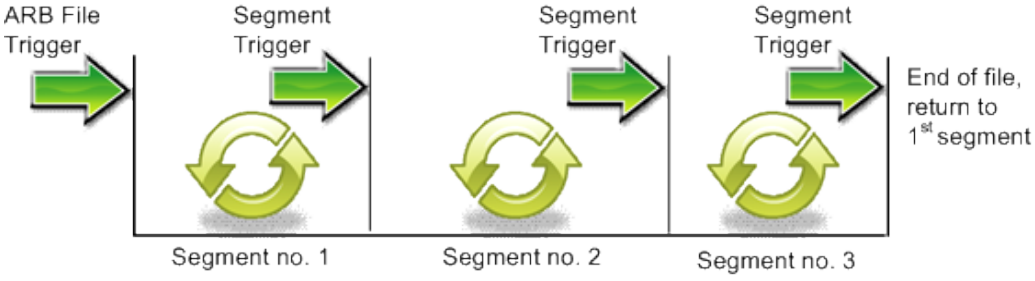
Fig. 2-11: ARB multi segment settings

Restart markers and user defined markers in multi segment mode

Restart and user defined marker signals are generated by the ARB generator while the ARB file is processed. Their timing and periodicity is based on the number of samples in the ARB file, assuming that the generator processes one sample in the file after another until it receives a new trigger event. For unsegmented files and automatically repeated segmented files ("Repetition: Auto", see below), the markers keep a fixed timing relative to the (re-)start of the processed file.

If a "Continuous" or "Continuous Seamless" multi segment repetition mode is active, the generator can jump to another segment or repeat segments. After a jump or a repetition, the restart and user defined markers are no longer synchronous to the processed file (for instance, the restart marker will no longer coincide with the first sample). Notice that restart and user defined markers can still be used in "Continuous" or "Continuous Seamless" mode, e.g. to generate periodic marker signals.

Baseband > ARB > Trigger > Multi Segment > Repetition
Selects a trigger mode for multi-segment waveform files. The general scheme for segments which are processed in consecutive order is depicted below. Use "Next Segment" to skip or repeat segments in the file.



"Continuous"	For "ARB > Repetition: Continuous" only: The generator cycles through the current segment. A trigger event causes immediate switchover to the beginning of the next segment. If the current segment is the last segment in the file, the file is re-started in the first segment.
"Continuous Seamless"	For "ARB > Repetition: Continuous" only: After receiving a trigger event, the generator waits until the end of the current segment before it steps to the next segment.
"Auto"	The generator processes one segment after another (like an unsegmented waveform file).

Remote command:
`TRIGger:GPRF:GEN<i>:ARB:SEGMents:MODE`

Baseband > ARB > Trigger > Multi Segment > Current Segment
Displays the currently processed segment with the segment number and segment name (if defined).

Remote command:
`SOURce:GPRF:GEN<i>:ARB:SEGMents:CURRent?`

Baseband > ARB > Trigger > Multi Segment > Next Segment
Selects the number of the segment to be processed after the current segment. The selection is independent of the "Current Segment" - it is possible to jump forth and back in the segmented waveform file.

`SOURce:GPRF:GEN<i>:ARB:SEGMents:NEXT`

Baseband > ARB > Trigger > Multi Segment > Trigger Source
Selects the source of the trigger events used to switch to the next segment. At present, "Manual" trigger is available: The generator steps to the next segment every time you click the "Execute" button.

Remote command:
`TRIGger:GPRF:GEN<i>:ARB:SEGMents:MANual:EXECute`

2.4.6.5 User Defined Marker

The "User Defined Marker" dialog defines a signal with up to 4 marker pulses relative to the processed waveform file. The marker signal can be used to trigger internal measurements or external devices; see chapter 2.2.4.2, "ARB Marker Signals", on page 14.

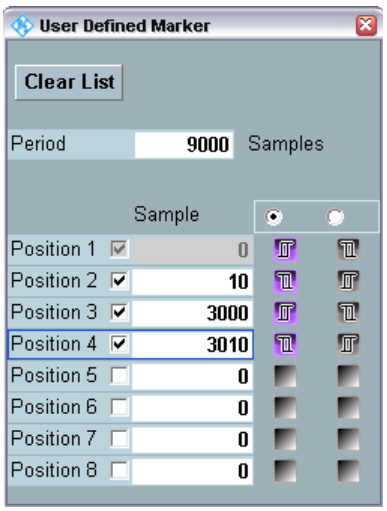


Fig. 2-12: User Defined Marker dialog

Suppose that the processed file has a total length of 9000 samples. The user defined marker settings above correspond to the following marker signal:

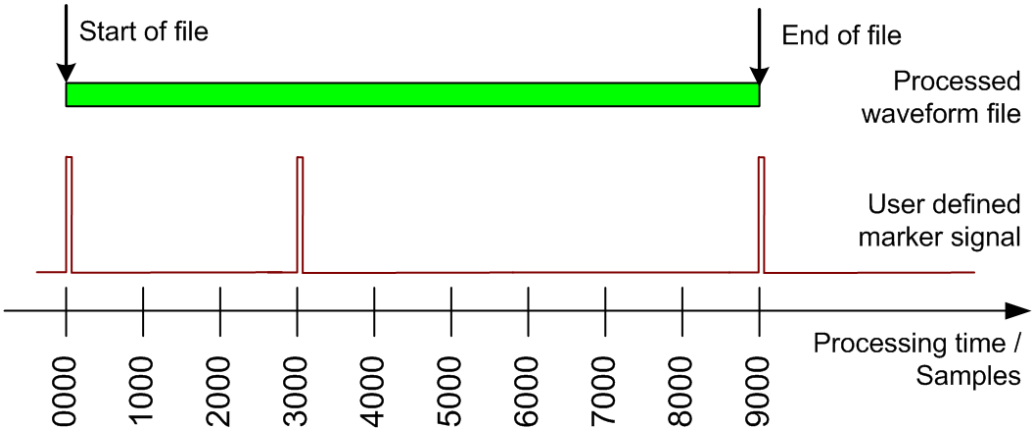


Fig. 2-13: User Defined Marker signal

Restart markers, periodic markers

To create a restart marker with a short pulse length, set the "Period" equal to the number of samples in the waveform file and enable "Position 1" (at sample 0) and "Position 2" (e.g. at sample 1). To create a marker with n equidistant pulses across the waveform length, keep the "Position 1" and "Position 2" settings and reduce the "Period" by a factor of n.

See also "Restart markers and user defined markers in multi segment mode" on page 28.

User Defined Marker
The dialog defines the marker events relative to the start of the processed waveform file (position 1, sample no. 0). The positions must be in ascending order. The "Start With" radio buttons invert the polarity of the entire generated marker signal. The entire marker signal (with the same polarity) is repeated after the selected "Period". The "Period" is often set equal to the length of the waveform file; it is independent of the enabled positions.

"Clear List" sets the "Period" equal to the number of samples in the loaded waveform file (1, if no file is loaded) and resets the remaining entries in the dialog.

Remote command:
`SOURce:GPRF:GEN<i>:ARB:UDMarker`
`SOURce:GPRF:GEN<i>:ARB:UDMarker:CLISt`

2.4.7 List Configuration

In list mode, the RF generator steps through a list of configurable frequencies and powers.

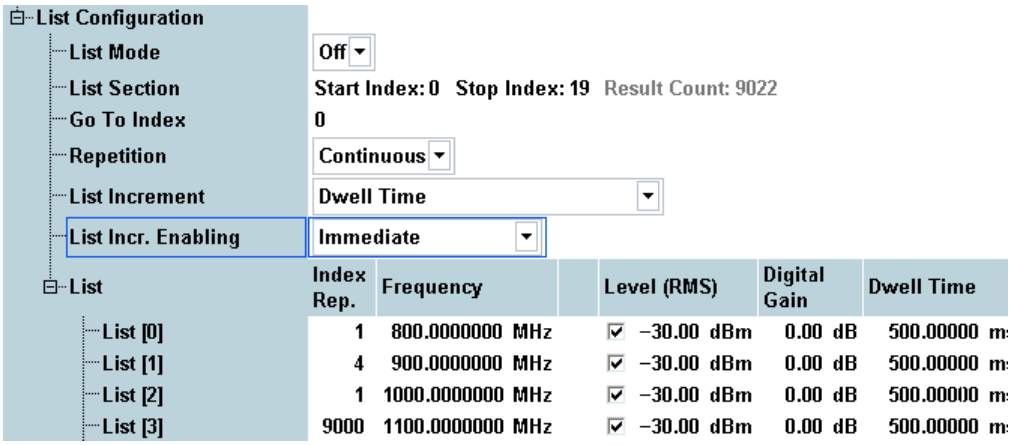


Fig. 2-14: GPRF generator settings: List mode

List Mode
Enables or disables the list mode. This function also appears among the RF settings; see chapter 2.4.3, "RF Settings (Standalone Scenario only)", on page 19.

Remote command:
`SOURce:GPRF:GEN<i>:LIST`

List Section
Definition of the used step range within the list. The generator steps through all list entries between the "Start Index" and the "Stop Index" in the "Frequency / Level List". The total number of generated steps ("Result Count"; the sum of all "Index Rep." values between the start index and the stop index) is displayed for information.

Remote command:
`SOURce:GPRF:GEN<i>:LIST:SSTop`
`SOURce:GPRF:GEN<i>:LIST:COUNt?`

Go to Index
Defines the start index for the second and all following generator cycles in continuous mode ("Repetition: Continuous"): If this value is larger than the "Start Index", the first cycle contains one or more additional steps, to be used for initialization or synchronization purposes before the actual (shorter) generator cycles start.

This parameter is unavailable in single list mode ("Repetition: Single").

Remote command:

```
SOURce:GPRF:GEN<i>:LIST:GOTO
SOURce:GPRF:GEN<i>:LIST:SSTop
```

Repetition
Defines how often the RF generator runs through the list section between the "Start Index" and the "Stop Index". The time on each step is given by the "List Increment" setting.

- **Single**:
  The generator runs through the list for a single time. Transmission at the start frequency/level step is initiated using the "List Configuration > Execute Single" hotkey (for "List Increment: Dwell Time", see below) or by a marker signal (other "List Increment" settings).
- **Continuous**:
  The generator cycles through the list section between the "Start Index" and the "Stop Index". The cycle is re-started automatically from the beginning of the list. "Go to Index" is available in this mode.

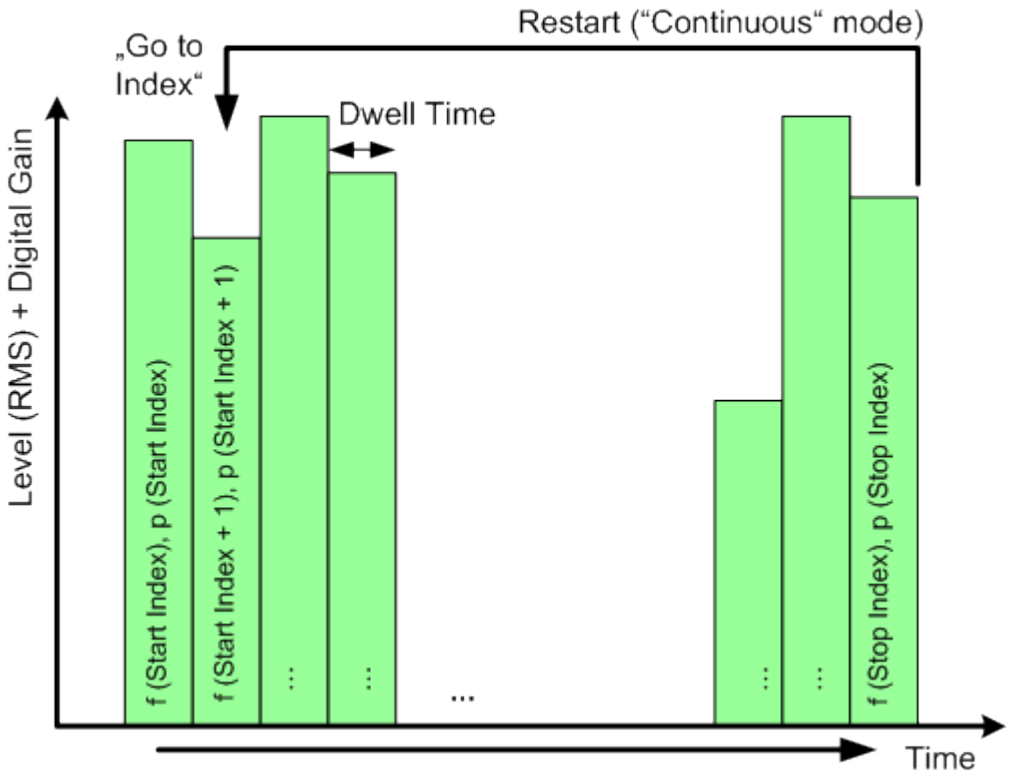


Fig. 2-15: List Mode: Repetition

Remote command:
`SOURce:GPRF:GEN<i>:LIST:REPetition`

List Increment
Defines how the RF generator steps through the list section between the "Start Index" and the "Stop Index".

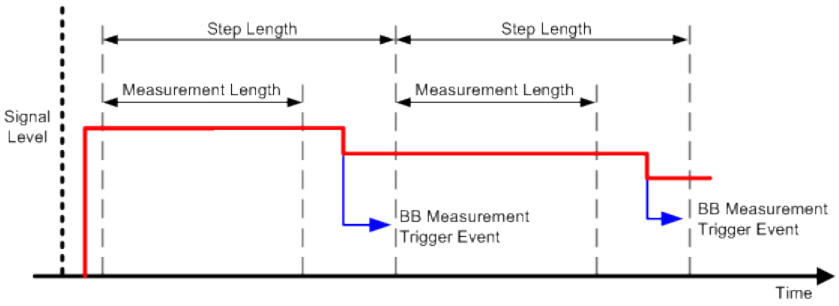
- **Dwell Time:** The generator transmits at each step for the selected "Dwell Time" and then proceeds to the next step. A single list cycle ("Repetition: Single") may be started by the "List Configuration > Execute Single" hotkey.
  This mode may be extended by additional trigger conditions using the parameters List Incr. Enabling and "Reenable On/Off".
  In single list mode with "Dwell Time" increment, the generator signal is turned off after each cycle (although the generator state remains ON). "Execute Single" turns the signal on for the next cycle. In all other list modes, the signal is continuously transmitted as long as the generator is in the ON state.
- **GPRF Gen<i>: ... Marker ...:** For arbitrary mode ("Baseband Mode: ARB") only: The generator cycles through the list, proceeding to the next step whenever a marker event in the processed ARB file or a user defined marker event is encountered. The dwell time settings are ignored. See "Baseband > ARB > Trigger > Source" on page 26.
  This mode may be extended by additional trigger conditions using the parameters List Incr. Enabling and "Reenable On/Off".

- **GPRF Meas<i>:Power:** The generator cycles through the list, proceeding to the next step in line with the "GPRF Power" measurement steps. The dwell time settings are ignored. The "GPRF Power" measurement must be running to use this list mode.
- **GSM Meas<i>: Multi Evaluation:** Analogous to the previous mode, however, the generator steps are synchronized to the measured GSM list mode segments (with option R&S CMW-KM200, "GSM R6 TX Measurements", and R&S CMW-KM012, "Multi Evaluation List Mode"). This setting is effective only while the GMS multi evaluation list mode is active. A "normal" GSM multi evaluation measurement does not induce any RF generator steps.
- **1xEV-DO Meas<i>: Multi Evaluation, WCDMA Meas<i>: Multi Evaluation ...:** Analogous to the previous mode, for other multi evaluation measurements that are run in list mode.

The timing of the "trigger" events that you can use to induce RF generator steps is calculated according to the "Step Length" and the "Measurement Length" of the "GPRF Power" measurement.

$T_{trigger}$ = <Measurement Length> + (<Step Length> – <Measurement Length>)/2

The period of the trigger events is equal to the step length. If the measurement length is in the center of the step, then the trigger events coincide with the step boundaries; the generated power steps will be synchronous to the measured steps.



Use the hotkeys associated with the "List Config." softkey to operate the GPRF generator in list mode.

Remote command:

`SOURce:GPRF:GEN<i>:LIST:INCRement`

`SOURce:GPRF:GEN<i>:LIST:ESINgle`

List Incr. Enabling

Defines a trigger condition for the list mode with "List Increment: GPRF Gen<i>: ... Marker ..." or "List Increment: Dwell Time".

Note: To combine "List Increment: Dwell Time" and "Repetition: Single" with one of the "List Incr. Enabling: ...Meas..." conditions, press "List Config. > Execute Single" once. This will properly initialize the list mode.

- **Immediate:**
  No initial trigger. The generator cycles through the list, see List Increment.
- **GPRF Meas<i>:Power:**

The generator starts cycling through the list when a "GPRF Power" measurement running in parallel proceeds to a new measurement step. After the initial trigger, the list is incremented by the marker signal or after the "Dwell Time", irrespective of the "GPRF Power" measurement.
Exception: Before it proceeds to a retriggered generator list step ("Reenable On/Off: On"; see "Frequency / Level List" on page 35), the generator waits for a new measurement step of the "GPRF Power" measurement.
The generator list mode cannot be initialized if no "GPRF Power" measurement is running.

- **Other measurements** (e.g. "GSM Meas<i>: Multi Evaluation"):
  Analogous to the previous mode, however, the generator steps are synchronized to the specific measurement interval (e.g. the measured GSM timeslot sequences).

See also: "Statistical Settings" in the R&S CMW user manual, chapter "System Overview"

Remote command:

```
SOURce:GPRF:GEN<i>:LIST:INCRement
SOURce:GPRF:GEN<i>:LIST:ESINgle
```

Frequency / Level List
Definition of up to 2000 pairs of frequencies and levels. The actual RF generator level at each frequency is equal to the "Level (RMS)" plus the "Digital Gain". The value range for the frequency covers the entire configurable value range of the instrument, the level range depends on the selected RF connector.

Each frequency/level step can be repeated a selectable number of times ("Index Rep."), so the total number of steps can exceed the maximum number of list entries.

- **Index Rep.:** Number of repetitions of each frequency/level step. The "Index Rep." simplifies the configuration of the list if repeated steps are desired.
- **Frequency:** RF frequency of the GPRF generator.
- **Level (RMS):** Level of the transmitted RF signal. Use different RMS level settings if you need large power steps.
- **Digital Gain:** Provides direct access to the IF levels. The relationship between the digital gain and the total RF generator level is highly linear: Use different digital gain values at equal "Level (RMS)" if you want to generate power steps with maximum accuracy over a limited dynamic range.
- **Dwell Time:** Transmission time on each frequency/level step in "Auto" or "Single" mode. The value is not used in the other list modes. The total time for the generator to step through a single cycle is the sum of all dwell times.
- **Mod. On/Off:** Can be used to generate a discontinuously modulated ARB generator signal: The baseband settings (ARB file contents) are ignored during frequency/level steps where "Mod. On/Off" is cleared. The ARB file continues to be downloaded irrespective of the "Mod. On/Off" settings. The setting is used in "ARB" baseband mode only.

- **Reenable On/Off:** Enable or disable retriggered generator list steps. The setting is available if a measurement is selected for "List Incr. Enabling": The GPRF generator waits for a new trigger event from the measurement (start of next measurement step) before it proceeds to a reenabled (retriggered) list step.
  List steps which are not reenabled are reached after the dwell time or after the generator detects a marker signal, depending on the selected "List Increment".

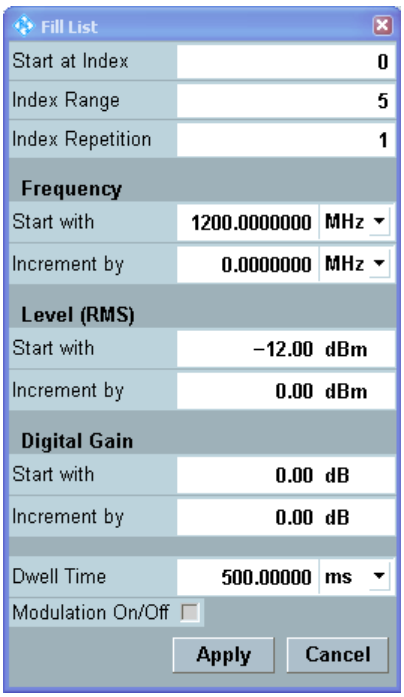
Note: If a list step contains an "Index Rep." > 1 in combination with an enabled retrigger, the retrigger setting applies to the first frequency/level step in the index repetition range only. The following list definitions are equivalent.

List [#]	Index Rep.	Frequency	Exp. Nom. Power	Reenable
0	1	1000 MHz	0 dBm	on
1	1	1000 MHz	0 dBm	off
2	1	1000 MHz	0 dBm	off
3	1	1000 MHz	–30 dBm	off
4	1	2000 MHz	0 dBm	on
5	1	2000 MHz	0 dBm	off
6	1	2000 MHz	0 dBm	off
7	1	3000 MHz	0 dBm	on

List [#]	Index Rep.	Frequency	Exp. Nom. Power	Reenable
0	3	1000 MHz	0 dBm	on
1	1	1000 MHz	–30 dBm	off
2	3	2000 MHz	0 dBm	on
3	1	3000 MHz	0 dBm	on

The "List Config. > Restart List" hotkey re-starts the list generator at the first frequency/level step. This is particularly useful for fast remote control operation (no need to turn the generator off and on again).

The "List Config. > Fill List..." hotkey opens a dialog which considerably simplifies the configuration of the frequency/level list. The dialog defines a list segment of arbitrary start index ("Start at Index") and length ("Index Range"). Within the segment, the frequency, level, and digital gain increases or decreases in equal steps. The dwell time and "Modulation On/Off" settings (if used) are equal.



Remote command:

```
SOURce:GPRF:GEN<i>:LIST:IREPetition
SOURce:GPRF:GEN<i>:LIST:IREPetition:ALL
SOURce:GPRF:GEN<i>:LIST:FREQuency
SOURce:GPRF:GEN<i>:LIST:FREQuency:ALL
SOURce:GPRF:GEN<i>:LIST:RFLevel
SOURce:GPRF:GEN<i>:LIST:RFLevel:ALL
SOURce:GPRF:GEN<i>:LIST:DGAin
SOURce:GPRF:GEN<i>:LIST:DGAin:ALL
SOURce:GPRF:GEN<i>:LIST:DTIMe
SOURce:GPRF:GEN<i>:LIST:DTIMe:ALL
SOURce:GPRF:GEN<i>:LIST:MODulation
SOURce:GPRF:GEN<i>:LIST:MODulation:ALL
SOURce:GPRF:GEN<i>:LIST:REENabling
SOURce:GPRF:GEN<i>:LIST:REENabling:ALL
SOURce:GPRF:GEN<i>:LIST:RLISt
SOURce:GPRF:GEN<i>:LIST:FILL
```

2.5 Programming

The following examples show how to control and configure the GPRF generator via a remote-control program.

The examples have been tested with the aid of a simple software tool.

See also: "Remote Control" in the R&S CMW user manual

2.5.1 Key Features

The GPRF generator is programmed as follows:

- The generator is controlled by SCPI commands with the following syntax: `...GPRF:GEN:...`
- After a *RST, the generator must be switched on: `SOURce:GPRF:GEN:STATe ON`. *OPC? ensures that the RF generator signal is actually available at the selected RF output before the next command line is executed.

2.5.2 Generating a CW Signal

```
FPRINT ********************************************************************
FPRINT System-Reset
FPRINT ********************************************************************
*RST; *OPC?
*CLS; *OPC?

FPRINT ********************************************************************
FPRINT Route output signal, define external attenuation
FPRINT ********************************************************************
ROUTe:GPRF:GEN:SCENario:SALone RF1C, TX1
ROUTe:GPRF:GEN?
SOURce:GPRF:GEN:RFSettings:EATTenuation 2

FPRINT ********************************************************************
FPRINT Set frequency and level, query peak envelope power, activate CW mode
FPRINT ********************************************************************
SOURce:GPRF:GEN:RFSettings:FREQuency 1.000000E+009
SOURce:GPRF:GEN:RFSettings:LEVel -70
SOURce:GPRF:GEN:RFSettings:PEPower?
SOURce:GPRF:GEN:BBMode CW

FPRINT ********************************************************************
FPRINT Switch on generator. With command synchronization, the queried
FPRINT generator state is "ON".
FPRINT ********************************************************************
SOURce:GPRF:GEN:STATe ON; *OPC?
SOURce:GPRF:GEN:STATe?
```

2.5.3 Generating a Dual-Tone Signal

```
FPRINT ********************************************************************
FPRINT System-Reset
FPRINT ********************************************************************
*RST;*OPC?

FPRINT ********************************************************************
```

```
FPRINT Activate dual-tone mode, set frequencies and levels
FPRINT ****************************************************************************
SOURce:GPRF:GEN:BBMode DTON
SOURce:GPRF:GEN:RFSettings:FREQuency 1.000000E+009
SOURce:GPRF:GEN:RFSettings:DGAin -1.12
SOURce:GPRF:GEN:DTONe:OFRequency1 1000
SOURce:GPRF:GEN:DTONe:OFRequency2 2000
SOURce:GPRF:GEN:DTONe:Ratio 10

FPRINT ****************************************************************************
FPRINT Query levels of source 1 and source 2
FPRINT ****************************************************************************
SOURce:GPRF:GEN:DTONe:LEVel1?
SOURce:GPRF:GEN:DTONe:LEVel2?

FPRINT ****************************************************************************
FPRINT Switch on generator
FPRINT ****************************************************************************
SOURce:GPRF:GEN:STATe ON; *OPC?
```

2.5.4 Using the Generator List Mode

```
FPRINT ****************************************************************************
FPRINT System-Reset
FPRINT ****************************************************************************
*RST; *OPC?

FPRINT ****************************************************************************
FPRINT Activate list mode, set frequencies and levels for 5 steps
FPRINT using two alternative command sets
FPRINT ****************************************************************************
SOURce:GPRF:GEN:LIST ON
SOURce:GPRF:GEN:LIST:SSTop 0, 4
SOURce:GPRF:GEN:LIST:STARt?
SOURce:GPRF:GEN:LIST:STOP?
SOURce:GPRF:GEN:LIST:IREPetition 0, 1; IREPetition 1, 1; IREPetition 2, 5; IREPetition 3, 5;
    IREPetition 4, 1
SOURce:GPRF:GEN:LIST:COUNt?
SOURce:GPRF:GEN:LIST:FREQuency 0, 1.9224E+009; FREQuency 1, 1.9224E+009;
    FREQuency 2, 1.9224E+009; FREQuency 3, 1.9224E+009; FREQuency 4, 1.9224E+009
SOURce:GPRF:GEN:LIST:RFLevel 0, -20; RFLevel 1, -23; RFLevel 2, -26;
    RFLevel 3, -29; RFLevel 4, -32
SOURce:GPRF:GEN:LIST:DGAin 0, -2; DGAin 1, -2; DGAin 2, -2; DGAin 3, -2;
    DGAin 4, -2
SOURce:GPRF:GEN:LIST:IREPetition:ALL?
SOURce:GPRF:GEN:LIST:FREQuency:ALL?
SOURce:GPRF:GEN:LIST:RFLevel:ALL?
SOURce:GPRF:GEN:LIST:DGAin:ALL?
SOURce:GPRF:GEN:LIST:FREQuency:ALL 1.9224E+009, 1.9224E+009, 1.9224E+009,
```

```
    1.9224E+009, 1.9224E+009
SOURce:GPRF:GEN:LIST:RFLevel:ALL -20, -23, -26, -29, -32
SOURce:GPRF:GEN:LIST:DGAin:ALL -2, -2, -2, -2, -2

FPRINT ************************************************************************
FPRINT Start the list in the second and the following cycles at step no. 1
FPRINT ************************************************************************
SOURce:GPRF:GEN:LIST:GOTO 1

FPRINT ************************************************************************
FPRINT Set dwell time equal to the duration of a WCDMA slot,
FPRINT let the generator cycle through the list,
FPRINT changing the frequency/level after the dwell times.
FPRINT ************************************************************************
SOURce:GPRF:GEN:LIST:DTIMe:ALL 666.67E-6, 666.67E-6, 666.67E-6, 666.67E-6,
    666.67E-6
SOURce:GPRF:GEN:LIST:INCRement:CATalog?
SOURce:GPRF:GEN:LIST:INCRement 'Dwell Time'

FPRINT ************************************************************************
FPRINT Switch on generator
FPRINT ************************************************************************
SOURce:GPRF:GEN:STATe ON: *OPC?
WAITKEY >List mode active, press OK to activate arbitrary mode<
```

2.5.5 Using the Arbitrary Mode

```
FPRINT ************************************************************************
FPRINT Activate arbitrary mode in combination with list mode, select single
FPRINT shot mode with 100 cycles and 1000 additional samples, enable modulation
FPRINT in 4 out of 5 frequency/level steps and load waveform file.
FPRINT Query properties of waveform file.
FPRINT ************************************************************************
SOURce:GPRF:GEN:BBMode ARB
SOURce:GPRF:GEN:ARB:REPetition SINGle
SOURce:GPRF:GEN:ARB:CYCles 100
SOURce:GPRF:GEN:ARB:ASAMples 1000
SOURce:GPRF:GEN:LIST:INCrement 'GPRF Gen1: Waveform Marker 4'
SOURce:GPRF:GEN:LIST:MODulation:ALL ON, ON, ON, OFF, ON
SOURce:GPRF:GEN:ARB:FILE 'D:\Rohde-Schwarz\CMW\Data\waveform\GSM1.wv'

SOURce:GPRF:GEN:ARB:FILE:DATE?
SOURce:GPRF:GEN:ARB:FILE:VERSion?
SOURce:GPRF:GEN:ARB:CRATe?
SOURce:GPRF:GEN:ARB:SAMPles?
SOURce:GPRF:GEN:ARB:LOFFset?
SOURce:GPRF:GEN:ARB:POFFset?

SOURce:GPRF:GEN:ARB:MSEGment:NUMBer?
```

```
SOURce:GPRF:GEN:ARB:MSEGment:CRATe?
SOURce:GPRF:GEN:ARB:MSEGment:SAMPles?
SOURce:GPRF:GEN:ARB:MSEGment:DURation?
SOURce:GPRF:GEN:ARB:MSEGment:NAME?
SOURce:GPRF:GEN:ARB:MSEGment:PAR?
SOURce:GPRF:GEN:ARB:MSEGment:POFFset?

FPRINT ********************************************************************
FPRINT Enable and configure the trigger system for (re-)starting a waveform
FPRINT file. Load the file and restart it using the manual trigger. Select
FPRINT a marker 2 trigger, define marker delay, and load new waveform file.
FPRINT ********************************************************************

TRIGger:GPRF:GEN:ARB:RETRigger ON
TRIGger:GPRF:GEN:ARB:AUTostart ON
SOURce:GPRF:GEN:ARB:FILE 'D:\Rohde-Schwarz\CMW\Data\waveform\GSM2.wv'
TRIGger:GPRF:GEN<i>:ARB:MANual:EXECute

FPRINT ********************************************************************
FPRINT Define marker delays, reset and then configure a user-defined trigger
FPRINT ********************************************************************

SOURce:GPRF:GEN:ARB:MARKer:DELays 500, 500, 500, 500
SOURce:GPRF:GEN:ARB:UDMarker:CLISt
SOURce:GPRF:GEN:ARB:UDMarker?
SOURce:GPRF:GEN:ARB:UDMarker 501, REDGe,  1, 100, 500, OFF, OFF, OFF, OFF, OFF

FPRINT ********************************************************************
FPRINT Configure multi-segment settings and load a multi-segment file.
FPRINT Query the current segment, and switch to the next segment.
FPRINT Query the position in the waveform file.
FPRINT ********************************************************************

TRIGger:GPRF:GEN<i>:ARB:SEGMents:MODE CONTinuous
SOURce:GPRF:GEN:ARB:FILE 'D:\Rohde-Schwarz\CMW\Data\waveform\GSM2_seg.wv'
SOURce:GPRF:GEN:ARB:SEGMents:CURRent?
SOURce:GPRF:GEN:ARB:SEGMents:NEXT?
TRIGger:GPRF:GEN<i>:ARB:SEGMents:MANual:EXECute
SOURce:GPRF:GENerator:ARB:SCount?

FPRINT ********************************************************************
FPRINT Start a single generator list cycle, using the GPRF Power measurement
FPRINT and the marker signal to increment the list. Define steps no. 1, 2, and 3
FPRINT as reenabled (retriggered) steps.
FPRINT ********************************************************************

SOURce:GPRF:GEN:LIST:REPetition SINGle
SOURce:GPRF:GEN:LIST:INCrement 'GPRF Gen1: Waveform Marker 4'
INITiate:GPRF:MEAS:POWer
WHILE FETCh:GPRF:MEAS:POWer:STATus? <> ON
```

```
SOURce:GPRF:GEN:LIST:INCrement:ENABling:CATalog?
SOURce:GPRF:GEN:LIST:INCrement:ENABling 'GPRF Meas1: Power'
SOURce:GPRF:GEN:LIST:REENabling:ALL ON, OFF, ON, OFF, OFF
SOURce:GPRF:GEN:LIST:REENabling 2, ON
SOURce:GPRF:GEN:LIST:ESINGle

WAITKEY >End, press OK to terminate program<
```

2.6 Command Reference

The following sections provide detailed reference information on the remote control commands of the General Purpose RF generator.

Issues of special interest for all commands

GEN<i> is used as abbreviation of "GENerator<instance>". For better readability only the abbreviated form (which is also accepted by the instrument) is given in the command reference.

The <instance> is relevant for instruments supporting several instances of the same firmware application. It can be omitted if the instrument supports only one instance, or to address the first instance.

See also: "Firmware Applications" in the R&S CMW user manual, chapter "Remote Control"

Command groups

The commands of the General Purpose RF generator are divided into the groups listed below.

2.6.1 Generator Control and States

The following commands control the RF generator, retrieve its state and report problems.

SOURce:GPRF:GEN<i>:STATe <Control>

Turns the generator on or off.

See also: "Generator Control" in the R&S CMW user manual, chapter "Remote Control"

Setting parameters:

<Control> ON | OFF

Switch generator **ON** or **OFF**

*RST: OFF

Return values:

<GeneratorState> OFF | PENDing | ON

OFF: generator switched off
PEND: generator switched on but no signal available yet
ON: generator switched on, signal available

*RST: OFF

Example: See Generating a CW Signal

Firmware/Software: V1.0.0.4

Manual operation: See "GPRF Generator (Softkey)" on page 19

SOURce:GPRF:GEN<i>:RELiability:ALL?

Reports if and why there are problems generating the configured signal.

This information is also displayed in the "Current State" view of the INFO dialog.

The reliability indicator has one of the following values:

- **0 (OK)**:
  Measurement values available, no error detected.
- **1 (Measurement Timeout)**:
  The measurement has been stopped after the (configurable) measurement timeout. Measurement results may be available, however, at least a part of the measurement provides only INValid results or has not completed the full statistic count.
- **2 (Capture Buffer Overflow)**:
  The measurement configuration results in a capture length exceeding the available memory.
- **3 (Overdriven) / 4 (Underdriven)**:
  The accuracy of measurement results may be impaired because the input signal level was too high / too low.
- **6 (Trigger Timeout)**:
  The measurement could not be started or continued because no trigger event was detected.
- **7 (Acquisition Error)**:
  The R&S CMW could not properly decode the RF input signal.
- **8 (Sync Error)**:
  The R&S CMW could not synchronize to the RF input signal.
- **9 (Uncal)**:
  Due to an inappropriate configuration of resolution bandwidth, video bandwidth or sweep time, the measurement results are not within the specified data sheet limits.
- **15 (Reference Frequency Error)**:

The instrument has been configured to use an external reference signal but the reference oscillator could not be phase locked to the external signal (e.g. signal level too low, frequency out of range or reference signal not available at all).

- **16 (RF Not Available)**:
  The measurement could not be started because the configured RF input path was not active. This problem may occur e.g. when a measurement is started in combined signal path mode and the master application has not yet activated the input path. The LEDs above the RF connectors indicate whether the input and output paths are active.
- **17 (RF Level not Settled) / 18 (RF Frequency not Settled)**:
  The measurement could not be started because the R&S CMW was not yet ready to deliver stable results after a change of the input signal power / the input signal frequency.
- **19 (Call not Established)**:
  For measurements: The measurement could not be started because no signaling connection to the DUT was established.
  For DAU IMS service: Establishing a voice over IMS call failed.
- **20 (Call Type not Usable)**:
  For measurements: The measurement could not be started because the established signaling connection had wrong properties.
  For DAU IMS service: The voice over IMS settings could not be applied.
- **21 (Call Lost)**:
  For measurements: The measurement was interrupted because the signaling connection to the DUT was lost.
  For DAU IMS service: The voice over IMS call was lost.
- **23 (Missing Option)**:
  The ARB file can not be played by the GPRF generator due to a missing option.
- **26 (Resource Conflict)**:
  The application could not be started or has been stopped due to a conflicting hardware resource or software option that is allocated by another application.
  Please stop the application that has allocated the conflicting resources and try again.
- **27 (No Sensor Connected)**:
  The GPRF External Power Sensor measurement could not be started due to missing power sensor.
- **40 (ARB File CRC Error)**:
  The ARB file CRC check failed. The ARB file is corrupt and not reliable.
- **42 (ARB Header Tag Invalid)**:
  The ARB file selected in the GPRF generator contains an invalid header tag.
- **43 (ARB Segment Overflow)**:
  The number of segments in the multi-segment ARB file is higher than the allowed maximum.
- **44 (ARB File not Found)**:
  The selected ARB file could not be found.
- **50 (Startup Error)**:
  The Data Application Unit (DAU), a DAU service or a DAU measurement could not be started. Please execute a DAU selftest.

- **51 (No Reply)**:
  The DAU has received no response, for example for a ping request.
- **52 (Connection Error)**:
  The DAU could not establish a connection to internal components. Please restart the instrument.
- **53 (Configuration Error)**:
  The current DAU configuration by the user is incomplete or wrong and could not be applied. Check especially the IP address configuration.
- **54 (Filesystem Error)**:
  The hard disk of the DAU is full or corrupt. Please execute a DAU selftest.
- **101 (Firmware Error)**:
  Indicates a firmware or software error. If you encounter this error for the first time, restart the instrument.
  If the error occurs again, consider the following hints:
  – Firmware errors can often be repaired by restoring the factory default settings. To restore these settings, restart your instrument and press the "Factory Default" softkey during startup.
  – If a software package (update) has not been properly installed this is often indicated in the "Setup" dialog, section "SW/HW-Equipment > Installed Software".
  – A software update correcting the error may be available. Updates are e.g. provided in the "CMW Customer Web" on GLORIS (registration required): https://extranet.rohde-schwarz.com.

  If you get firmware errors even with the properly installed latest software version, please send a problem report including log files to Rohde & Schwarz.
- **102 (Unidentified Error)**:
  Indicates an error not covered by other reliability values. For troubleshooting please follow the steps described for "101 (Firmware Error)".
- **103 (Parameter Error)**:
  Indicates that the measurement could not be performed due to internal conflicting parameter settings.
  A good approach to localize the conflicting settings is to start with a reset or preset or even restore the factory default settings. Then reconfigure the measurement step by step and check when the error occurs for the first time.
  If you need assistance to localize the conflicting parameter settings please contact Rohde & Schwarz (see http://www.service.rohde-schwarz.com).

Return values:

<Reliability>	The reliability indicator
<ReliabilityMsg>	Contains the reason for a reliability > 0 or the empty string "" for reliability = 0
<ReliabilityAddInfo>	Contains additional information for a reliability > 0 or the empty string "" for reliability = 0
Usage:	Query only
Firmware/Software:	V3.0.11
Manual operation:	See "Baseband Configuration > ARB > ARB File" on page 24

2.6.2 Scenario Selection and Signal Routing

The following commands select the output scenario, define the physical signal routing and specify an external attenuation value.

ROUTe:GPRF:GEN<i>:SCENario?

Returns the active scenario.

Return values:

<Scenario> SALone | IQOut

SALone: An RF signal is generated (standalone scenario)
IQOut: The generated baseband signal is sent to IQ Out (digital baseband interface)

Usage: Query only

Firmware/Software: V3.0.10

ROUTe:GPRF:GEN<i>:SCENario:SALone <TXConnector>, <RFConverter>

Activates the standalone scenario and selects the output path for the generated RF signal, i.e. the RF connector and the TX module.

Depending on the installed hardware and the active sub-instrument or instance <i> only a subset of the described parameter values is allowed. The *RST values and the mapping of virtual connector names to physical connectors also depend on the active sub-instrument or instance <i>.

All instruments are equipped with the RF 1 and RF 2 connectors and one RX and TX module. Additional RF connectors and RX/TX modules are optionally available for R&S CMW270 and R&S CMW500, but not for R&S CMW280.

See also: "Signal Path Settings" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<TXConnector> RF1C | RF1O | RF2C | RF3C | RF3O | RF4C | RFAC | RFAO | RFBC

RF1C, RF2C, RF3C, RF4C, RF1O, RF3O:
RF 1 COM to RF 4 COM and RF 1/3 OUT front panel connectors

RFAC, RFBC, RFAO:
Virtual names for the RF COM and RF OUT connectors

*RST: RF1C

<RFConverter> TX1 | TX2 | TX3 | TX4
TX module for the output path
*RST: TX1

Example: See Generating a CW Signal

Firmware/Software: V2.0.10

Manual operation: See "Scenario and Routing" on page 19

ROUTe:GPRF:GEN<i>:SCENario:IQOut <TXConnector>, <TXConverter>

Activates the IQ Out scenario and selects the output path for the generated digital baseband (IQ) signal, i.e. the IQ connector and the TX module.

Depending on the installed hardware and the active sub-instrument or instance <i> only a subset of the described parameter values is allowed. The *RST values also depend on the active sub-instrument or instance <i>.

See also: "Signal Path Settings" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<TXConnector> IQ2O | IQ4O | IQ6O | IQ8O
Digital IQ Out back panel connector 2 to 8
*RST: not used

<TXConverter> ITX1 | ITX2
IQ TX module 1 or 2
*RST: not used

Firmware/Software: V3.0.10

Manual operation: See "Scenario and Routing" on page 19

ROUTe:GPRF:GEN<i>?

Queries the active test scenario and connector assignment.

Return values:

<Scenario> SALone | IQOut
SALone: An RF signal is generated (standalone scenario)
IQOut: The generated baseband signal is sent to IQ Out (digital baseband interface)

<Master> "No Connection"
unique value

<TXConnector> RF1C | RF1O | RF2C | RF3C | RF3O | RF4C | IQ2O | IQ4O
RF1C, RF2C, RF3C, RF4C, RF1O, RF3O:
RF 1 COM to RF 4 COM and RF 1/3 OUT front panel connectors
IQ2O | IQ4O
Digital IQ Out back panel connectors 2 and 4

<RFConverter> TX1 | TX2 | TX3 | TX4 | ITX1 | ITX2
TX module for the output path

Example: See Generating a CW Signal

Usage: Query only

Firmware/Software: V2.0.10
V3.0.10 Support for IQ Out scenario

Manual operation: See "Scenario and Routing" on page 19

SOURce:GPRF:GEN<i>:RFSettings:EATTenuation <ExtRFOutAtt>

Defines an external attenuation (or gain, if the value is negative), to be applied to the RF output connector.

Parameters:
<ExtRFOutAtt> Range: -50 dB to 90 dB
*RST: 0 dB
Default unit: dB

Example: See Generating a CW Signal

Firmware/Software: V1.0.0.4

Manual operation: See "External Attenuation (Output)" on page 19

2.6.3 Constant-Frequency Settings

The following commands configure the constant-frequency generator mode.

SOURce:GPRF:GEN<i>:RFSettings:FREQuency <Frequency>

Selects the frequency of the RF generator (Generator Frequency). Some of the baseband modes (modulation types) modify the generator frequency.

Parameters:
<Frequency> Range: 70E+6 Hz to 6E+9 Hz
*RST: 1.2E+9 Hz
Default unit: Hz

Example: See Generating a CW Signal

Firmware/Software: V1.0.0.4

Manual operation: See "Frequency" on page 20

SOURce:GPRF:GEN<i>:RFSettings:LEVel <Level>

Sets the base level (Level (RMS)) of the constant-frequency RF generator.

Parameters:

<Level>
Range: –130 dBm to 0 dBm at RF 1 COM and RF 2 COM, –120 dBm to +13 dBm at RF 1 OUT; please also notice the ranges quoted in the data sheet
Increment: 0.01 dB
*RST: -12 dBm
Default unit: dBm

Example: See Generating a CW Signal

Firmware/Software: V1.0.0.4

Manual operation: See " Level (RMS)" on page 20

SOURce:GPRF:GEN<i>:RFSettings:PEPower?

Queries the "Peak Envelope Power" for single and dual-tone signals.

Return values:

<PeakEnvelopePow>
Range: –130 dBm to 0 dBm at RF 1 COM and RF 2 COM, –120 dBm to +13 dBm at RF 1 OUT; please also notice the ranges quoted in the data sheet
Increment: 0.01 dB
Default unit: dBm

Example: See Generating a CW Signal

Usage: Query only

Firmware/Software: V1.0.4.11

Manual operation: See " Level (RMS)" on page 20

SOURce:GPRF:GEN<i>:RFSettings:DGAin <DigitalGain>

Defines the digital gain of the constant-frequency RF generator.

Parameters:

<DigitalGain>
Range: -30 dB to 0 dB
Increment: 0.01 dB
*RST: 0 dB
Default unit: dB

Example: See Generating a Dual-Tone Signal

Firmware/Software: V1.0.10.1

Manual operation: See "Digital Gain" on page 20

2.6.4 Baseband Settings

The following commands select the baseband mode for the constant-frequency generator and define the modulation parameters.

SOURce:GPRF:GEN<i>:BBMode <BaseBandMode>

Selects the baseband mode for the generator signal.

Parameters:

<BaseBandMode> CW | DTONe | ARB

CW: Unmodulated CW signal
DTONe: Dual tone signal (see commands `SOURce:GPRF:GEN<i>:DTONe...`)
ARB: ARB generator (waveform file; see `SOURce:GPRF:GEN<i>:ARB:FILE`)

*RST: CW

Example: See Generating a Dual-Tone Signal

Firmware/Software: Software version V1.0.0.4

Manual operation: See "Baseband Mode" on page 21

SOURce:GPRF:GEN<i>:DTONe:OFRequency<source> <Frequency>

Selects a positive or negative offset frequency. The frequency of the modulated signal is equal to the base frequency (see `SOURce:GPRF:GEN<i>:LIST:FREQuency`) plus the offset frequency.

Suffix:

<source> 1..2
No. of source signal

Parameters:

<Frequency> Range: -40E+6 Hz to 40E+6 Hz
*RST: 0 Hz
Default unit: Hz

Example: See Generating a Dual-Tone Signal

Firmware/Software: V1.0.0.4

Manual operation: See "Baseband Configuration > Dual Tone > Offset Frequency" on page 22

SOURce:GPRF:GEN<i>:DTONe:RATio <Ratio>

Sets the base level (Level (RMS)) of the constant-frequency RF generator.

Parameters:

<Ratio>
Range: 0 dB to 30 dB
Increment: 0.01 dB
*RST: 0 dB
Default unit: dB

Example: See Generating a Dual-Tone Signal

Firmware/Software: V1.0.0.4

Manual operation: See "Baseband Configuration > Dual Tone > Ratio / Level (RMS)" on page 22

SOURce:GPRF:GEN<i>:DTONe:LEVel<source>?

Queries the output level of the source signal <source>. The output level is a function of the generator output level (see `SOURce:GPRF:GEN<i>:RFSettings:LEVel`) and the ratio (see `SOURce:GPRF:GEN<i>:DTONe:RATio`).

Suffix:

<source>
1..2
No. of source signal

Return values:

<Level>
Range: Range: –160.00 dBm to 0.00 dBm at RF 1 COM and RF 2 COM, –150 dBm to +13 dBm at RF 1 OUT; please also notice the ranges quoted in the data sheet.
Increment: 0.01 dB
Default unit: dBm

Example: See Generating a Dual-Tone Signal

Usage: Query only

Firmware/Software: V1.0.0.4

Manual operation: See "Baseband Configuration > Dual Tone > Ratio / Level (RMS)" on page 22

2.6.5 ARB Settings (Option R&S CMW-B110 A)

The following commands control the ARB generator.

SOURce:GPRF:GEN<i>:ARB:FOFFset <FrequencyOffset>

Sets/gets the frequency offset to be imposed at the baseband during ARB generation. In standalone scenario this will result in an equivalent frequency offset at the RF.

Parameters:

<FrequencyOffset> Range: -40E+6 to +40E+6
*RST: 0
Default unit: Hz

Firmware/Software: V3.0.10

Manual operation: See "Baseband Configuration > ARB > Frequency Offset" on page 23

SOURce:GPRF:GEN<i>:ARB:REPetition <Repetition>

Defines how often the ARB file is processed.

Parameters:

<Repetition> CONTinuous | SINGle

CONTinuous: Unlimited, cyclic processing
SINGle: File is processed n times, where n is the number of cycles (see `SOURce:GPRF:GEN<i>:ARB:CYCLes`)

*RST: CONT

Example: See Using the Arbitrary Mode

Firmware/Software: V1.0.10.1

Manual operation: See "Baseband Configuration > ARB > Repetition" on page 23

SOURce:GPRF:GEN<i>:ARB:CYCLes <Cycles>

Defines how often the ARB file is processed in single mode (see `SOURce:GPRF:GEN<i>:ARB:REPetition`).

Parameters:

<Cycles> Range: 0 to 10E+3
*RST: 1

Example: See Using the Arbitrary Mode

Firmware/Software: V1.0.10.1

Manual operation: See "Baseband Configuration > ARB > Repetition" on page 23

SOURce:GPRF:GEN<i>:ARB:ASAMples <AddSamples>

Extends the processing time of a waveform file by the specified number of samples. The additional samples are valid in single-shot repetition mode only (see `SOURce:GPRF:GEN<i>:ARB:REPetition`).

Parameters:

<AddSamples> Range: 0 to max. (depending on waveform file)
*RST: 0

Example: See Using the Arbitrary Mode

Firmware/Software: V1.0.15.0

Manual operation: See "Baseband Configuration > ARB > Repetition" on page 23

SOURce:GPRF:GEN<i>:ARB:FILE <ARBFile>

Selects a waveform file, to be used for the arbitrary waveform generator (see `SOURce:GPRF:GEN<i>:BBMode`).

Parameters:

<ARBFile> String parameter, specifies the name of the waveform file (.wv).
*RST: n/a

Example: See Using the Arbitrary Mode

Firmware/Software: V1.0.0.4

Manual operation: See "Baseband Configuration > ARB > ARB File" on page 24

SOURce:GPRF:GEN<i>:ARB:FILE:DATE?

Queries the date of the loaded waveform file.

Return values:

<Date> String containing the date

Example: See Using the Arbitrary Mode

Usage: Query only

Firmware/Software: V1.0.4.11

Manual operation: See "Baseband Configuration > ARB > ARB File" on page 24

SOURce:GPRF:GEN<i>:ARB:FILE:VERSion?

Queries the version of the loaded waveform file.

Return values:

<Version> String containing the version (or empty string, if no file version is defined)

Example: See Using the Arbitrary Mode

Usage: Query only

Firmware/Software: V1.0.15.20

Manual operation: See "Baseband Configuration > ARB > ARB File" on page 24

SOURce:GPRF:GEN<i>:ARB:FILE:OPTion?

Returns the R&S CMW-KVxxx and R&S CMW-KWxxx options that are required to process the loaded ARB file with the arbitrary RF generator.

Return values:

<Options> A comma-separated list of KV and KW options.

Usage: Query only

Firmware/Software: V3.0.10

Manual operation: See "Baseband Configuration > ARB > ARB File" on page 24

SOURce:GPRF:GEN<i>:ARB:CRATe?

Queries the clock rate of the loaded waveform file. The clock rates of waveform file created with R&S WinIQSIM2 are compatible with the R&S CMW; see Generating and Transferring Waveform Files.

Note: If a multi-segment waveform file is loaded, this command returns the clock rate in the last segment. Use `SOURce:GPRF:GEN<i>:ARB:MSEGment:CRATe?` to query the clock rates of the individual segments.

Return values:

<ClockRate>
Range: as defined in the waveform file
*RST: n/a
Default unit: Hz

Example: See Using the Arbitrary Mode

Usage: Query only

Firmware/Software: V1.0.4.11

Manual operation: See "Baseband Configuration > ARB > ARB File" on page 24

SOURce:GPRF:GEN<i>:ARB:SAMPles?

Queries the number of samples in the loaded waveform file. The R&S CMW supports waveform files with a size up to 512 MB.

Return values:
<Samples> Number of samples, integer value.

Example: See Using the Arbitrary Mode

Usage: Query only

Firmware/Software: V1.0.0.4

Manual operation: See "Baseband Configuration > ARB > ARB File" on page 24

SOURce:GPRF:GEN<i>:ARB:SAMPles:RANGe <Range>[, <Start>, <Stop>]

Defines the subrange of samples from the loaded ARB file that shall be processed by the arbitrary signal generator.

Either the full file (all samples) or a subrange starting with the first sample can be processed.

Parameters:
<Range> FULL | SUB

FULL: the full ARB file is processed
SUB: the subrange defined by the <Start> and <Stop> parameters is processed

*RST: FULL

<Start> The start (first sample) of the subrange

Range: 0 (fixed)

<Stop> The start (last sample) of the subrange

Range: 0 to #samples in loaded ARB file - 1
*RST: 0

Firmware/Software: V3.0.10

Manual operation: See "Baseband Configuration > ARB > ARB File" on page 24

SOURce:GPRF:GEN<i>:ARB:LOFFset?

Queries the level offset (Peak to Average Ratio, PAR) of the loaded waveform file. The PAR is equal to the absolute value of the difference between the "RMS Offset" and the "Peak Offset" defined in WinIQSIM2 (crest factor).

Note: If a multi-segment waveform file is loaded, this command returns the PAR in the last segment. Use `SOURce:GPRF:GEN<i>:ARB:MSEGment:PAR?` to query the PAR values of the individual segments.

Return values:
<LevelOffset> PAR value; see above
Default unit: dB

Example: See Using the Arbitrary Mode

Usage: Query only

Firmware/Software: V1.0.0.4

Manual operation: See "Baseband Configuration > ARB > ARB File" on page 24

SOURce:GPRF:GEN<i>:ARB:POFFset?

Queries the peak offset of the loaded waveform file.

Note: If a multi-segment waveform file is loaded, this command returns the peak offset in the last segment. Use `SOURce:GPRF:GEN<i>:ARB:MSEGment:POFFset?` to query the peak offset values of the individual segments.

Return values:
<PeakOffset> Offset value as specified in WinIQSIM2
Default unit: dB

Example: See Using the Arbitrary Mode

Usage: Query only

Firmware/Software: V1.0.10.1

Manual operation: See "Baseband Configuration > ARB > ARB File" on page 24

SOURce:GPRF:GEN<i>:ARB:CRCProtect?

Indicates whether the loaded ARB file contains a CRC checksum, which could be used for an integrity check (see `SOURce:GPRF:GEN<i>:RELiability:ALL?`)

Note that in order to get a valid result, the related ARB file has to be loaded into memory, i.e. the baseband mode must be ARB and the generator state must be ON. Otherwise NAV is returned.

Return values:
<CRCProtection> NO | YES
Range: not used to not used

Usage: Query only

Firmware/Software: V3.0.10

Manual operation: See "Baseband Configuration > ARB > ARB File" on page 24

SOURce:GPRF:GEN<i>:ARB:MSEGment:NUMBer?

Queries the segment numbers of all segments in the loaded multisegment waveform file.

Return values:

<SegNumber> Comma-separated list of segment numbers, one value for each segment

Range: integer values
*RST: n/a

Example: See Using the Arbitrary Mode

Usage: Query only

Firmware/Software: V1.0.15.20

Manual operation: See "Baseband Configuration > ARB > ARB File" on page 24

SOURce:GPRF:GEN<i>:ARB:MSEGment:CRATe?

Queries the clock rates of all segments in the loaded multisegment waveform file. The clock rates of waveform file created with R&S WinIQSIM2 are compatible with the R&S CMW; see Generating and Transferring Waveform Files.

Return values:

<ClockRate> Comma-separated list of clock rates, one value for each segment

Range: as defined in the waveform file
*RST: n/a
Default unit: Hz

Example: See Using the Arbitrary Mode

Usage: Query only

Firmware/Software: V1.0.15.20

Manual operation: See "Baseband Configuration > ARB > ARB File" on page 24

SOURce:GPRF:GEN<i>:ARB:MSEGment:SAMPles?

Queries the number of samples in all segments in the loaded multisegment waveform file.

Return values:

<Samples> Comma-separated list of all sample values, one value for each segment

Range: n/a

Example: See Using the Arbitrary Mode

Usage: Query only

Firmware/Software: V1.0.15.20

Manual operation: See "Baseband Configuration > ARB > ARB File" on page 24

SOURce:GPRF:GEN<i>:ARB:MSEGment:DURation?

Queries the durations (processing times) of all segments in the loaded multisegment waveform file. The duration is given by the number of samples divided by the clock rate.

Return values:

<Duration> Comma-separated list of durations, one value for each segment

Range: 1E-9 s to 0.999999999999999E+15 s
*RST: n/a
Default unit: s

Example: See Using the Arbitrary Mode

Usage: Query only

Firmware/Software: V1.0.15.20

Manual operation: See "Baseband Configuration > ARB > ARB File" on page 24

SOURce:GPRF:GEN<i>:ARB:MSEGment:NAME?

Queries the names of all segments in the loaded multisegment waveform file.

Return values:

<Name> Comma-separated list of names, one string value for each segment

*RST: n/a

Example: See Using the Arbitrary Mode

Usage: Query only

Firmware/Software: V1.0.15.20

Manual operation: See "Baseband Configuration > ARB > ARB File" on page 24

SOURce:GPRF:GEN<i>:ARB:MSEGment:PAR?

Queries the level offset (Peak to Average Ratio, PAR) of all segments in the loaded multisegment waveform file. The PAR is equal to the absolute value of the difference between the "RMS Offset" and the "Peak Offset" defined in WinIQSIM2 (crest factor).

Return values:

<PAR> Comma-separated list of all PAR values, one value for each segment

Range: n/a
Default unit: dB

Example: See Using the Arbitrary Mode

Usage: Query only

Firmware/Software: V1.0.15.20

Manual operation: See "Baseband Configuration > ARB > ARB File" on page 24

SOURce:GPRF:GEN<i>:ARB:MSEGment:POFFset?

Queries the peak offset of all segments in the loaded multisegment waveform file.

Return values:

<PeakOffset> Comma-separated list of all peak offset values as specified in WinIQSIM2, one value for each segment

Range: n/a
Default unit: dB

Example: See Using the Arbitrary Mode

Usage: Query only

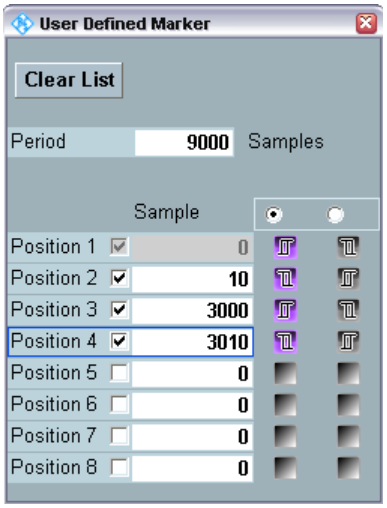
Firmware/Software: V1.0.15.20

Manual operation: See "Baseband Configuration > ARB > ARB File" on page 24

SOURce:GPRF:GEN<i>:ARB:UDMarker <Period>, <StartState>, <Positions>(8)

Defines the marker period plus up to 8 marker events relative to the processed waveform file. The user defined marker is available as an ARB output trigger source.

Example: The command `SOURce:GPRF:GEN<i>:ARB:UDMarker 30, FEDG, 0, 2, 4, 6, 8, 10, OFF, OFF` sets the user defined marker as follows:



Parameters:

<Period> Period of the user defined marker sequence

Range: 1 to 1E+9
*RST: 1

<StartState> REDGe | FEDGe

Polarity of marker pulses (first transition)

*RST: REDG

<Positions> Positions of marker signals. Eight values must be specified; the first value must be 0.

Range: 0 (pos. 0) or 1 (other positions) to max. (must not exceed the <Period>). OFF disables a position.

*RST: 0 (pos. 1) or OFF (other positions)

Example: See Using the Arbitrary Mode

Firmware/Software: V1.0.15.0

Manual operation: See "User Defined Marker" on page 31

SOURce:GPRF:GEN<i>:ARB:UDMarker:CLISt

Clears the user-defined marker list, i.e. resets the `SOURce:GPRF:GEN<i>:ARB:UDMarker` command and sets the "Period" equal to the number of samples in the loaded waveform file. If no waveform file is loaded, the "Period" is reset to 1.

Example: See Using the Arbitrary Mode

Usage: Event

Firmware/Software: V1.0.15.20

Manual operation: See "User Defined Marker" on page 31

2.6.6 ARB Trigger and Multi-Segment Settings

The following commands configure the ARB trigger system for single-segment and multi-segment waveform files.

TRIGger:GPRF:GEN<i>:ARB:RETRigger <Retrigger>

Enables or disables the trigger system for waveform files.

Parameters:

<Retrigger> OFF | ON

Trigger system disabled or enabled

*RST: ON

Example: See Using the Arbitrary Mode

Firmware/Software: V1.0.4.11

Manual operation: See "Baseband > ARB > Trigger > Retrigger" on page 26

TRIGger:GPRF:GEN<i>:ARB:AUTostart <Autostart>

Enables or disables the automatic download of the selected (and loaded) waveform file whenever the generator is turned on.

Parameters:

<Autostart> OFF | ON
Autostart disabled or enabled
*RST: ON

Example: See Using the Arbitrary Mode

Firmware/Software: V1.0.4.11

Manual operation: See "Baseband > ARB > Trigger > Autostart" on page 26

TRIGger:GPRF:GEN<i>:ARB:CATalog:SOURce?

Lists all available trigger sources, to be set via `TRIGger:GPRF:GEN<i>:ARB:SOURce`. The list depends on the installed options.

Return values:

<TriggerSources> Comma-separated list of all sources. Each value is a string (e.g. "Manual" for manual trigger).

Example: See Using the Arbitrary Mode

Usage: Query only

Firmware/Software: V1.0.15.20

Manual operation: See "Baseband > ARB > Trigger > Source" on page 26

TRIGger:GPRF:GEN<i>:ARB:SOURce <Source>

Selects the source of the trigger events. Some values are always available in this firmware application. They are listed below. Depending on the installed options additional values may be available. A complete list of all supported values can be displayed using `TRIGger:GPRF:GEN<i>:ARB:CATalog:SOURce?`.

Parameters:

<Source> "Manual", "Base1: External TRIG A","Base1: External TRIG B","Base1: User Trigger 1","Base1: User Trigger 2"
Manual trigger from GPRF Generator GUI, external trigger signal fed in at TRIG A or TRIG B or global user initiated trigger (`TRIGger:BASE:UINitiated<n>:EXECute`).

Example: See Using the Arbitrary Mode

Firmware/Software: V1.0.15.20

Manual operation: See "Baseband > ARB > Trigger > Source" on page 26

TRIGger:GPRF:GEN<i>:ARB:MANual:EXECute

Generates a trigger event for the ARB trigger. The trigger causes the generator to (re-)start the download of the selected (and loaded) waveform file.

Example: See Using the Arbitrary Mode

Usage: Event

Firmware/Software: V1.0.4.11

Manual operation: See "Baseband > ARB > Trigger > Source" on page 26

TRIGger:GPRF:GEN<i>:ARB:DELay <Delay>

Sets/gets the trigger delay for the arbitrary RF generator, i.e. the time delaying the start of the generator relative to the selected trigger event. This does not apply to manual execution (see `TRIGger:GPRF:GEN<i>:ARB:SEGMents:MANual:EXECute` on page 64).

Parameters:

<Delay>
Range: 0 s to 100 s
*RST: 0 s
Default unit: s

Firmware/Software: V.3.0.10

Manual operation: See "Baseband > ARB > Trigger > Delay" on page 27

SOURce:GPRF:GEN<i>:ARB:MARKer:DELays <Marker2>, <Marker3>, <Marker4>, <RestartMarker>

Defines delay times for the ARB output trigger events relative to the marker events.

Parameters:

<Marker2>
Range: -10 to 4000
*RST: 0

<Marker3>
Range: -10 to 4000
*RST: 0

<Marker4>
Range: -10 to 4000
*RST: 0

<RestartMarker>
Range: 0 to max. (depending on waveform file)
*RST: 0

Example: See Using the Arbitrary Mode

Firmware/Software: V1.0.15.0

Manual operation: See "Baseband > ARB > Marker > Waveform > Marker 2 ..." on page 27

TRIGger:GPRF:GEN<i>:ARB:SEGMents:MODE <Mode>

Selects a trigger mode for multi-segment waveform files.

Parameters:

<Mode> CONTinuous | CSEamless | AUTO

CONTinuous: A trigger event causes immediate switchover to the next segment
CSEamless: A trigger event causes switchover after the end of the segment has been reached
AUTO: The generator processes one segment after another

*RST: CONT

Example: See Using the Arbitrary Mode

Firmware/Software: V1.0.4.11 (AUTO in V1.0.15.0)

Manual operation: See "Baseband > ARB > Trigger > Multi Segment > Repetition" on page 28

SOURce:GPRF:GEN<i>:ARB:SEGMents:CURRent?

Displays the currently processed segment with the segment number and segment name (if defined).

Return values:

<SegmentNumber> Integer number. `NAV` is returned if no file is loaded.

Range: 0 to 1000
*RST: n/a

<SegmentName> String parameter containing the name. `NAV` is returned if no file is loaded or no name is defined.

Example: See Using the Arbitrary Mode

Usage: Query only

Firmware/Software: V1.0.15.0

Manual operation: See "Baseband > ARB > Trigger > Multi Segment > Current Segment " on page 29

SOURce:GPRF:GEN<i>:ARB:SEGMents:NEXT <SegmentNumber>

Selects a segment to be processed after the end of the currently processed segment.

Parameters:

<SegmentNumber> Range: 0 to 31
*RST: n/a

Example: See Using the Arbitrary Mode

Firmware/Software: V1.0.15.20

Manual operation: See "Baseband > ARB > Trigger > Multi Segment > Next Segment " on page 29

TRIGger:GPRF:GEN<i>:ARB:SEGMents:MANual:EXECute

Generates a trigger event for the ARB segment trigger. The segment trigger causes the generator to step to the beginning of the next segment in the multi-segment file.

Example: See Using the Arbitrary Mode

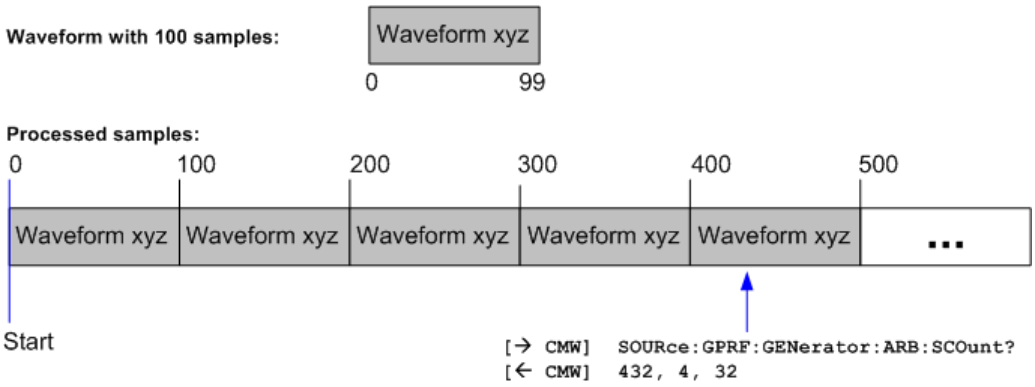
Usage: Event

Firmware/Software: V1.0.4.11

Manual operation: See "Baseband > ARB > Trigger > Multi Segment > Trigger Source" on page 29

SOURce:GPRF:GEN<i>:ARB:SCOunt?

Returns the position of the currently processed sample within the ARB file. The remote query takes between 2 ms and 3 ms, which introduces an uncertainty to the results. The meaning of the three returned values is shown in the figure below.



Notice: In multi-segment files, you can repeat segments, skip segments, and omit parts of segments (repetition mode "Continuous" or "Continuous Seamless"). The number of processed samples until the end of the file is reached is not necessarily equal to the number of samples in the file. Consequently, only the total number of processed samples (first returned value) can be counted reliably.

Return values:

<CountTime> Time elapsed since the start of the waveform file

Range: n/a
Default unit: s

<Cycles> Number of complete cycles: A cycle ends when the waveform file is re-started from the beginning.

Range: n/a

<SamplesCurrent> Number of processed samples in the current cycle
Range: n/a

Example: See Using the Arbitrary Mode

Usage: Query only

Firmware/Software: V2.0.10

2.6.7 ARB IQ Out Settings

The following commands configure the sampling rate and the transfer mode and return properties of the digital IQ output signal.

SOURce:GPRF:GEN<i>:IQSettings:SRATe <Sample Rate>

Sets/gets the sample rate of the digital IQ out signal.

Parameters:
<Sample Rate> Range: 100E+6 | 30.72E+6 | 15.36E+6 | 7.68E+6 | 3.84E+6 | 1.92E+6
*RST: 100E+6
Default unit: Samples per second

Firmware/Software: V3.0.10
V3.0.11 Sample rates 19.2 Msps and 9.6 Msps removed

Manual operation: See "Sample Rate" on page 21

SOURce:GPRF:GEN<i>:IQSettings:LEVel?

Returns the RMS level of the outgoing IQ signal relative to the maximum power level.

Return values:
<Level> Range: not used to not used
Default unit: dBFS

Usage: Query only

Firmware/Software: V3.0.10

Manual operation: See "Baseband Power and Crest Factor" on page 21

SOURce:GPRF:GEN<i>:IQSettings:PEP?

Returns the peak envelope power of the outgoing IQ signal relative to the maximum power level.

Return values:
<PEP> Range: not used to not used
Default unit: dBFS

Usage: Query only

Firmware/Software: V3.0.10

Manual operation: See "Baseband Power and Crest Factor" on page 21

SOURce:GPRF:GEN<i>:IQSettings:CRESt?

Returns the crest factor (peak-to-average power ratio) of the outgoing IQ signal.

Return values:
<Crest> Range: not used to not used
Default unit: dB

Usage: Query only

Firmware/Software: V3.0.10

Manual operation: See "Baseband Power and Crest Factor" on page 21

SOURce:GPRF:GEN<i>:IQSettings:TMODe <Transfer Mode>

Sets/gets the transfer mode for the digital output.

Parameters:
<Transfer Mode> ENABlemode | REQuestmode
"enable mode" or "request mode"
*RST: ENAB

Firmware/Software: V3.0.10

2.6.8 List Mode Settings

The following commands configure the list mode of the RF generator.

SOURce:GPRF:GEN<i>:LIST <EnableListMode>

Enables or disables the list mode of the RF generator.

Parameters:

<EnableListMode> ON | OFF

ON: List mode enabled
OFF: List mode disabled (constant-frequency generator)

*RST: OFF

Example: See Using the Generator List Mode

Firmware/Software: V1.0.0.4

Manual operation: See "List Mode" on page 21

SOURce:GPRF:GEN<i>:LIST:SSTop <StartIndex>, <StopIndex>[, <GotoIndex>]

Defines the first and last generated frequency/level steps in list mode.

Parameters:

<StartIndex> Range: 0 to min{<StopIndex>,1999}
*RST: 0

<StopIndex> Range: <StartIndex> to 1999
*RST: 19

Setting parameters:

<GotoIndex> The start index for all but the first generator cycle in continuous mode. See also `SOURce:GPRF:GEN<i>:LIST:GOTO` on page 68.

Range: <StartIndex> to <StopIndex>

Example: See Using the Generator List Mode

Firmware/Software: V1.0.0.4
V3.0.12 <GotoIndex> added

Manual operation: See "List Section" on page 31

SOURce:GPRF:GEN<i>:LIST:STARt <StartIndex>

Defines the number of the first measured frequency/level step in the list. The start index must not be larger than the stop index (see `SOURce:GPRF:GEN<i>:LIST:STOP`).

Parameters:

<StartIndex> Range: 0 to 1999
*RST: 0

Example: See Using the Generator List Mode

Firmware/Software: V1.0.2.7

SOURce:GPRF:GEN<i>:LIST:STOP <StopIndex>

Defines the number of the last measured frequency/level step in the list. The stop index must not be smaller than the start index (see `SOURce:GPRF:GEN<i>:LIST:STARt`).

Parameters:

<StopIndex> Range: 0 to 1999
*RST: 19

Example: See Using the Generator List Mode

Firmware/Software: V1.0.2.7

SOURce:GPRF:GEN<i>:LIST:COUNt? <ListCount>

Queries the number of frequency/level steps of the RF generator in list mode.

Parameters:

<ListCount> Number of frequency/level steps in list mode
Range: 1 to 2000
*RST: 20

Example: See Using the Generator List Mode

Usage: Query only

Firmware/Software: V1.0.0.4

Manual operation: See "List Section" on page 31

SOURce:GPRF:GEN<i>:LIST:GOTO <GoToIndex>

Defines the start index for the second and all following generator cycles in continuous mode (`SOURce:GPRF:GEN<i>:LIST:REPetition`). The index must be in the selected list section (`SOURce:GPRF:GEN<i>:LIST:SSTop`).

Parameters:

<GoToIndex> Range: 1 to 2000
*RST: 0

Example: See Using the Generator List Mode

Firmware/Software: V1.0.10.1

Manual operation: See "Go to Index" on page 32

SOURce:GPRF:GEN<i>:LIST:REPetition <Repetition>

Defines how often the RF generator runs through the list.

Parameters:

<Repetition> SINGle | CONTinuous

SINGle: The generator runs through the list for a single time. The sequence is triggered via .SOURce:GPRF:GEN<i>:LIST:ESINgle

CONTinuous: The generator cycles through the list.

*RST: CONT

Example: See Using the Arbitrary Mode

Firmware/Software: V1.0.10.1

Manual operation: See "Repetition" on page 32

SOURce:GPRF:GEN<i>:LIST:INCRement <ListIncrSrc>

Defines how the RF generator steps through the list. The list below corresponds to a basic R&S CMW configuration with an ARB generator (option R&S CMW-B110 A). Depending on the installed options, additional modes may be available. To generate a complete list of all supported modes, see SOURce:GPRF:GEN<i>:LIST:INCRement:CATalog?.

Parameters:

<ListIncrSrc> String parameter, specifies the source for the list increment:
'Dwell Time': The generator transmits at each frequency/level step for the selected "Dwell Time" (SOURce:GPRF:GEN<i>:LIST:DTIMe)
'GPRF Gen1: Waveform Marker 4': List incremented by the ARB file (only for baseband mode ARB, see SOURce:GPRF:GEN<i>:BBMode)
'GPRF Meas1: Power': List incremented in line with a running "GPRF Power" measurement

Example: See Using the Generator List Mode

Firmware/Software: V1.0.10.1

Manual operation: See "List Increment" on page 33

SOURce:GPRF:GEN<i>:LIST:INCRement:CATalog?

Lists all list increment modes that can be set using SOURce:GPRF:GEN<i>:LIST:INCRement.

Return values:

<ListIncrSrcs> Comma separated list of strings. Each string represents a supported increment mode.

Example: See Using the Generator List Mode

Usage: Query only

Firmware/Software: V1.0.10.1

SOURce:GPRF:GEN<i>:LIST:INCRement:ENABling <Enabling>

Defines an initial trigger condition for the list mode with list increment "GPRF Gen<i>: Waveform Marker 4" (see `SOURce:GPRF:GEN<i>:LIST:INCRement`). The list below corresponds to a basic R&S CMW configuration. Depending on the installed options, additional modes may be available. To generate a complete list of all supported modes, see `SOURce:GPRF:GEN<i>:LIST:INCRement:ENABling:CATalog?`.

Parameters:

<Enabling> String parameter, specifies the source for the initial trigger
'Immediate': No initial trigger
'GPRF Meas1: Power': "GPRF Power" measurement provides initial trigger

Example: See Using the Arbitrary Mode

Firmware/Software: V1.0.10.1

SOURce:GPRF:GEN<i>:LIST:INCRement:ENABling:CATalog?

Lists all initial trigger modes that can be set using `SOURce:GPRF:GEN<i>:LIST:INCRement:ENABling`.

Return values:

<EnablingSrcs> Comma separated list of strings. Each string represents a supported initial trigger mode.

Example: See Using the Arbitrary Mode

Usage: Query only

Firmware/Software: V1.0.10.1

SOURce:GPRF:GEN<i>:LIST:ESINgle

Starts a single generator cycle through the frequency/level list.

This command is available only while:

- the list mode is enabled (see `SOURce:GPRF:GEN<i>:LIST`)
- and "Single" list mode is set (`SOURce:GPRF:GEN<i>:LIST:REPetition`)
- and increment "Dwell Time" is set (`SOURce:GPRF:GEN<i>:LIST:INCRement`)

Example: See Using the Arbitrary Mode

Usage: Event

Firmware/Software: Software version V1.0.2.7

Manual operation: See "List Increment" on page 33

SOURce:GPRF:GEN<i>:LIST:IREPetition <Index>, <Repetition>
SOURce:GPRF:GEN<i>:LIST:IREPetition? <Index>

Defines or queries the "Index Repetion" of a selected frequency/level step.

Parameters:
<Repetition> Repetition of the frequency/level step
Range: 1 to 99999
*RST: 0

Parameters for setting and query:
<Index> Number of frequency/level step in the table
Range: 0 to 1999
*RST: n/a

Example: See Using the Generator List Mode

Firmware/Software: V2.0.10

Manual operation: See "Frequency / Level List" on page 35

SOURce:GPRF:GEN<i>:LIST:IREPetition:ALL <IndexRepetitions>...

Defines or queries the "Index Repetion" of all frequency/level steps.

Parameters:
<IndexRepetitions> n comma separated values, one per frequency/level step, where n ≤ 2000. The query returns 2000 results.
Range: 1 to 10000
*RST: 1

Example: See Using the Generator List Mode

Firmware/Software: V2.0.10
V3.0.12 Max. index repetitions increased to 10000

Manual operation: See "Frequency / Level List" on page 35

SOURce:GPRF:GEN<i>:LIST:DTIMe <Index>, <Dwelltime>
SOURce:GPRF:GEN<i>:LIST:DTIMe? <Index>

Defines or queries the transmission time for a selected frequency/level step in "Dwell Time" mode. The value is not used in the other list modes (see `SOURce:GPRF:GEN<i>:LIST:INCRement`).

Parameters:
<Dwelltime> Dwell time for the frequency/level step
Range: 200E-6 s to 40 s
Increment: 10E-9 s
*RST: 0.5 s
Default unit: s

Parameters for setting and query:

<Index> Number of frequency/level step in the table

Range: 0 to 1999
*RST: n/a

Example: See Using the Generator List Mode

Firmware/Software: V1.0.0.4 (extended by <Index> in V1.0.2.6)

Manual operation: See "Frequency / Level List" on page 35

SOURce:GPRF:GEN<i>:LIST:DTIMe:ALL <AllDwelltimes>...

Defines the transmission times for all frequency/level steps in "Dwell Time" mode. The value is not used in the other list modes (see `SOURce:GPRF:GEN<i>:LIST:INCRement`).

Parameters:

<AllDwelltimes> n comma separated values, one per frequency/level step, where n < 2001. The query returns 2000 results.

Range: 200E-6 s to 40 s
*RST: 0.5 s
Default unit: s

Example: See Using the Generator List Mode

Firmware/Software: V1.0.2.6

Manual operation: See "Frequency / Level List" on page 35

SOURce:GPRF:GEN<i>:LIST:FREQuency <Index>, <Frequency>
SOURce:GPRF:GEN<i>:LIST:FREQuency? <Index>

Defines or queries the frequency of a selected frequency/level step.

Parameters:

<Frequency> Frequency of the frequency/level step

Range: 70E+6 Hz to 6E+9 Hz
Increment: 0.1 Hz
*RST: 1.2E+9 Hz
Default unit: Hz

Parameters for setting and query:

<Index> Number of frequency/level step in the table

Range: 0 to 1999
*RST: n/a

Example: See Using the Generator List Mode

Firmware/Software: V1.0.0.4

Manual operation: See "Frequency / Level List" on page 35

SOURce:GPRF:GEN<i>:LIST:FREQuency:ALL <AllFrequencies>...

Defines the frequencies of all frequency/level steps.

Parameters:

<AllFrequencies> n comma separated values, one per frequency/level step, where n < 2001. The query returns 2000 results.

Range: 70E+6 Hz to 6E+9 Hz
*RST: 800E+6 Hz
Default unit: Hz

Example: See Using the Generator List Mode

Firmware/Software: V1.0.2.6

Manual operation: See "Frequency / Level List" on page 35

SOURce:GPRF:GEN<i>:LIST:RFLevel <Index>, <Level>
SOURce:GPRF:GEN<i>:LIST:RFLevel? <Index>

Defines or queries the level of the frequency/level step numbered <Index>.

Parameters:

<Level> Number of frequency/level step in the table.

Range: –130 dBm to 0 dBm at RF 1 COM and RF 2 COM, –120 dBm to +13 dBm at RF 1 OUT; please also notice the ranges quoted in the data sheet
*RST: -30 dBm
Default unit: dBm
Additional parameters: OFF | ON (disables | enables the frequency/level step)

Parameters for setting and query:

<Index> Range: 0 to 1999
*RST: n/a

Example: See Using the Generator List Mode

Firmware/Software: V1.0.0.4 (...:ALL command in version V1.0.2.6)

Manual operation: See "Frequency / Level List" on page 35

SOURce:GPRF:GEN<i>:LIST:RFLevel:ALL <AllLevels>...

Defines the levels of all frequency/level steps.

Parameters:

<AllLevels> n comma separated values, one per frequency/level step, where n < 2001. The query returns 2000 results.

Range: –130 dBm to 0 dBm at RF 1 COM and RF 2 COM, –120 dBm to +13 dBm at RF 1 OUT; please also notice the ranges quoted in the data sheet
Increment: 0.01 dBm
*RST: -30 dBm
Default unit: dBm
Additional parameters: OFF | ON (disables | enables the frequency/level step)

Example: See Using the Generator List Mode

Firmware/Software: V1.0.2.6

Manual operation: See "Frequency / Level List" on page 35

SOURce:GPRF:GEN<i>:LIST:DGAin <Index>, <DigitalGain>
SOURce:GPRF:GEN<i>:LIST:DGAin? <Index>

Defines or queries the digital gain of a selected frequency/level step.

Parameters:

<DigitalGain> Digital gain at the step

Range: -30 dB to 0 dB
*RST: 0 dB
Default unit: dB

Parameters for setting and query:

<Index> Number of frequency/level step in the table

Range: 0 to 1999
*RST: n/a

Example: See Using the Generator List Mode

Firmware/Software: V1.0.0.4

Manual operation: See "Frequency / Level List" on page 35

SOURce:GPRF:GEN<i>:LIST:DGAin:ALL <AllDigitalGains>...

Defines the digital gains of all frequency/level steps.

Parameters:

<AllDigitalGains> n comma separated values, one per frequency/level step, where n < 2001. The query returns 2000 results.

Range: -30 dB to 0 dB
*RST: 0 dB
Default unit: dB

Example: See Using the Generator List Mode

Firmware/Software: V1.0.2.6

Manual operation: See "Frequency / Level List" on page 35

SOURce:GPRF:GEN<i>:LIST:MODulation <Index>, <Modulation>
SOURce:GPRF:GEN<i>:LIST:MODulation? <Index>

Defines or queries the "Mod. On / Off" setting of a selected frequency/level step. The setting is valid only in arbitrary baseband mode (see `SOURce:GPRF:GEN<i>:BBMode`).

Parameters:

<Modulation> OFF | ON

Switch modulation OFF or ON

*RST: ON

Parameters for setting and query:

<Index> Number of frequency/level step in the table

Range: 0 to 1999
*RST: n/a

Example: See Using the Generator List Mode

Firmware/Software: V1.0.2.7

Manual operation: See "Frequency / Level List" on page 35

SOURce:GPRF:GEN<i>:LIST:MODulation:ALL <AllModulations>...

Defines or queries the "Mod. On / Off" setting of all frequency/level steps. The setting is valid only in arbitrary baseband mode (see `SOURce:GPRF:GEN<i>:BBMode`).

Parameters:

<AllModulations> OFF | ON

n comma separated values, one per frequency/level step, where n < 2001. The query returns 2000 results.
Each value switches the modulation of a step **OFF** or **ON**.

*RST: ON

Example: See Using the Generator List Mode

Firmware/Software: V1.0.2.6

Manual operation: See "Frequency / Level List" on page 35

SOURce:GPRF:GEN<i>:LIST:REENabling <Index>, <Reenabling>
SOURce:GPRF:GEN<i>:LIST:REENabling? <Index>

Defines or queries the "Reenable On / Off" setting of a selected frequency/level step. The setting is valid if the list increment is enabled by a measurement (see `SOURce:GPRF:GEN<i>:LIST:INCRement:ENABling`).

Parameters:

<Reenabling> OFF | ON

Disable/enable retriggered frequency/level steps

*RST: ON (step 1) and OFF (all other steps)

Parameters for setting and query:

<Index> Number of frequency/level step in the table

Range: 0 to 1999
*RST: n/a

Example: See Using the Generator List Mode

Firmware/Software: V2.0.10

Manual operation: See "Frequency / Level List" on page 35

SOURce:GPRF:GEN<i>:LIST:REENabling:ALL <AllReenables>...

Defines or queries the "Reenable On / Off" setting of all frequency/level steps. The setting is valid if the list increment is enabled by a measurement (see `SOURce:GPRF:GEN<i>:LIST:INCRement:ENABling`).

Parameters:

<AllReenables> OFF | ON

n comma separated values, one per frequency/level step, where n < 2001. The query returns 2000 results.
Each value disables/enables a retriggered frequency/level step.

*RST: ON (step 1) and OFF (all other steps)

Example: See Using the Generator List Mode

Firmware/Software: V2.0.10

Manual operation: See "Frequency / Level List" on page 35

SOURce:GPRF:GEN<i>:LIST:RLISt

Re-starts the list generator at the first frequency/level step. This command provides a fast alternative to a complete re-start of the list generator (turn generator off and on again).

Example: See Using the Generator List Mode

Usage: Event

Firmware/Software: V1.0.15.20

Manual operation: See "Frequency / Level List" on page 35

SOURce:GPRF:GEN<i>:LIST:FILL <StartIndex>, <Range>, <IndexRepetition>, <Start Frequency>, <FreqIncrement>, <Start Power>, <PowerIncrement>[, <Start DwellTime>[, <Reenable>[, <Modulation>[, <Start Gain>, <Gain Increment>]]]]

Convenience command to simplify the configuration of the frequency/level list.

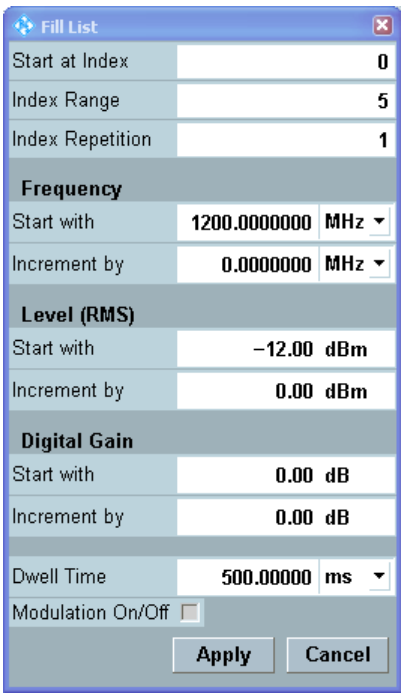


Fig. 2-16: Fill List GUI

Within a list segment determined by its start index and range (length), the frequency, power and (optionally the) digital gain are incremented by configurable step sizes while the other list item settings are fixed.

Setting parameters:

<Start Index> The start index of the list segment to be "filled".

Range: 0 to 1999
*RST: 0

<Range> The range (length) of the list segment to be "filled".

Range: 1 to 2000
*RST: 5

<Index Repetition> The constant "index repetition" within this list segment.

Range: 1 to 2000
*RST: 1

<Start Frequency> The frequency of list item <Start Index>.

Default unit: Hz

<Frequency Increment> The constant frequency increment within this list segment.

Default unit: Hz

<Start Power> The RMS level of list item <Start Index>.

Default unit: dBm

<Power Increment> The constant power increment within this list segment.

Default unit: dBm

<Dwell Time>	The constant dwell time within this list segment. Default unit: s
<Reenable>	OFF | ON The constant "Reenable increment" property within this list segment.
<Modulation>	OFF | ON The constant "Modulation ON|OFF" property within this list segment.
<Start Gain>	The digital gain of list item <Start Index>. Default unit: dB
<Gain Increment>	The constant digital gain increment within this list segment. Default unit: dB
Usage:	Event
Firmware/Software:	V3.0.10
Manual operation:	See "Frequency / Level List" on page 35

2.7 List of Commands

3 GPRF Measurements

The General Purpose RF (GPRF) measurements provide an RF test and measurement functionality that is not related to a particular network standard. General Purpose RF (GPRF) measurements determine the properties of an arbitrary RF signal.

3.1 What's New in this Revision

This revision describes version 3.0.12 and later of the "GPRF Measurements" firmware application. Compared to the previous software versions it provides the following new/ modified features:

Power Measurement List Mode:

- List size increased from 2000 to 4000

Software Version

To check your R&S CMW software version, open the "Setup" dialog and click "HW/SW Equipment". The initial software version for each remote control command is quoted in the reference description.

3.1.1 V3.0.11 (Compared to V3.0.10)

Power Measurement List Mode:

- Configurable timing of generated "GPRF Meas<i>:Power" trigger (see "TX Increment Timing" on page 125)

3.2 General Description

The R&S CMW provides the following GPRF measurements.

3.2.1 Power Measurement

The "Power" measurement measures a series of measurement steps at (possibly) different power and frequency levels and performs a statistical evaluation. The measure-

ment is a flexible tool for power measurements on an arbitrary RF. In particular it can be used for fast transmitter adjustments over a wide range of channels and output powers.

3.2.1.1 Test Setup

The external RF signal source (mobile station, signal generator etc.) is connected to one of the RF input connectors (RF COM) at the front panel of the R&S CMW. No additional cabling and no external trigger is needed.

The input level ranges of all RF COM connectors are identical.

See also: "RF Connectors" in the R&S CMW user manual, chapter "Getting Started"

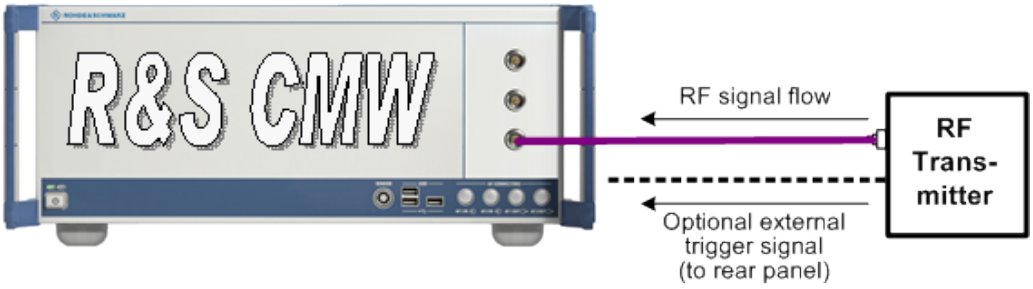


Fig. 3-1: Connecting an RF transmitter to the instrument

3.2.1.2 Measurement Settings

The parameters for the "Power" measurement are accessible from the "Power Configuration" dialog; see Power: Parameters and Settings. In the measurement menu, various softkeys with associated hotkeys provide fast access to the most important power parameters.

The "Power" measurement can be performed with a wide range of IF filters of various shapes and bandwidths. In addition to Gaussian and bandpass filters, the measurement provides special filter types for various network standards, e.g. channel filters for WCDMA, CDMA2000, and TD-SCDMA measurements. Special measurement modes are described in the following sections.

3.2.1.3 Single Step vs. List Mode

In its simplest configuration the "Power" measurement provides the average power in a measurement interval of configurable length ("Measurement Length"): The instrument behaves like a power meter.

The measurement interval can be repeated periodically over a sequence of power/frequency steps ("List Mode"). A single step sequence is termed a "sweep".

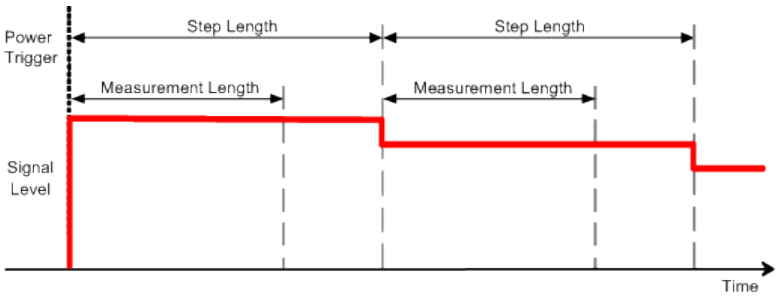


Fig. 3-2: Step length and measurement length

The measurement interval is moved with respect to the power steps, if the first step that the DUT generates is shortened. This can be suitable to avoid the switching transients due to the power steps.

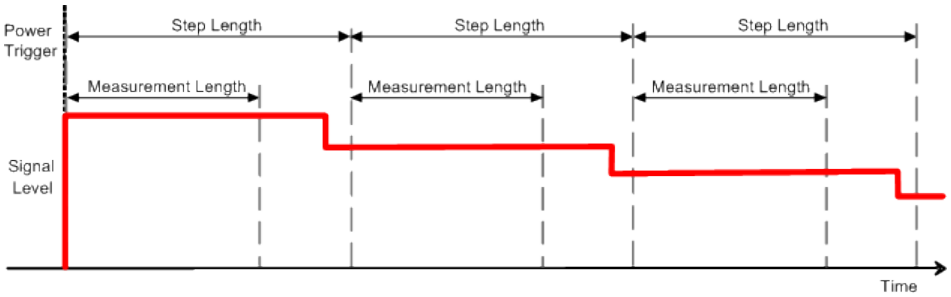


Fig. 3-3: Sweep with shortened first step

Alternatively it is possible to introduce a trigger offset in order to move the measurement interval relative to the steps.

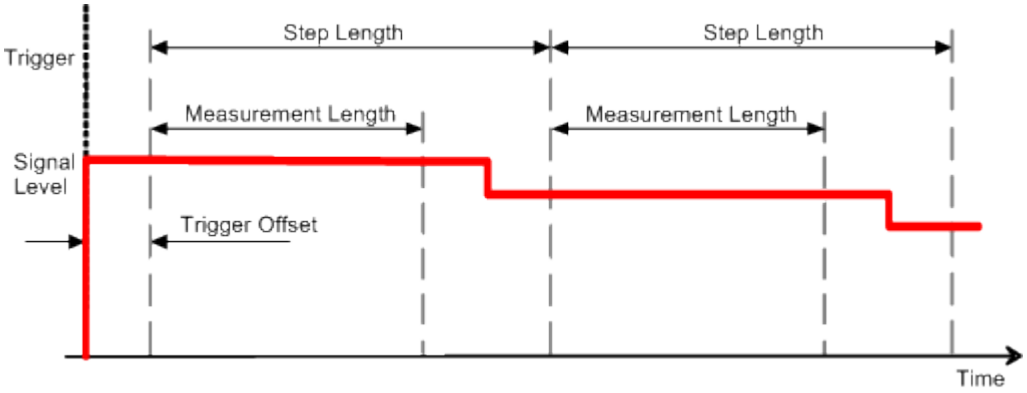


Fig. 3-4: Sweep with trigger offset (1)

A trigger offset is also suitable if the first power step is longer than the following steps.

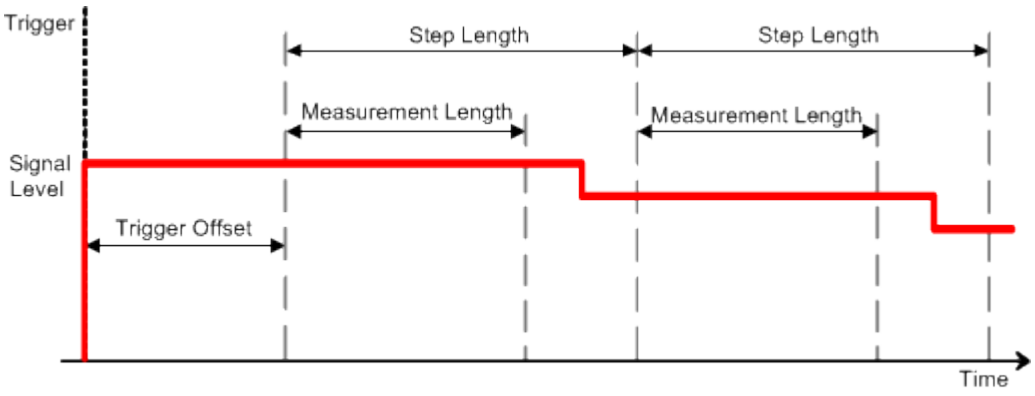


Fig. 3-5: Sweep with trigger offset (2)

The entire sweep can be repeated several times to perform statistical evaluations.

3.2.1.4 Trigger Modes

The "Power" measurement can be performed in "Free Run" (untriggered) mode, however, a power trigger ("Trigger Source: IF Power") is suitable, in particular if the measurement has to be synchronized to a sequence of power steps. The R&S CMW provides several alternative trigger modes for RF input signals with different characteristics.

Trigger Once

The measurement is triggered once; all the following evaluation intervals are calculated according to the "Step Length" and the "Measurement Length" settings. The trigger is re-armed only after the measurement is stopped and re-started.

This mode is recommended for signals where all steps (including possible repetitions for statistics) are within the "Step Length".

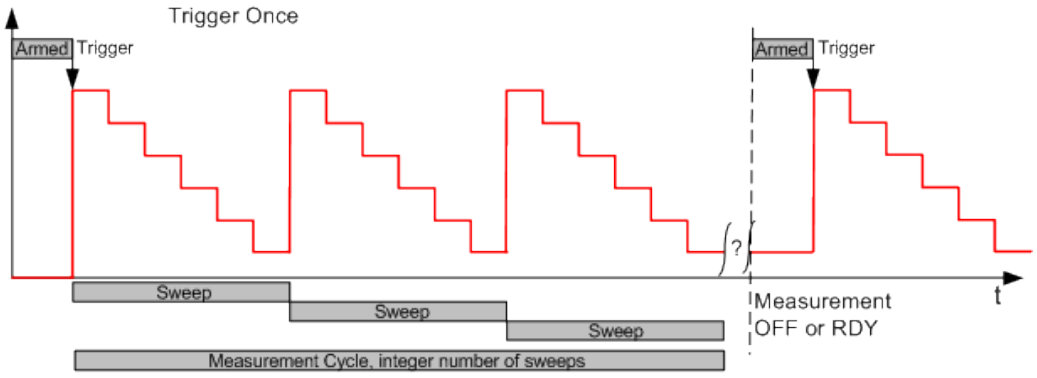


Fig. 3-6: Retrigger Once mode

Retrigger Sweep

The measurement starts after the first trigger event and continues according to the "Step Length" and the "Measurement Length" settings until a sweep (a sequence of power

steps) is completed. After the sweep is completed, a new trigger event can re-synchronize the measurement.

This mode is recommended for signals where all steps within one sweep are within the "Step Length" but the time gap between the sweeps is not very precise. Furthermore this mode is recommended for very high statistic counts where re-triggering can compensate for a possible time drift of the DUT.

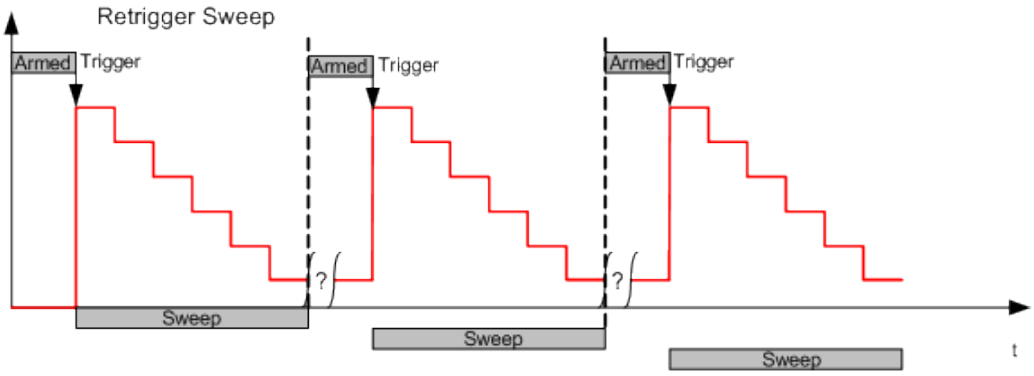


Fig. 3-7: Retrigger Sweep mode

Retrigger All

Like "Retrigger Sweep", however, the trigger is re-armed at each power/frequency step. This mode is recommended for steps with unknown or irregular distances.

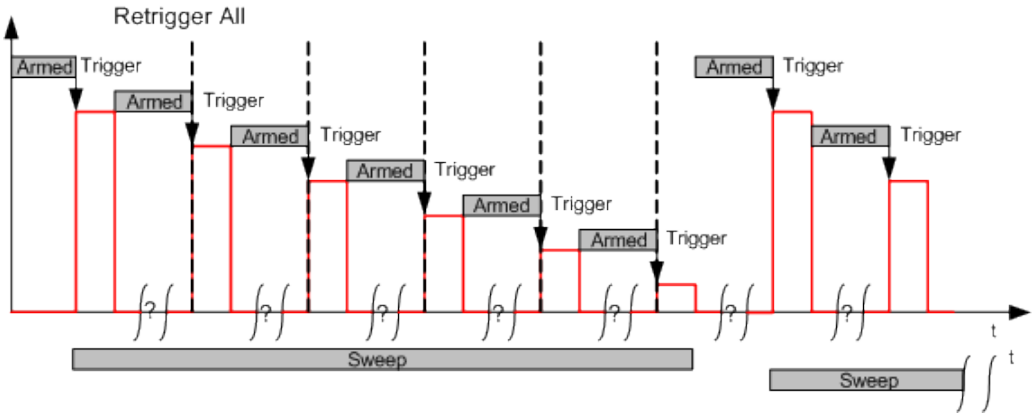


Fig. 3-8: Retrigger All mode

Retrigger Preselected

Like "Retrigger All", however, the trigger is re-armed only at some preselected power steps. This subdivides the sweep into a sequence of continuously measured subsweeps; the trigger is re-armed at each subsweep. The whole retrigger pattern is repeated for each sweep.

This mode is a compromise between "Retrigger Sweep" and "Retrigger All". It is also recommended if the conditions for "Retrigger All" apply but no trigger signal is available for each step.

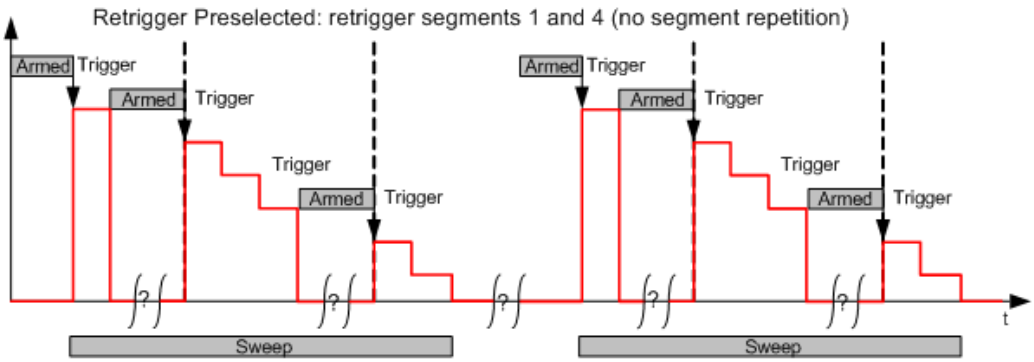


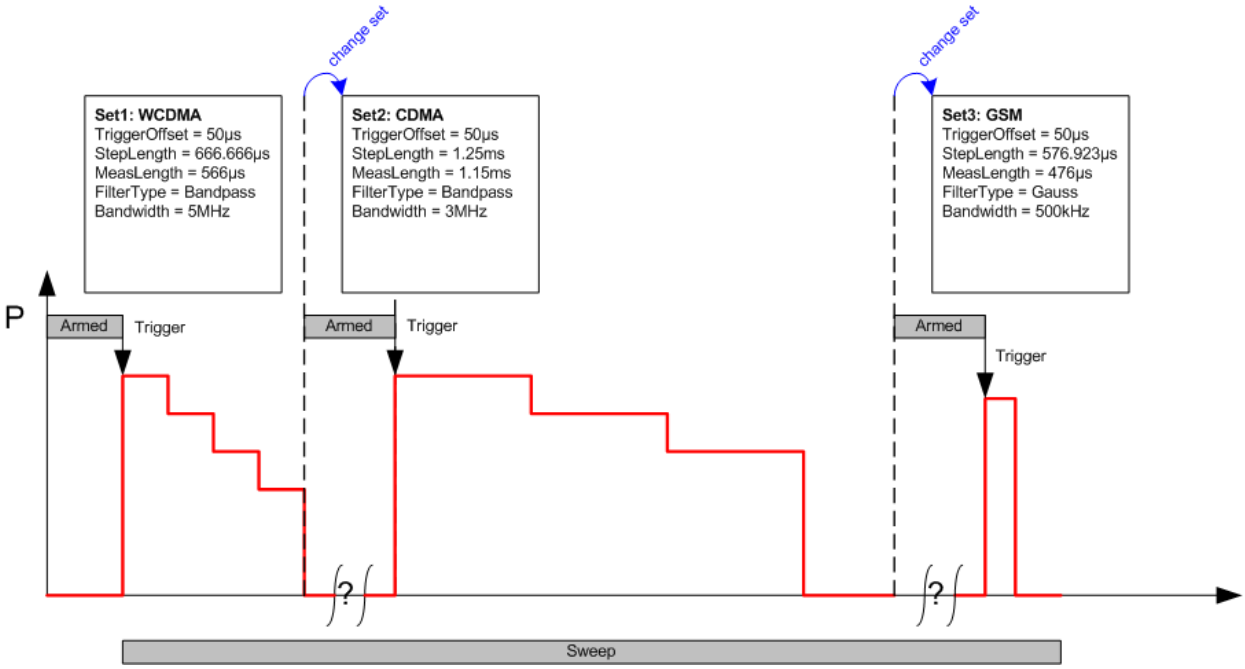
Fig. 3-9: Retrigger Preselected mode

3.2.1.5 List Mode with Variable Parameter Sets

The list mode can be extended to measure power steps with different filter settings, step lengths, measurement lengths, and trigger offsets. This extension requires a "Retrigger Preselected" trigger mode (see Retrigger Preselected mode); the R&S CMW needs a switching period (<500 µs) to adapt to a new parameter set.

List mode requires option CMW-KM012.

A typical application for the extended list mode is a measurement on an uplink/reverse link signal which is switched over from one network standard to another. An example is shown below.



The parameter sets (Set 0, Set 1 ... Set 31) are predefined in the "Power Configuration" dialog ("Measurement Control > Parameter Set List"). To configure the extended list mode, one of the predefined parameter sets is assigned to each list step.

3.2.1.6 I/Q Data Measurement

In addition to the power results in list mode, the R&S CMW provides I/Q amplitudes acquired at variable sampling rates. The I/Q data measurement can be enabled for specific power steps; the R&S CMW determines the sampling rate according to the filter settings for each step. The following table contains a selection of sampling rates for different filter types and bandwidths. Use `FETCh:GPRF:MEAS<i>:POWer:IQINfo?` to query the sampling rate and no. of samples for an arbitrary power step configuration.

Filter type	Bandwidth	Sampling rate
Gauss	10 Hz	250 Hz
	10 kHz	125 kHz
	10 MHz	50 MHz
Bandpass	1 kHz	4 kHz
	500 kHz	2.5 MHz
	40 MHz	50 MHz
WCDMA	3.84 MHz (fixed)	100 MHz / 6
TD-SCDMA	1.28 MHz (fixed)	100 MHz / 18
CDMA	1.2288 MHz (fixed)	5 MHz

The I/Q data measurement is essentially a remote-controlled feature. The measurement can be enabled in the list mode editor; the results must be retrieved using `READ...` and `FETCh...` queries. The relevant remote control commands are listed below.

Table 3-1: Commands for I/Q data measurement

Command	Action
`CONFigure:GPRF:MEAS<i>:POWer:LIST:IQData` `CONFigure:GPRF:MEAS<i>:POWer:LIST:IQData:ALL`	Enable I/Q data measurement
`CONFigure:GPRF:MEAS<i>:POWer:LIST:MUNit`	Select magnitude unit
`FETCh:GPRF:MEAS<i>:POWer:IQINfo?`	Return sampling rate and no. of samples per step
`FETCh:GPRF:MEAS<i>:POWer:IQData?` `FETCh:GPRF:MEAS<i>:POWer:IQData:BIN?`	Return all measurement results per step

Additional conditions and restrictions

The R&S CMW returns a maximum of 4 Msamples of I/Q data. If the number of samples (depending on the step length / measurement length settings and the sampling rate) exceeds 4,000,000 the `READ...` and `FETCh...` queries return `NCAP` values for all steps where this threshold value is exceeded.

Example: I/Q data measurement with 4 steps, each with 1.5 Msamples of data. The threshold value is within the third step, so the R&S CMW returns valid results for the first two steps, `NCAP` values for steps no. 3 and 4.

The step length must exceed the measurement length by at least 10 µs. All returned measurement data is acquired within the configured **measurement** lengths. This entails a discontinuous measurement interval if the measurement extends over several steps (see e.g. Sweep with trigger offset (1)).

Recommended approach for I/Q data measurements

In view of the dependencies and restrictions described above, the measurement should be performed as follows:

1. Configure the measurement control settings for the measured power step(s).
2. Query the sampling rate and no. of samples; check whether the no. of samples is below 4,000,000. If necessary, adjust the settings from step no. 1.
3. Select the magnitude unit and enable the I/Q data measurement.
4. Perform the measurement; query and analyze the results.

3.2.1.7 Measurement Results

Power results are either presented as summary statistics (per power step) or as statistical distributions or densities (only for single-step measurements. In list mode, all power results of the sweep can be displayed in a bar graph or in tables.

See also: "Statistical Results" in the R&S CMW user manual, chapter "System Overview"

The summary statistics include the standard deviation that indicates how widely spread the power values are at each power step.

Single Step: Power Evaluation Mode

If the list mode is disabled and the evaluation mode "Power" is selected via the corresponding softkey, the measurement diagram displays the "Power Current RMS value".

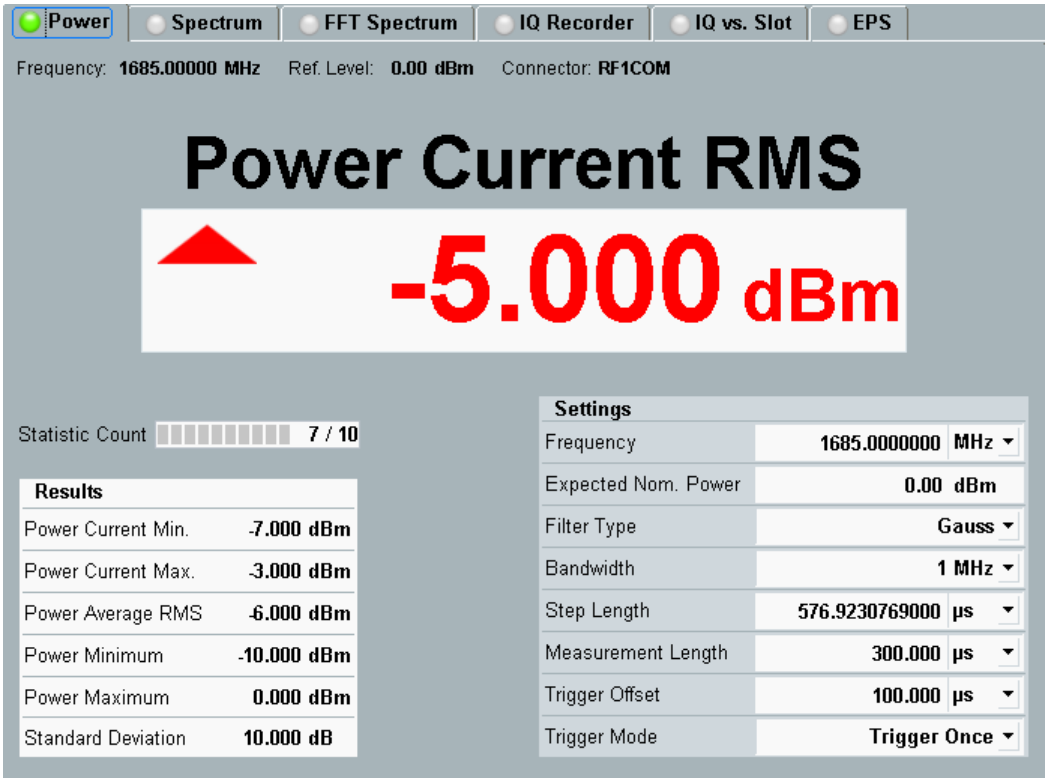


Fig. 3-10: Single power step results: Power display mode

The **Results** panel presents the summary statistics of the power values for the current measurement interval and for all meausrement intervals within the statistic count.

See also: "Statistical Results" in the R&S CMW user manual, chapter "System Overview"

The **Settings** panel gives access to the basic settings of the "Power" measurement

Single Step: Statistic Evaluation Mode

If the list mode is disabled and the "Statistic" evaluation mode is selected via the corresponding softkey, the measurement diagram either shows the complementary cumulative distribution function (CCDF) or the amplitude probability density (APD):

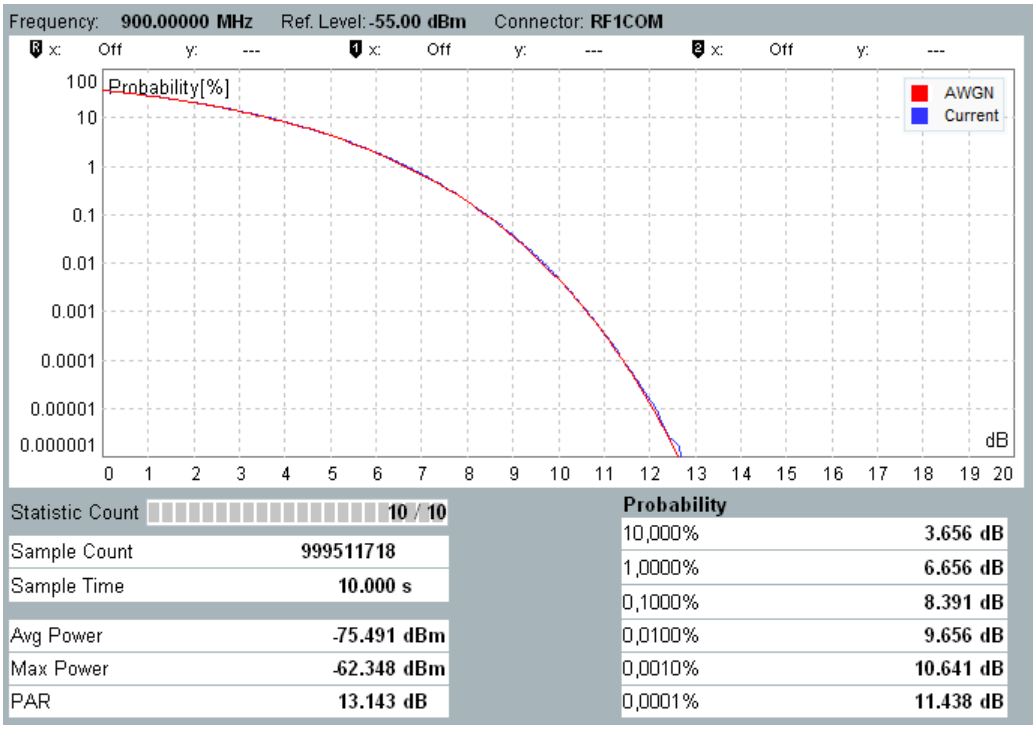


Fig. 3-11: Single power step results: CCDF display

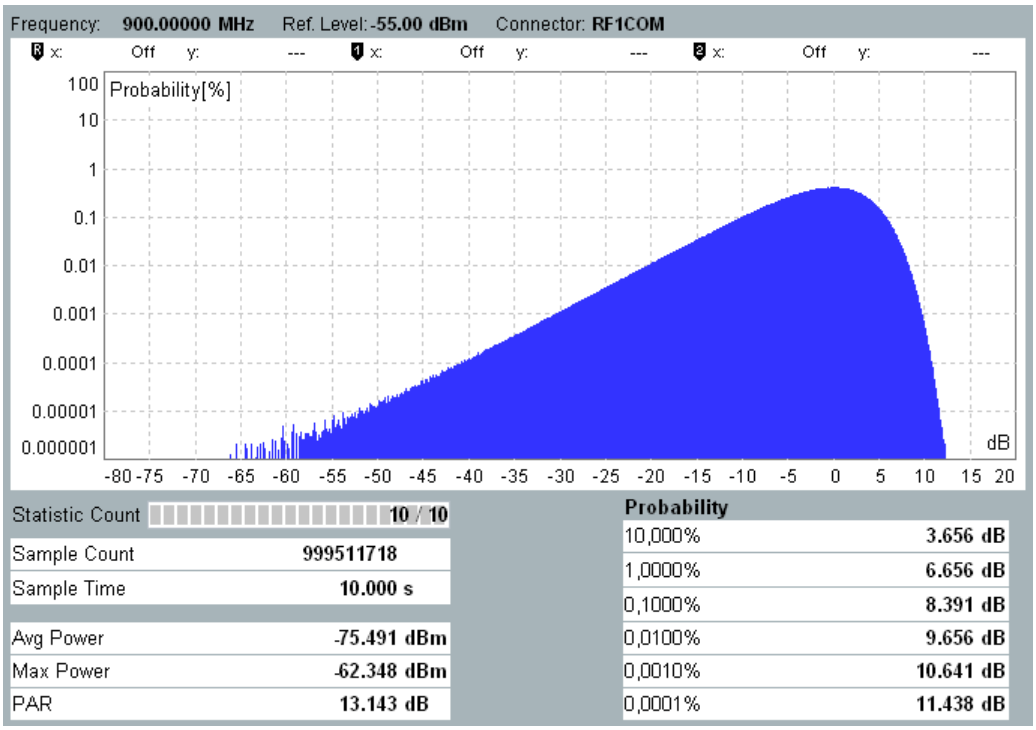


Fig. 3-12: Single power step results: APD display

The displayed diagram can be toggled via the "Display > Display CCDF APD" hotkey. Both diagrams represent the likelihood of deviations from the average power.

In the lower part of the view statistic information is presented:

- The number of samples evaluated for the statistic
- The average power, maximum power and peak to average power ratio (crest factor)
- Several percentiles of the power distribution indicating how wide the samples are spread around the average

List Mode: Diagram View

In list mode, the measured power values appear in a bar graph, the numerical results at a particular power step are displayed in a table below.

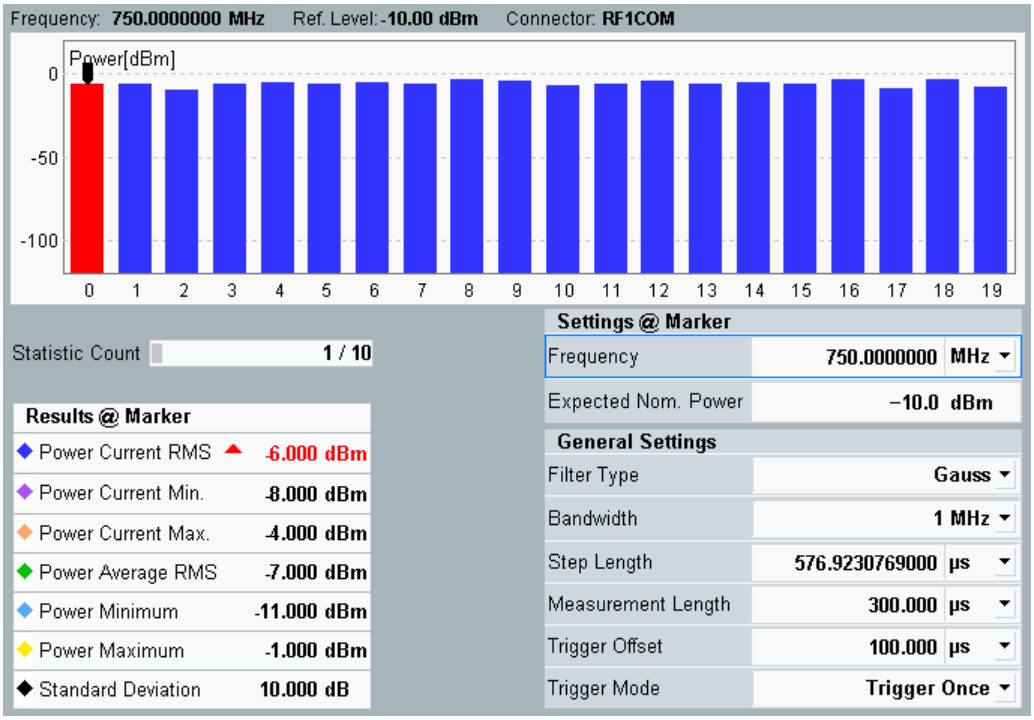


Fig. 3-13: Power measurement results: Diagram View (List Mode)

- Use the Power Configuration > List Configuration parameters to control the number of measured steps.
- Use the Power Configuration > Display parameters to control the number of superimposed bars with different colors.
- Use the "Marker" hotkeys to position markers on the traces of the active view.
- Use the check boxes in the result section below the diagrams to display or hide the results.
- **Result panel**
  A statistical evaluation of the power values at the current marker position is displayed below the diagram.
  Use the check boxes to display or hide the results in the upper and lower diagram.
- **Settings panels**
  An overview of the essential current settings of the "Power" measurement is displayed to the right of the result panels.

Use "Display > Hide Settings" to hide the settings panels.

See also: "Statistical Results" in the R&S CMW user manual, chapter "System Overview"

List Mode: Table View

The results in the bar graphs of the List Mode: Diagram View are also displayed in a table with numeric values.

Frequency: 1685.00000 MHz Ref. Level: 0.00 dBm Connector: RF1COM

Power	Current RMS [dBm]	Current Min. [dBm]	Current Max. [dBm]	Average RMS [dBm]	Minimum Min. [dBm]	Maximum Max. [dBm]
[0]	-6.000	-8.000	-4.000	-7.000	-11.000	-1.000
[1]	-6.000	-6.000	-2.000	-7.000	-9.000	0.000
[2]	-9.700	-8.700	-4.700	-5.300	-10.300	0.700
[3]	-6.600	-6.600	-3.600	-5.600	-9.600	0.400
[4]	-5.100	-9.100	-3.100	-6.900	-11.900	0.100
[5]	-6.200	-6.200	-2.200	-7.200	-11.200	-0.200
[6]	-5.500	-9.500	-5.500	-8.500	-12.500	-2.500
[7]	-5.800	-8.800	-4.800	-7.800	-12.800	-2.800
[8]	-3.900	-9.900	-2.900	-8.100	-12.100	-1.100
[9]	-4.400	-8.400	-4.400	-9.400	-11.400	-3.400
[10]	-7.300	-8.300	-1.300	-7.700	-11.700	-3.700
[11]	-6.000	-8.000	-5.000	-10.000	-14.000	-4.000
[12]	-4.700	-5.700	-2.700	-8.300	-13.300	-3.300
[13]	-6.600	-11.600	-5.600	-9.600	-14.600	-2.600
[14]	-5.100	-6.100	-0.100	-10.900	-13.900	-2.900
[15]	-6.200	-10.200	-7.200	-9.200	-15.200	-5.200
[16]	-3.500	-3.500	-2.500	-9.500	-13.500	-3.500
[17]	-8.800	-8.800	-8.800	-9.800	-13.800	-3.800
[18]	-3.900	-2.900	0.100	-12.100	-16.100	-4.100
[19]	-8.400	-12.400	-6.400	-10.400	-14.400	-5.400

Statistic Count 1 / 10

Fig. 3-14: Power measurement results: Table View (List Mode)

3.2.2 Spectrum Analyzer

The functions provided by this measurement correspond to those of a conventional spectrum analyzer.

In "Frequency Sweep Mode" the frequency spectrum of the test signal over the selected frequency range is measured with the selected resolution and sweep time.

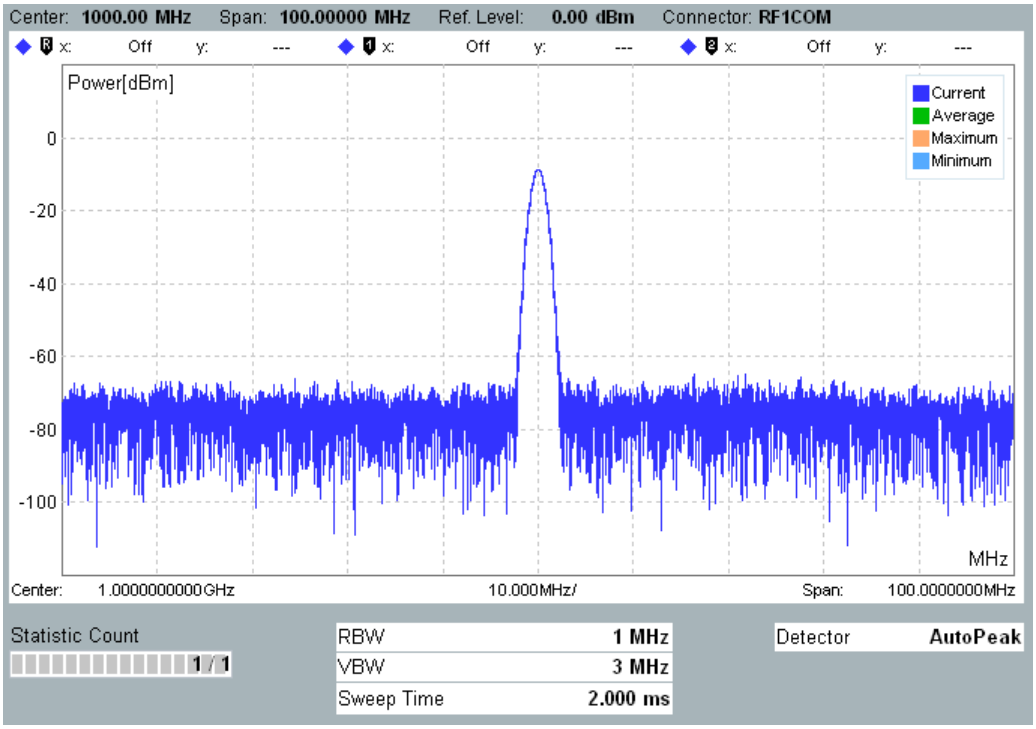


Fig. 3-15: Spectrum Analyzer: Frequency Sweep Mode

In "Zero Span Mode", for a fixed frequency the waveform of the video signal is displayed.

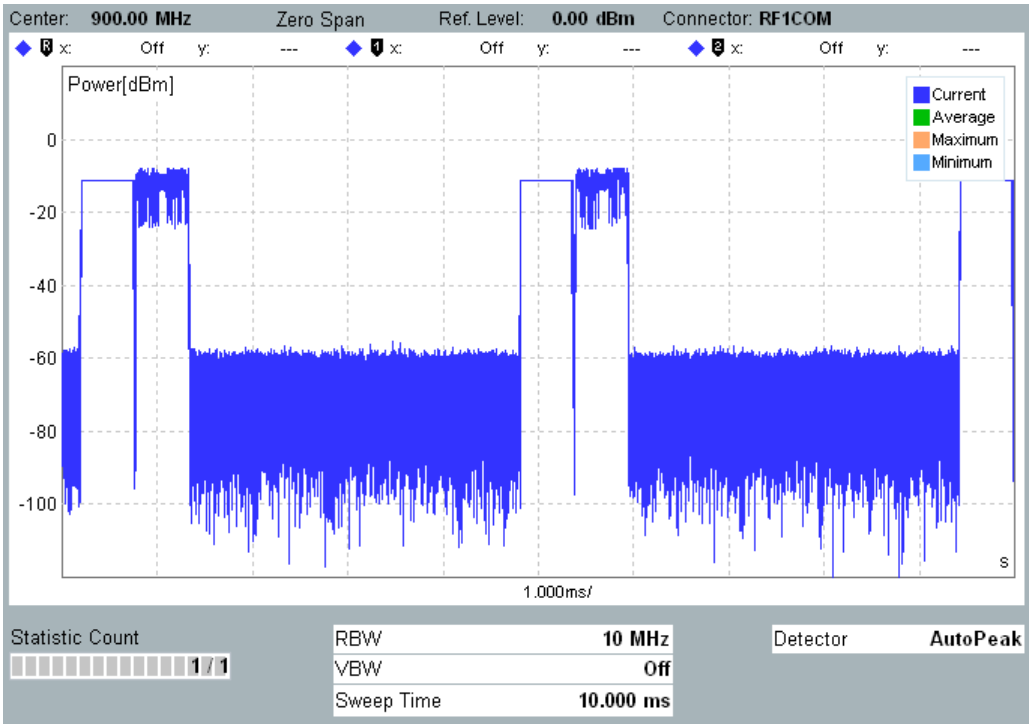


Fig. 3-16: Spectrum Analyzer: Zero Span Mode

Spectrum Analyzer measurement requires option CMW-KM010.

3.2.2.1 Test Setup

The external RF signal source (mobile station, signal generator etc.) is connected to one of the RF input connectors (RF COM) at the front panel of the R&S CMW. No additional cabling and no external trigger is needed.

The input level ranges of all RF COM connectors are identical.

See also: "RF Connectors" in the R&S CMW user manual, chapter "Getting Started"

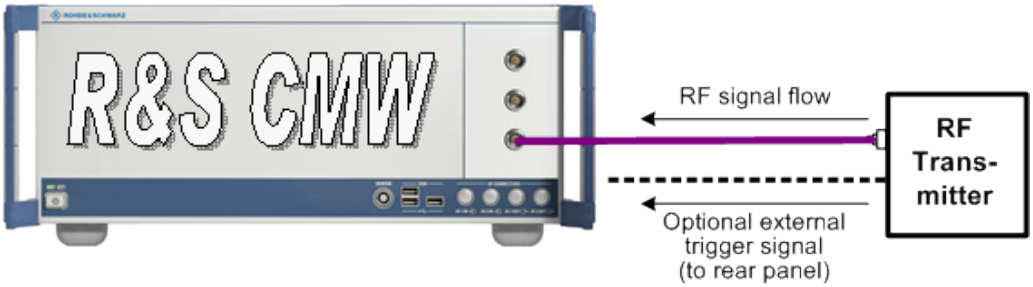


Fig. 3-17: Connecting an RF transmitter to the instrument

3.2.2.2 Configuring the Measurement

After connecting the RF signal source to the R&S CMW as shown above, only a few settings have to be adjusted.

Firstly the "Expected Nominal Power" and (optional) a "User Margin" and "External Attenuation" have to be specified. Recommended values are:

- "Expected Nominal Power" = RMS power of the analyzed signal
- "User Margin" = expected crest factor + reserve

The other required settings depend on the analyzer's operating mode.

Frequency Sweep

In frequency sweep mode the essential user input is the frequency range to be analyzed. This can be defined by specifying either its "Center" frequency and "Span" or its "Start" and "Stop" frequency.

The R&S CMW by default automatically selects the appropriate measurement granularity (resolution bandwidth, RBW), display smoothing (video bandwidth, VBW) and minimum sweep time (SWT).

- Auto RBW = Span/50
- Auto VBW = 3 x RBW
- Auto SWT = minimum possible SWT to obtain precise results

These auto-values do not depend on the particular frequency range, but rather on its "Span".

You can also take control of these properties by manually adjusting the RBW, VBW and sweep time, respectively. Note however that there is a fundamental tradeoff between RBW and SWT: the finer the resolution the longer the minimum sweep time. An insufficient SWT will result in a nonzero reliability indicator "9 (Uncal): Due to improper setting of RBW, VBW, SWT the measurement is not within the specified data sheet limits".

Partial coupling of the parameters is also possible. With manual setting of the resolution and video bandwidths, the sweep time can, for instance, be adapted automatically.

Zero Span

Displays the time domain video signal at the selected frequency with the selected resolution and sweep time.

The most important measurement control settings are accessible via softkey/hotkey combinations.

3.2.3 FFT Spectrum Analyzer

The "FFT Spectrum Analyzer" measures an RF signal at constant frequency and calculates the Fast Fourier Transform (FFT) in order to obtain a frequency-domain representation. The application provides the signal power in a frequency span up to 40 MHz around the analyzer center frequency and allows accurate frequency measurements.

3.2.3.1 Test Setup

The external RF signal source (mobile station, signal generator etc.) is connected to one of the RF input connectors (RF COM) at the front panel of the R&S CMW. No additional cabling and no external trigger is needed.

The input level ranges of all RF COM connectors are identical.

See also: "RF Connectors" in the R&S CMW user manual, chapter "Getting Started"

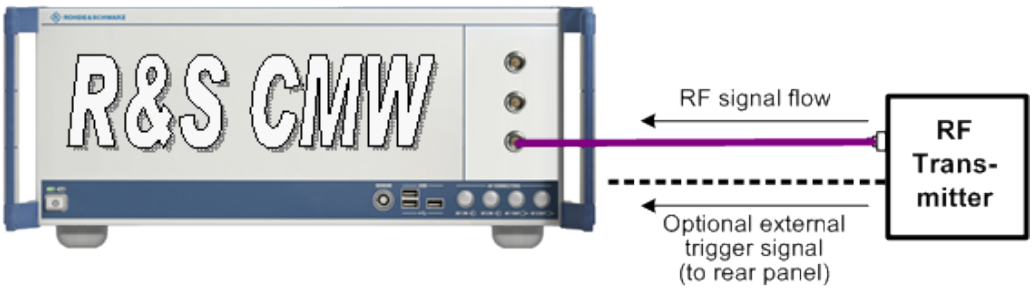


Fig. 3-18: Connecting an RF transmitter to the instrument

3.2.3.2 Configuring the Measurement

After connecting your RF signal source to the R&S CMW as shown above, you have to adjust the following analyzer settings to the properties of the analyzed signal:

- The analyzer "Frequency"
- The "Expected Nominal Power" and (optional) a "User Margin" and "External Attenuation". Recommended values: "Expected Nominal Power" = RMS power of the analyzed signal; "User Margin" = expected crest factor + reserve.

If no other trigger source is specified the measurement is untriggered ("Free Run" trigger source). The spectrum curve appears in the "FFT Spectrum Analyzer" measurement dialog. The most important measurement control settings are accessible via softkey/hotkey combinations; see Frequency Settings and Resolution Bandwidth.

3.2.3.3 Measurement Procedure

The "FFT Spectrum Analyzer" records L_{FFT} equidistant samples in an FFT window with a time record length T. A time-domain window of Gaussian shape and α = 3.8 is applied to the raw data in order to reduce typical errors like spectral leakage and level errors. The windowed data set is transformed to the frequency domain. A receiver filter reduces the calculated spectrum to the useful central part. In a last step, the frequency samples in the useful part are reduced to a fixed number of 801 using a peak or RMS detector.

The measurement procedure is shown in the figure below. Note that the R&S CMW offers the desired "Frequency Span" SPAN, the number of raw samples L_{FFT} ("FFT Length"), and the "Detector" type as setting parameters. The sampling rate $f_s = 1/\Delta t$ and the time record length T are automatically adjusted to the selected SPAN and L_{FFT} values.

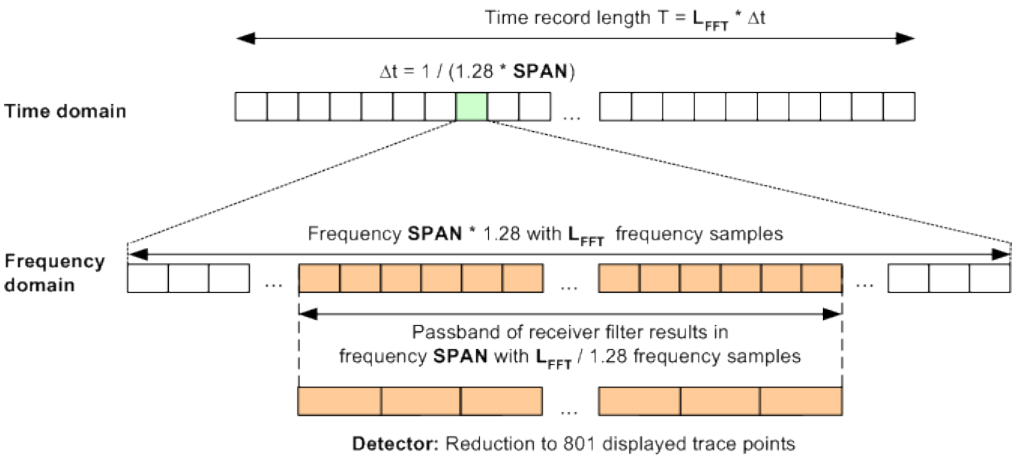


Fig. 3-19: FFT calculation and setting parameters (bold)

If the peak detector is selected, the number of frequency samples is multiplied by four in order to reduce the level errors introduced by the Fourier transform. The process is commonly referred to as upsampling; it reduces the inherent level errors over the entire frequency span to values smaller than 0.05 dB.

Due to these properties, the "FFT Spectrum Analyzer" is appropriate for accurate level and frequency measurements.

3.2.3.4 Frequency Settings and Resolution Bandwidth

The "FFT Spectrum Analyzer" is essentially controlled by the following parameters:

- The "Frequency Span" SPAN defines the useful bandwidth.
- The "FFT Length" L_{FFT} defines the number of raw samples.

The frequency resolution is commonly expressed in terms of the "Resolution Bandwidth" (RBW): The smaller the RBW, the finer the frequency resolution. For the Gaussian window involved in the Measurement Procedure, the following relation holds:

$$B_{3dB} = \frac{2 \cdot 1.28 \cdot SPAN}{L_{FFT}}$$

This results in the following table for the supported frequency spans and FFT lengths. Combinations with the same ratio of SPAN / L_{FFT} have the same RBW.

Table 3-2: RBW in Hz with Gaussian window (α = 3.8)

SPAN	L_{FFT} = 1024 (1k)	L_{FFT} = 2048 (2k)	L_{FFT} = 4096 (4k)	L_{FFT} = 8192 (8k)	L_{FFT} = 16384 (16k)
40 MHz	1.00E+05	5.00E+04	2.50E+04	1.25E+04	6.25E+03
20 MHz	5.00E+04	2.50E+04	1.25E+04	6.25E+03	3.13E+03
10 MHz	2.50E+04	1.25E+04	6.25E+03	3.13E+03	1.56E+03
5 MHz	1.25E+04	6.25E+03	3.13E+03	1.56E+03	7.81E+02
2.5 MHz	6.25E+03	3.13E+03	1.56E+03	7.81E+02	3.91E+02
1.25 MHz	3.13E+03	1.56E+03	7.81E+02	3.91E+02	1.95E+02

3.2.3.5 Measurement Results

The results of the "FFT Spectrum Analyzer" are displayed in a single dialog. Use the "Display" parameters to change the appearance and contents of the dialog.

Measurement Dialog

The "FFT Spectrum Analyzer" dialog shows the spectrum diagram, an I/Q vs. time and I/Q constellation diagram (optional), and the frequencies and levels of up to 5 peaks in the spectrum.

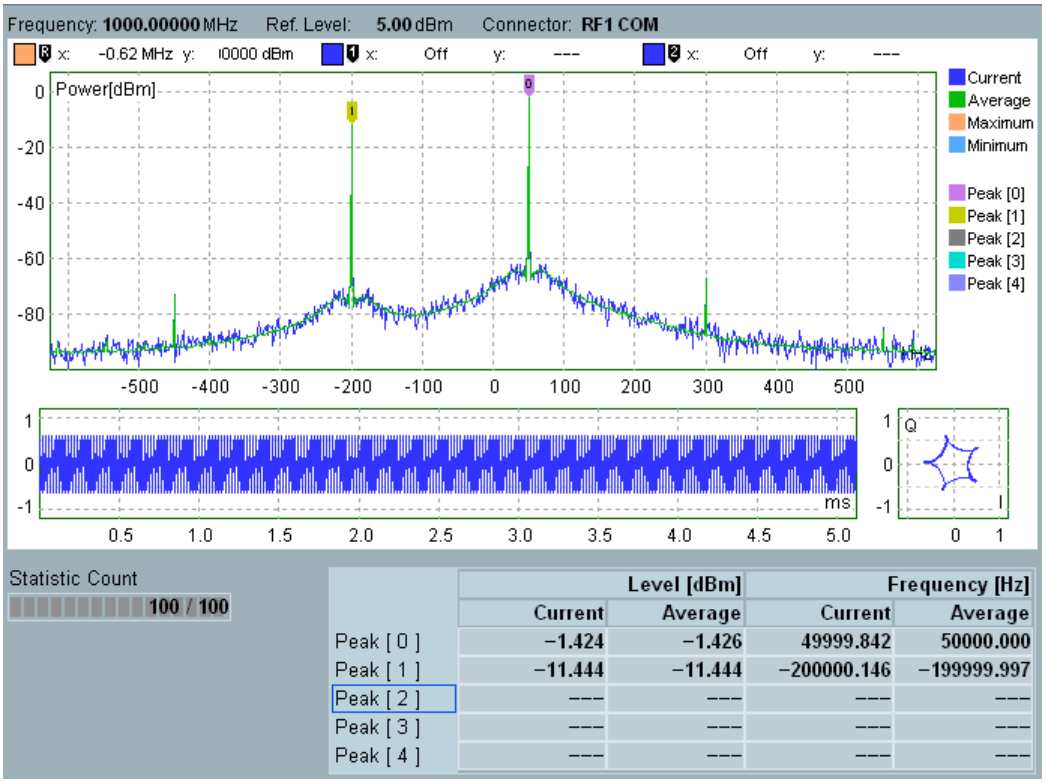


Fig. 3-20: FFT Spectrum Analyzer: two-tone signal analysis

Below the title bar, the dialog shows the most important RF and analyzer settings; see FFT Spectrum Analyzer: Parameters and Settings. The diagrams and tables contain the following results.

- **Spectrum diagram**
  Shows the power of the measured RF signal in a selectable frequency range ("FFT > Frequency Span"). With default scaling, the 0 Hz abscissa value in the center of the diagram corresponds to the center "Frequency" of the RF analyzer. The measurement control settings, in particular "FFT > FFT Length" and "FFT > Detector" affect the displayed results.
  Up to 5 markers on the trace show the detected peaks, sorted according to their power. To refine the peak search, you can select up to five different search ranges ("Marker > Peak Search Ranges"). In the measurement example above, a two-tone CW signal is analyzed.
- **Time domain diagrams**
  The time domain diagrams show the normalized I and Q amplitudes as a function of time (left diagram) and as a vector in the I/Q plane (right diagram). Both diagrams are useful for checking the input signal, in particular for measurements on bursty signals using a power trigger.
  The time range of the left time domain diagram is equal to the total time record length (FFT window), depending on the "FFT > FFT Length" and "FFT > Frequency Span" settings. Use "Display > Time Domain On / Off" to show or hide the diagrams. See Time Domain and IQ Diagrams for more examples.
- **Table**

The table shows the levels and frequencies of the detected peaks in the spectrum diagram. In the measurement example above, the "FFT Spectrum Analyzer" detects two narrow-band tones at approx. 50 kHz and -200 kHz off the RF analyzer frequency.

- **Statistic Count**
  Progress bar for the measurement. During the first single shot after the start of the measurement, the bar shows the current measurement interval relative to the "Statistic Count". A filled progress bar indicates that the first shot is complete and the statistical depth has been reached.

Refer to sections Modifying the Diagrams and Using Markers for more information about customizing the diagrams.

Time Domain and IQ Diagrams

The purpose of the time domain and the IQ diagrams is to monitor the measured time domain samples in parallel with the FFT results. The following examples show the analysis of a continuous or pulsed two-tone signal.

Continuous signal, no time domain window displayed

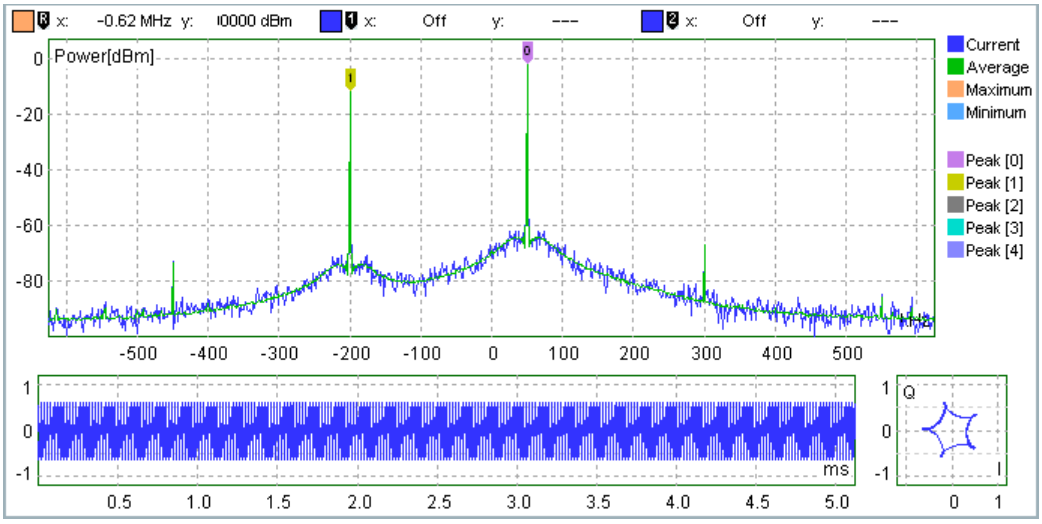


Fig. 3-21: FFT Spectrum Analyzer result with raw time domain data

The left time domain diagram has a constant envelope. The IQ constellation diagram contains a Lissajous curve which results from the superposition of the two signal components. The time domain window is not shown in the time domain and IQ diagrams but affects the calculated spectrum in the upper (FFT) diagram.

Continuous signal, time domain window displayed

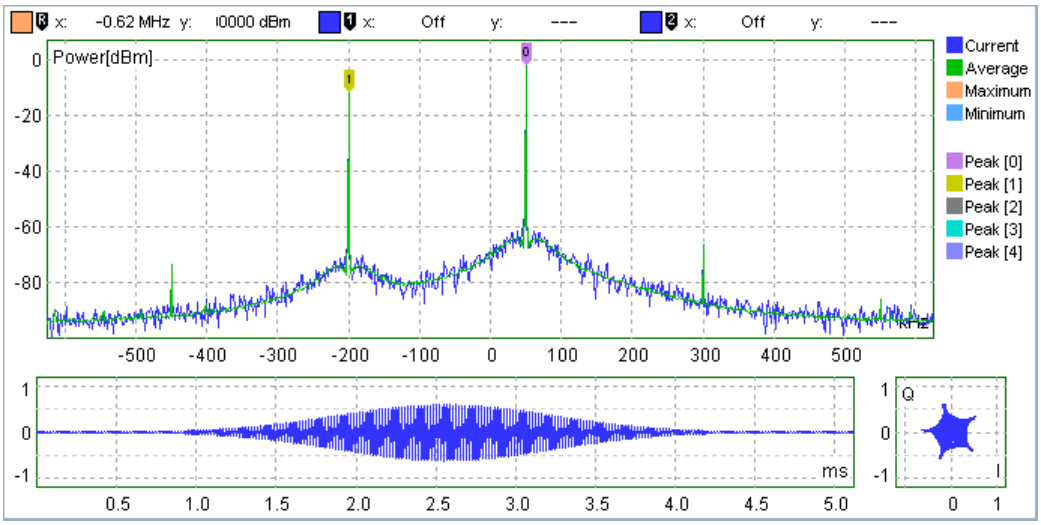


Fig. 3-22: FFT Spectrum Analyzer result with windowed time domain data

The left time domain diagram shows the Gaussian time domain window. The Lissajous curve in the IQ constellation diagram is filled because the amplitudes decrease towards the beginning and the end of the measured time domain. The calculated spectrum is unchanged compared to the first example.

Pulsed signal, no time domain window displayed

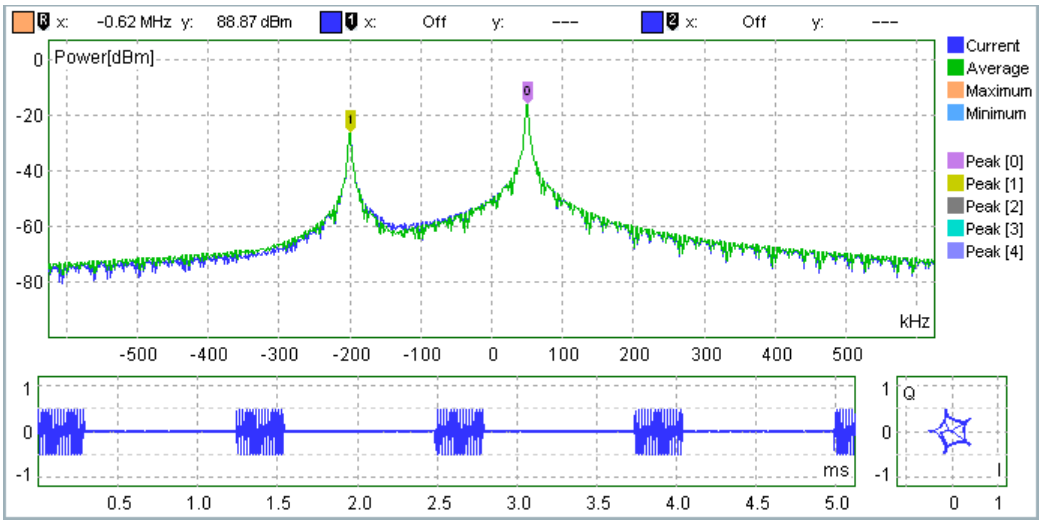


Fig. 3-23: FFT Spectrum Analyzer result with pulsed signal

The left time domain diagram shows the pulses; the calculated FFT result shows a transient spectrum. Due to the time domain window (not shown in the time domain and the IQ diagrams) the power ramps of the central pulse have the largest influence on the spectrum.

Modifying the Diagrams

Use the "Display" parameters to change the appearance and contents of the diagrams. The following "Display" hotkeys are available:

Hotkey	Description
"Time Domain On / Off"	Display or hide both time domain diagrams.
"Select Trace ..."	Select the trace types to be displayed in the view.
"X Scale... / Y Scale..."	Modify the ranges of the X-axis and the Y-axis.

The "Trigger Offset" parameters define the position of the FFT window and thus the time domain diagram relative to the trigger events.

Hotkey	Description
"Trigger Offset: Fixed":	Set the center of the FFT window (and thus, the center of the time domain diagram) relative to the trigger events.
"Trigger Offset: Variable":	For statistic count > 1: Vary the center of the time domain diagram between an offset start time and an offset stop time.

Using Markers

Use the "Marker" parameters to activate markers and to modify their position. The following "Marker" hotkeys are available:

Hotkey	Description
"Ref. Marker ...":	Enable or disable the reference marker, select a trace and the marker position on that trace
"Marker 1 /2 ...":	Enable or disable marker 1 or 2 and define the marker position (absolute or relative to the reference marker) Depending on the trace mode, a trace can also be selected.
"Select Trace Mode":	Define whether all markers are collectively set to the same trace or to individual traces
"Peak Search Ranges..."	Refine the peak search in the spectrum diagram; see Additional Hotkeys.

3.2.4 I/Q Recorder Measurement

The I/Q Recorder measurement provides the I/Q amplitudes that the R&S CMW acquires with different IF filter settings. After the measurement is started, the instrument records up to 4 MSamples of data. The results are returned in ASCII or binary format; it is also possible to store the binary data to a file.

Part of the I/Q Recorder measurement is available in remote control only; a programming example is given in section I/Q Recorder Measurement. The key parameters are set by means of the following remote control commands.

Table 3-3: I/Q recorder commands

Parameters	SCPI commands
No. of captured samples	`CONFigure:GPRF:MEAS<i>:IQRecorder:CAPTure`
Filter settings	`CONFigure:GPRF:MEAS<i>:IQRecorder:FILTer...`, see Filter Settings
Data Format	`FORMat:BASE:DATA`
File for binary results	`CONFigure:GPRF:MEAS<i>:IQRecorder:IQFile`
Control measurement	`INITiate:GPRF:MEAS<i>:IQRecorder` etc., see Measurement Control and States
Retrieve results	`FETCh:GPRF:MEAS<i>:IQRecorder?` etc., see Measurement Results
Configure list mode	`CONFigure:GPRF:MEAS<i>:IQRecorder:LIST...`, see List Configuration

3.2.4.1 Test Setup

The external RF signal source (mobile station, signal generator etc.) is connected to one of the RF input connectors (RF COM) at the front panel of the R&S CMW. No additional cabling and no external trigger is needed.

The input level ranges of all RF COM connectors are identical.

See also: "RF Connectors" in the R&S CMW user manual, chapter "Getting Started"

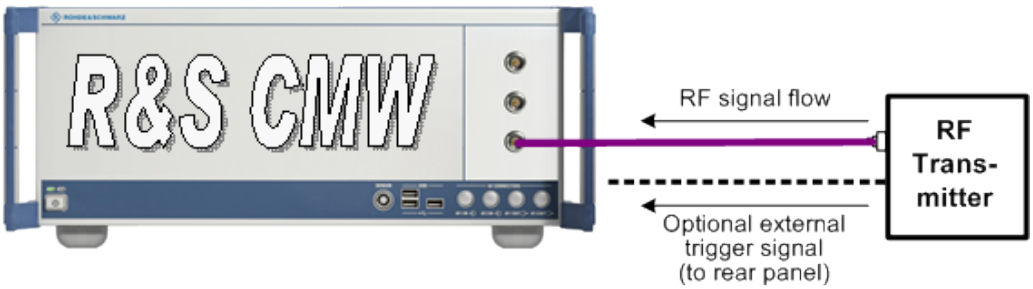


Fig. 3-24: Connecting an RF transmitter to the instrument

3.2.4.2 Filter Settings and Samples

The R&S CMW provides a wide selection of Gaussian and bandpass filters to record the I/Q data. Gauss filters have shorter settling times and therefore larger sampling rates; bandpass filters have a flat passband and steeper edges.

The filter settings determine the maximum sampling rate as shown below. It is possible, however, to reduce the maximum sampling rate by a factor (and thus increase the measurement time); see `CONFigure:GPRF:MEAS<i>:IQRecorder:RATio`.

Table 3-4: Filter settings for I/Q Recorder

Gauss filter bandwidth	Max. sampling rate	Bandpass filter bandwidth	Max. sampling rate
1 kHz	20 kHz	1 kHz	5 kHz
10 kHz	200 kHz	10 kHZ	50 kHz
100 kHz	2 MHz	100 kHz	500 kHz
1 MHz	20 MHz	1 MHz	5 MHz
10 MHz	100 MHz	10 MHz	50 MHz
		40 MHz	100 MHz

3.2.4.3 ASCII and Binary Data Formats

The measurement results may be retrieved as comma separated ASCII values or in binary format. Binary data transfer has several advantages:

- The transfer is faster and more efficient (the size of the output strings is typically reduced by a factor of 3 or 4).
- Binary data can be post-processed by many external applications without previous conversion.

The general format of a binary output string is described below.

Table 3-5: Binary output format

Parameter	Format	Values, Range	Description
Reliability,	ASCII	See Reliability Indicator	Validity of the captured data
#L	ASCII	[1 ... 7]	Number of digits of the following counter N
N	ASCII	[8 .. 8*4194304]	Total number of the following data bytes. N = 8 * <number of captured samples>
$Value_i$ with i = 1 ... N/4	Binary	$byte_{i,1}$ $byte_{i,2}$ $byte_{i,3}$ $byte_{i,4}$ with i=1 to N/4	32-bit (4-byte) IEEE 754 floating point number in little-endian byte order (the least significant byte is sent first, the rightmost bytes in the example below are most significant)
EOS	ASCII	Hex: 0xD0xA	End of string character, [0x0D = carriage return] & [0x0A = line feed]

Example of valid measurement output data with capture length 16 (and therefore N = 128):

{0,#3128 $byte_{1,1}$ $byte_{1,2}$ $byte_{1,3}$ $byte_{1,4}$ $byte_{2,1}$ $byte_{2,2}$ $byte_{2,3}$ $byte_{2,4}$ ... $byte_{32,1}$ $byte_{32,2}$ $byte_{32,3}$ $byte_{32,4}$ EOS} Note that a comma separates the reliability indicator from the data part.

If an error is detected the output string is truncated after the reliability indicator.

3.2.4.4 List Mode

In list mode, the I/Q Recorder measurement extends over a series of steps with common length but individual analyzer settings. This is very similar to the list mode for Power or I/Q vs. Slot measurements; a (fictitious) GUI for the I/Q Recorder would look as shown below.

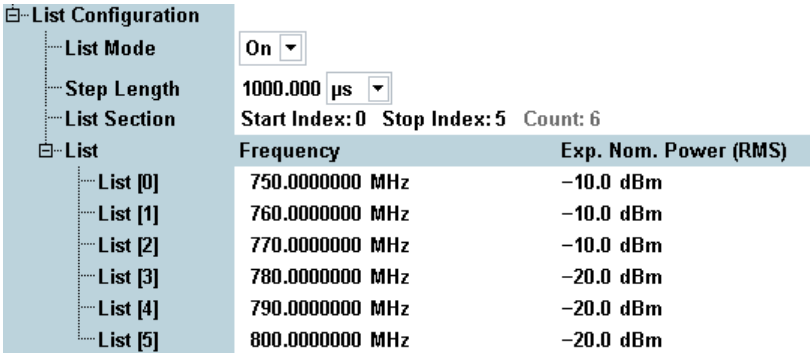


Fig. 3-25: List mode parameters

List mode requires option CMW-KM012.

In list mode the interval to be measured is given by the <Step Length> times the number of steps (<Count> = <Stop Index> - <Start Index> + 1). With a definite number of samples and sampling rate, the actual measurement time (given by the no. of captured samples = <Samples before trigger> + <Samples after trigger> divided by the sampling rate) can be smaller or larger than the list mode interval:

- If the measurement time is smaller than the list mode interval the I/Q Recorder results do not cover all list steps.
- If the measurement time is larger than the list mode interval, the I/Q Recorder cycles through the list so that some steps are measured more than once.

The R&S CMW needs a settling time of approx. 300 µs after each frequency change, 5 µs after each level change. Samples acquired during the setting times yield potentially inaccurate results. Make sure that the mobile phone under test changes its frequency and/or level in line with the defined power/frequency steps and discard the results measured during the settling times.

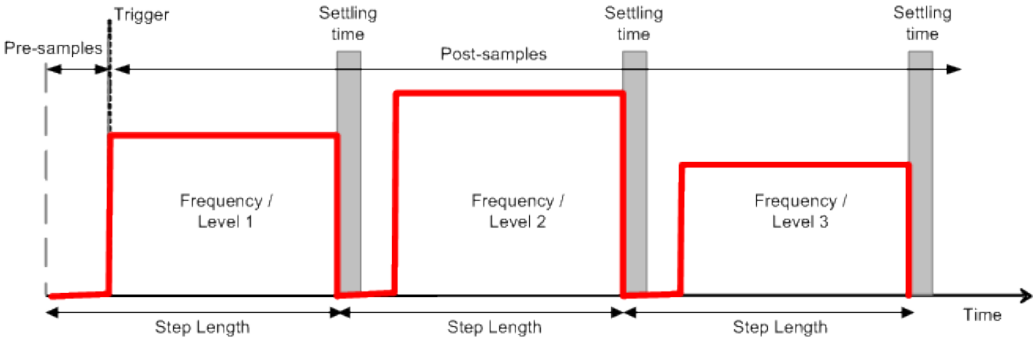


Fig. 3-26: Steps and settling times in I/Q recorder list mode

3.2.5 I/Q vs. Slot Measurement

The "I/Q vs. Slot" measurement provides averaged I/Q amplitudes (or equivalently, averaged levels and phases) and average frequency errors in a sequence of consecutive measurement steps of configurable length. Typically, "I/Q vs. Slot" is used to measure the level and phase of an unmodulated (CW) carrier signal, e.g. in order to assess the nonlinearities of a mobile phone's modulator.

- I/Q vs. slot measurement requires option CMW-KM011.
- List mode requires option CMW-KM012.

3.2.5.1 Test Setup

The external RF signal source (mobile station, signal generator etc.) is connected to one of the RF input connectors (RF COM) at the front panel of the R&S CMW. No additional cabling and no external trigger is needed.

The input level ranges of all RF COM connectors are identical.

See also: "RF Connectors" in the R&S CMW user manual, chapter "Getting Started"

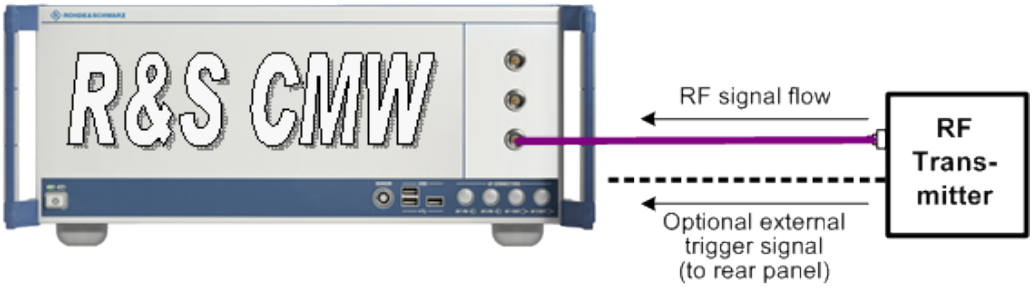
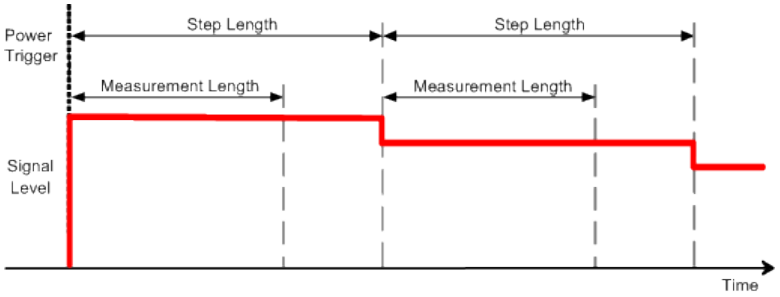


Fig. 3-27: Connecting an RF transmitter to the instrument

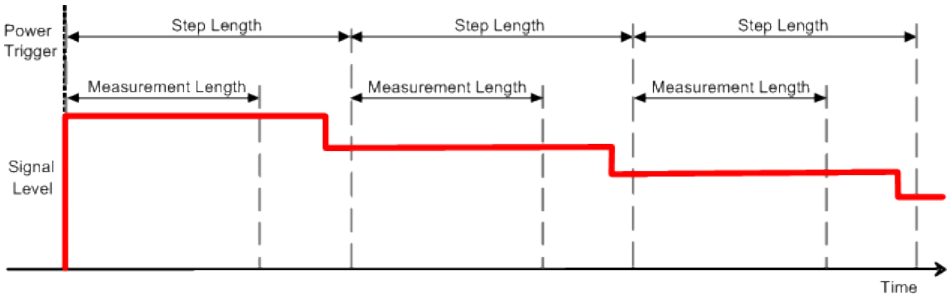
3.2.5.2 Power Steps and Subsweeps

In its simplest (default) configuration the "I/Q vs. Slot" measurement provides the averaged I and Q amplitudes in a measurement interval of configurable length ("Measurement Length").

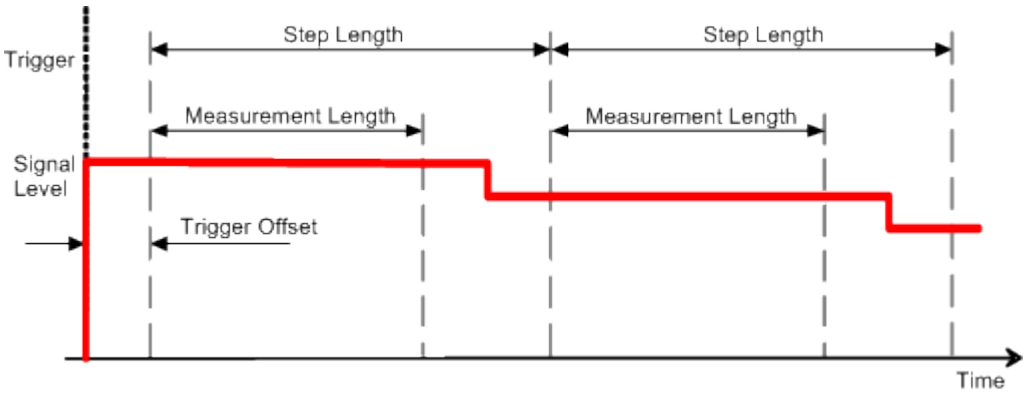
The measurement interval can be repeated periodically over a sequence of measurement steps (according to the selected "Step Count"). A single step sequence at constant analyzer settings (frequency, expected nominal power) is termed a "subsweep".



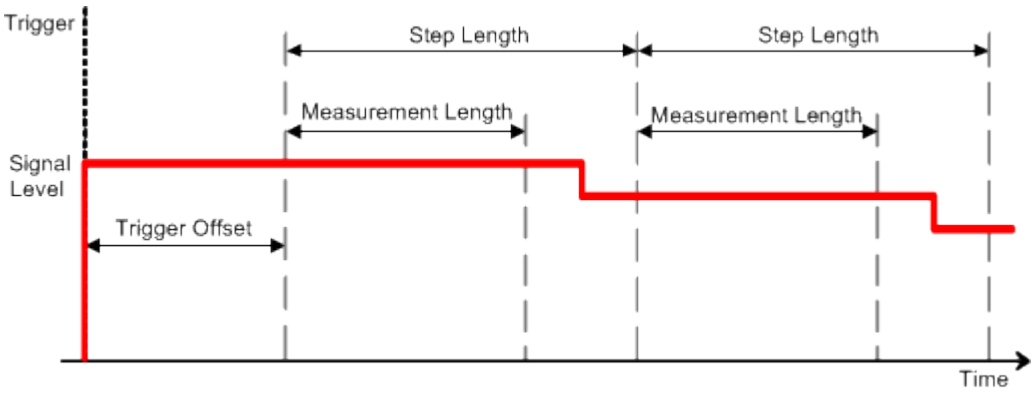
The measurement interval is moved with respect to the power steps, if the first step that the DUT generates is shortened. This can be suitable to avoid the switching transients due to the power steps.



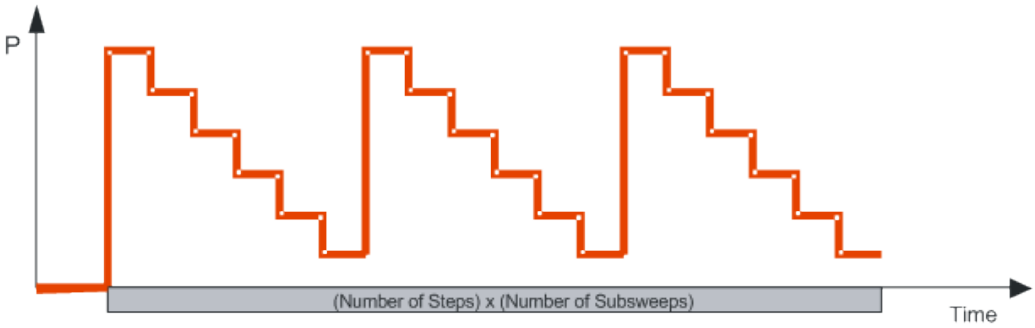
Alternatively it is possible to introduce a trigger offset in order to move the measurement interval relative to the steps.



A trigger offset is also suitable if the first power step is longer than the following steps.



In list mode, subsweeps can be repeated several times at different frequencies and different expected nominal powers. Each subsweep contains the same number of steps. Within the subsweeps, the analyzer settings (frequency and expected nominal powers) are left unchanged.



3.2.5.3 Trigger Modes

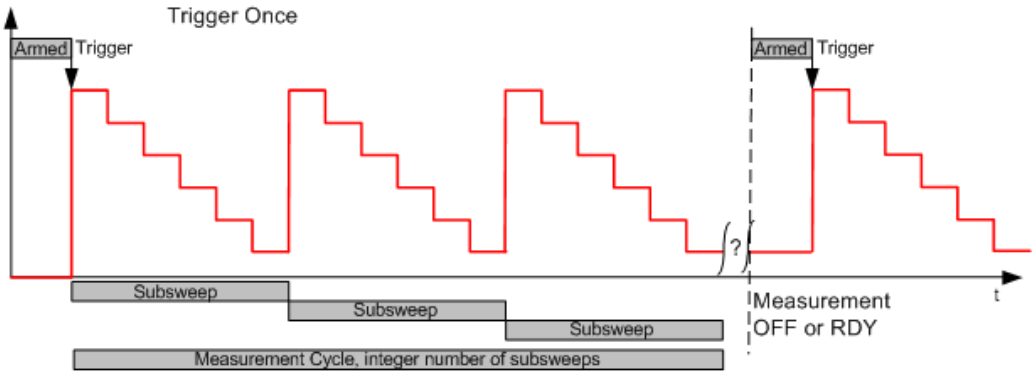
The "I/Q vs. Slot" measurement can be performed in "Free Run" (untriggered) mode, however, a power trigger ("Trigger Source: IF Power") is suitable, in particular if the measurement has to be synchronized to a sequence of power steps as shown in chapter 3.2.5.2, "Power Steps and Subsweeps", on page 106.

The R&S CMW provides alternative trigger modes for RF input signals with different characteristics.

Trigger Once

The measurement is triggered once; all the following evaluation intervals are calculated according to the "Step Length" and the "Measurement Length" settings. The trigger event starts an entire measurement cycle, comprising the selected number of steps and subsweeps. The trigger is re-armed only after the measurement is stopped and re-started.

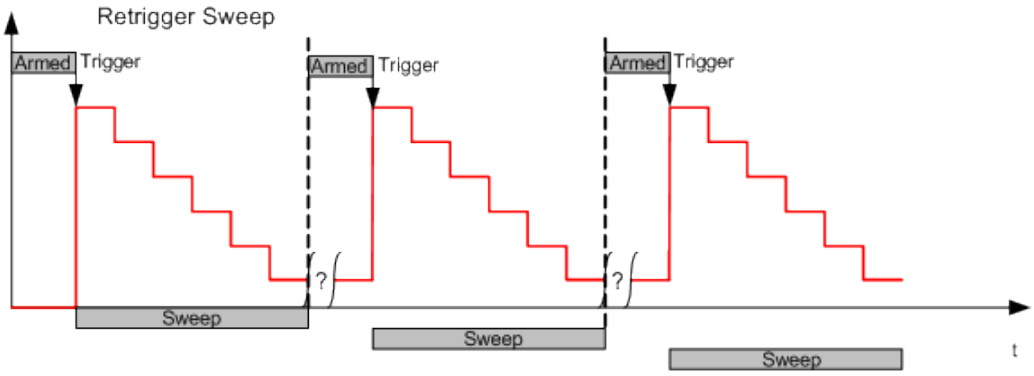
This mode is recommended for signals where all steps (including possible repetitions for statistics) are within the "Step Length".



Retrigger Sweep

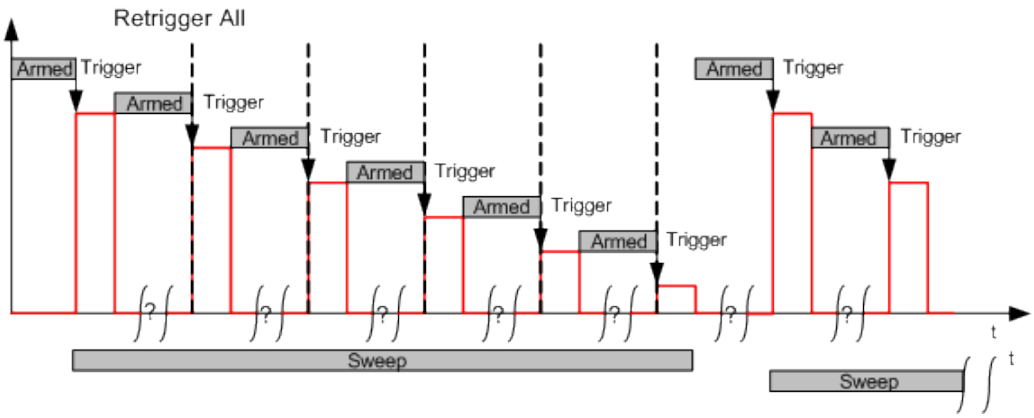
The measurement starts after the first trigger event and continues according to the "Step Length" and the "Measurement Length" settings until a sweep (a sequence of power steps) is completed. After the sweep is completed, a new trigger event can re-synchronize the measurement.

This mode is recommended for signals where all steps within one sweep are within the "Step Length" but the time gap between the sweeps is not very precise. Furthermore this mode is recommended for very high statistic counts where re-triggering can compensate for a possible time drift of the DUT.



Retrigger All

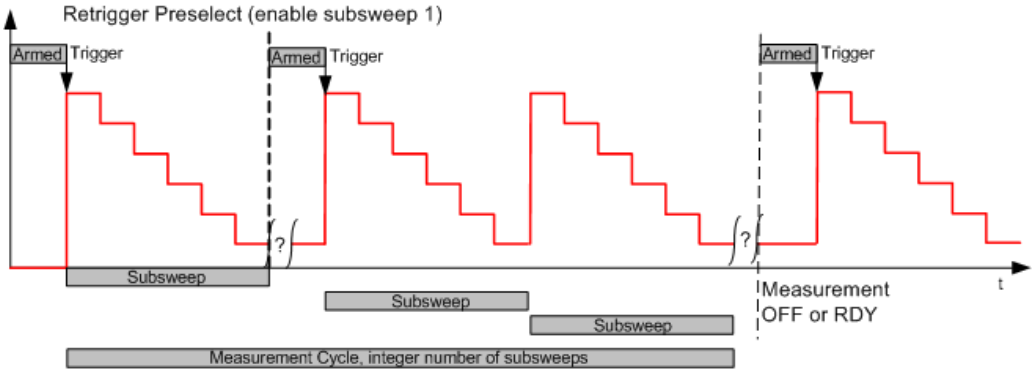
Like "Retrigger Sweep", however, the trigger is re-armed at each power/frequency step. This mode is recommended if for steps with unknown or irregular distances.



Retrigger Preselected

Like "Retrigger All", however, the trigger is re-armed only at some preselected power steps. This subdivides the sweep into a sequence of continuously measured subsweeps; the trigger is re-armed at each subsweep. The whole retrigger pattern is repeated for each sweep.

This mode is a compromise between "Retrigger Sweep" and "Retrigger All". It is also recommended if the conditions for "Retrigger All" apply but no trigger signal is available for each step.



3.2.5.4 Measurement Settings

The parameters for the "I/Q vs. Slot" measurement are accessible from the "I/Q vs. Slot Configuration" dialog; see I/Q vs. Slot: Parameters and Settings. In the measurement menu, various softkeys with associated hotkeys provide fast access to the most important "I/Q vs. Slot" settings.

The "I/Q vs. Slot" measurement can be performed with bandpass filters of different shape (Gauss, Nyquist).

3.2.5.5 Measurement Results

The basic "I/Q vs. Slot" measurement results are the I and Q amplitudes of the measured RF signal, averaged over the specified "Measurement Length", assuming a constant RF

frequency. It is possible to convert the I/Q amplitudes into a pair of level and phase values. The R&S CMW also displays the frequency error for each measurement step.

Measurement Diagram

The step functions in the diagrams show the measured results for all measurement steps. The result panels below contain the numeric results in a single, selectable measurement interval plus the overall frequency error.

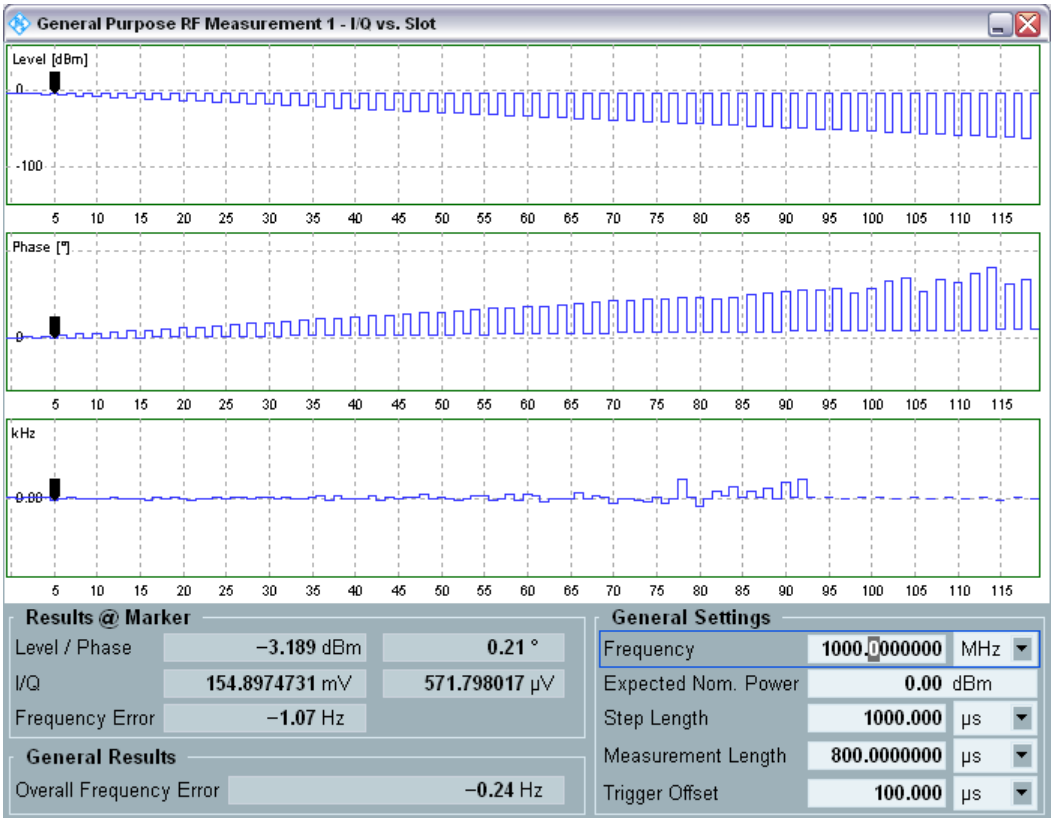


Fig. 3-28: I/Q vs. Slot measurement results: Diagram View

- **Diagrams**
  The diagrams show the average results at all measurement steps. The curves correspond to a sequence of consecutive subsweeps, each containing <Step Count> results (see Power Steps and Subsweeps). The number of results per measurement curve is equal to the product <Step Count> * < No. of Subsweeps >.
  – Use "Display > Diagrams" to switch between "Level / Phase" and I, Q representation, to show or hide the frequency error diagram.
  – Use the other hotkeys associated with the "Display" softkey to optimize the appearance of the screen.
  – Use the "Marker" hotkeys to position markers on the traces of the active view.
- **Result panels**
  Average level and phase and I/Q amplitudes and frequency errors in the measurement interval.
- **Settings panels**

An overview of the essential current settings of the "I/Q vs. Slot" measurement is displayed to the right of the result panels. Open the configuration dialog to access and modify all settings.

The I/Q amplitude results are based on frequency-corrected RF signals; see Measurement Procedure. The measurement results are related as follows:

- Phase = arctan (Q / I)
- Level / dBm = 10 * log [(I^2 + Q^2) / 50 Ω / mW]
- Phase convention: The phase in the first step of each measurement is set to zero degrees.
- The "Overall Frequency Error" is the arithmetic mean value of the "Frequency Error" values at all measurement steps shown in the diagrams, except the steps which are potentially invalid; see Measurement Procedure.

3.2.5.6 Measurement Procedure

The R&S CMW calculates the average I/Q amplitudes assuming an RF signal at constant frequency over each subsweep (CW signal). Average quantities derived from the I and Q amplitudes of a modulated RF carrier are generally meaningless because the amplitudes vary in sign.

The expected RF carrier frequency for each subsweep must be defined in the configuration dialog. However, the R&S CMW measures the actual RF carrier frequency and provides frequency-corrected I/Q amplitudes. Invalid measurement steps (see "Exceptions" below) do not contribute to the frequency error calculation.

Frequency Correction

The R&S CMW estimates the (average) RF frequency $<f>_I$ for each measurement step I. The average frequency per subsweep is calculated as the arithmetic mean value of all $<f>_I$ values in the subsweep except the invalid ones. This average RF frequency is used in the calculation of the I/Q amplitudes: The I/Q amplitudes (or level and phase values) are frequency-corrected results.

The difference between $<f>_I$ and the nominal RF frequency in the subsweep yields the "Frequency Error" which is displayed together with the I/Q amplitudes. Moreover, the R&S CMW calculates the "Overall Frequency Error", defined as the arithmetic mean value of the frequency errors in all valid measurement steps.

Exceptions

The following types of measurement steps are classified as exceptions.

- Steps with a signal level below the Frequency Estimation Limit.
- Steps during the last millisecond of each subsweep where the analyzer is set to the next expected RF carrier frequency to allow for a sufficient settling time. The I/Q amplitudes (or level and phase values) for these steps are still displayed but generally meaningless.

The frequency errors in these steps are invalid.

Restrictions

The "I/Q vs. Slot" measurement can be performed for a wide range of step lengths and measurement lengths. The total number of steps in the measurement must not exceed 3000, irrespective of the selected measurement length.

3.2.6 External Power Sensor Measurement

The External Power Sensor measurement records the power values measured by an external R&S NRP power sensor and performs a statistical evaluation.

3.2.6.1 Sensor Connection and Test Setup

The external power sensor is connected to the SENSOR connector at the front panel of the R&S CMW. If the sensor measures an external signal, no extra RF connection with the R&S CMW is needed.

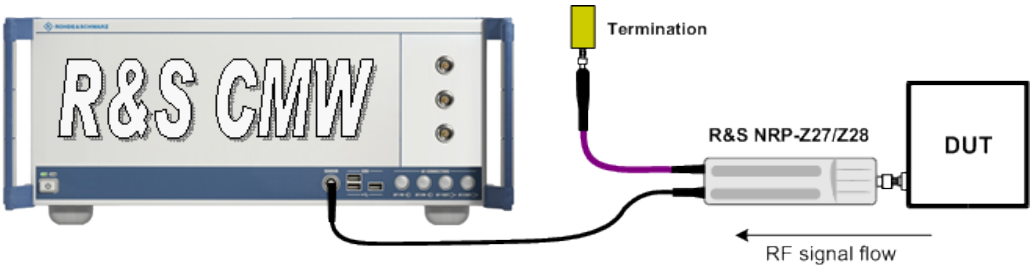


Fig. 3-29: Test setup for external power sensor measurement on a DUT

An external power sensor can be used also to monitor the RF power at a particular point in the test setup. e.g. in order to determine an attenuation in the test setup and "calibrate" the RF source. Moreover it is possible to feed the sensor output signal back to the R&S CMW, e.g. in order to perform an additional "Power" measurement.

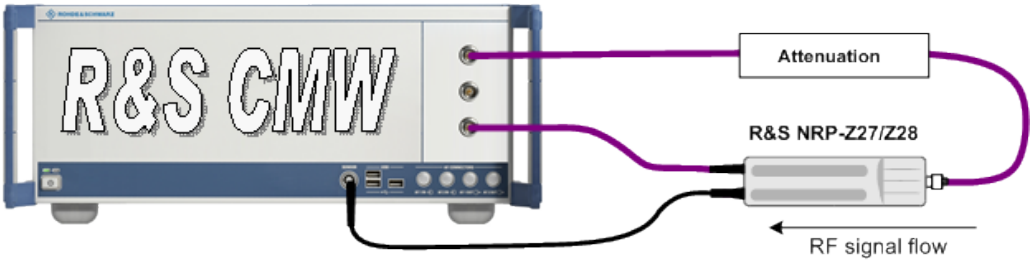


Fig. 3-30: Test setup for external power sensor measurement power calibration

The R&S CMW supports the following sensor types:

- R&S NRP-Z27
- R&S NRP-Z28

Refer to the relevant documentation for information about the sensor properties.

3.2.6.2 Measurement Settings

The sensor is controlled via the SENSOR connection. All control parameters are accessible from the "External Power Sensor Configuration" dialog; see External Power Sensor: Parameters and Settings.

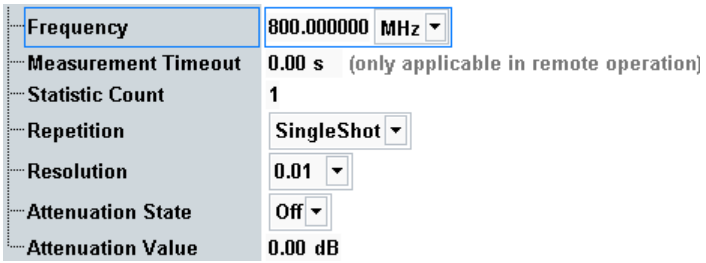


Fig. 3-31: External Power Sensor Configuration

The statistical settings (Control) define the number of power results requested from the power sensor. An attenuation value corrects the power reading of the external power sensor.

3.2.6.3 Zeroing

Zeroing calibrates the external power sensor by adjusting its reading at zero signal power. For this purpose, the RF power source must be switched off or disconnected from the sensor (see tips below!). R&S power sensors automatically detect the presence of any significant input power. This aborts zeroing and generates an error message. Zeroing can take a few seconds, depending on the sensor model; refer to the documentation of your external power sensor for more information.

Repeat zeroing:

- During warm-up after switching on or connecting the instrument
- After a substantial change of the ambient temperature
- After fastening the power sensor module to an RF connector at high temperature
- After several hours of operation
- When very low-power signals are to be measured, e.g. less than 10 dB above the lower measurement limit.

Switch off the RF power source for zeroing; do not disconnect it from the power sensor. In this way you will maintain the thermal equilibrium, and zeroing will also compensate for the noise superimposed on the measured signal (e.g. from a broadband amplifier).

A reset of the R&S CMW does not affect the last zeroing result.

3.2.6.4 Measurement Results

The basic "External Power Sensor" result is the sensor power at the selected frequency. Moreover, the measurement provides a statistical evaluation of the sensor power results. Note that the "Power Current" result is the result that the sensor obtained in the mea-

surement interval indicated under "Statistic Count". The R&S NRP-Z27/-Z28 power sensors provide a broadband power result.

See also: "Statistical Results" in the R&S CMW user manual, chapter "System Overview"

All results are displayed in the measurement diagram.

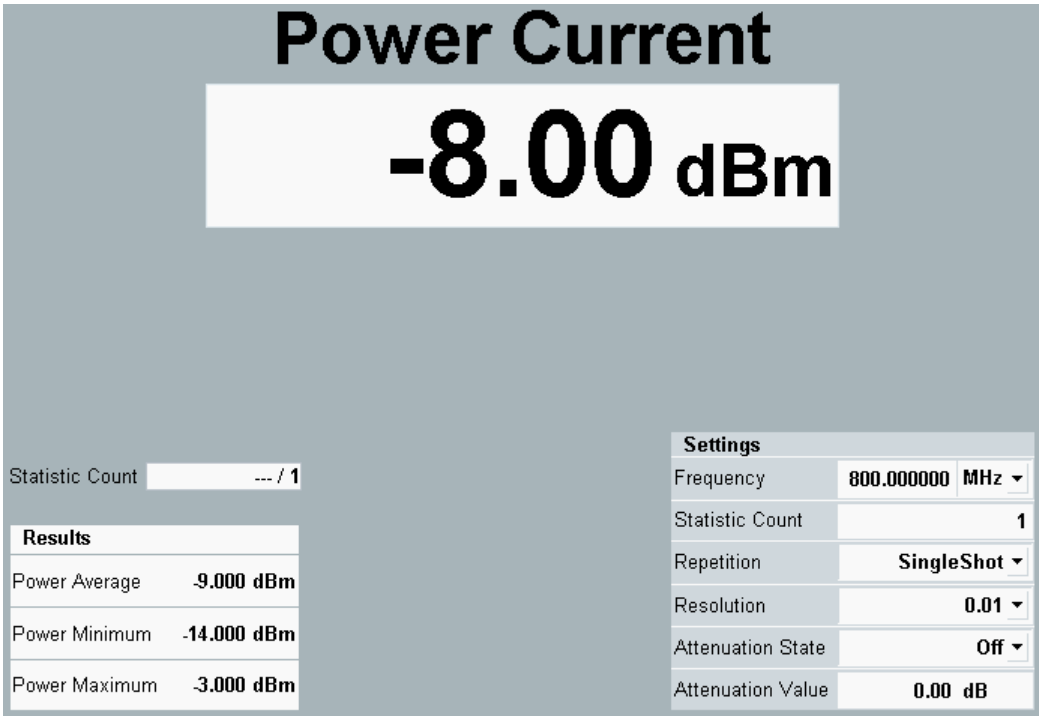


Fig. 3-32: External Power Sensor measurement results

The progress of the measurement is shown as a numeric value ("Statistic Count").

An overview of the essential current settings of the "Power" measurement is displayed to the right of the result panels.

3.3 GUI Reference

The following sections provide detailed reference information on the parameters of the General Purpose RF measurements. The first section describes parameters common to several measurements.

3.3.1 Signal Routing and Analyzer Settings

The following common parameters configure the RF input path. They are used for the "Power", "Spectrum", "FFT Spectrum Analyzer", "I/Q Recorder" and "I/Q vs. Slot" measurements.

See also: "Connection Control (Measurements)" in the R&S CMW user manual, chapter "System Overview"

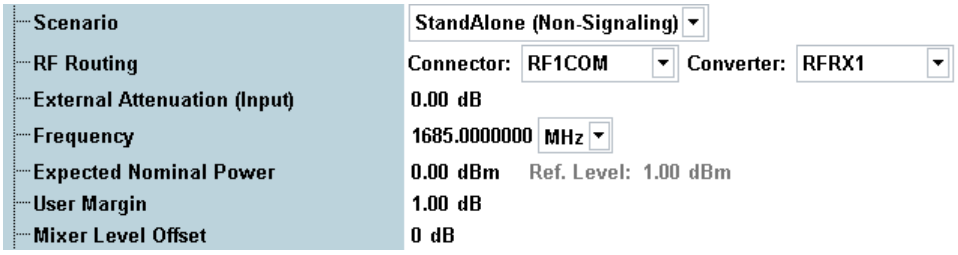


Fig. 3-33: Signal routing and analyzer settings for GPRF measurements

Scenario
Selects the measurement scenario. The GPRF measurements can be used in "Standalone" mode or in combination with another R&S CMW application.

"Standalone" — Perform the GPRF measurements independently, using all GPRF measurement settings.

"Combined Signal Path" — Use another signaling application (e.g. "GSM Signaling") as a master application for the GPRF measurements. The available master applications (depending on the options on your instrument) are displayed in the "Controlled by" list.
The master application configures the signal routing and analyzer settings for the GPRF measurements. While "Combined Signal Path" is active, the master application settings appear in a "Controller Settings" section. Changing the "Controller Settings" affects the master application but leaves the original (suspended) GPRF measurement settings unchanged. The original settings are restored when the "Standalone" scenario is selected again.

"Measure @ Protocol Test" — Use a protocol test application as a master application for the GPRF measurements. The master application configures the signal routing and analyzer settings for the GPRF measurements; the displayed values are ignored. The remaining GPRF measurement settings must be compatible with the configuration of the protocol test application.

Remote command:

```
ROUTe:GPRF:MEAS<i>:SCENario?
ROUTe:GPRF:MEAS<i>:SCENario:CATalog:CSPath?
ROUTe:GPRF:MEAS<i>:SCENario:MAPRotocol
ROUTe:GPRF:MEAS<i>?
```

RF Routing
Selects the input path for the measured RF or digital IQ signal, i.e. the input connector and the RX module to be used.

Depending on your hardware configuration there may be dependencies between both parameters. Select the input connector first. The "Converter" parameter offers only values compatible to the selected input connector.

Remote command:
`ROUTe:GPRF:MEAS<i>:SCENario:SALone`
`ROUTe:GPRF:MEAS<i>:SCENario:CSPath`

External Attenuation (Input)
Defines the value of an external attenuation (or gain, if the value is negative) in the input path. The power readings of the R&S CMW are corrected by the external attenuation value.

The external attenuation value is also used in the calculation of the maximum input power that the R&S CMW can measure.

If a correction table for frequency-dependent attenuation is active for the chosen connector, then the table's name and a button are displayed. Press the button to display the table entries.

Remote command:
`CONFigure:GPRF:MEAS<i>:RFSettings:EATTenuation`

Frequency
Center frequency of the RF analyzer. Set this frequency to the frequency of the measured RF signal to obtain a meaningful measurement result.

Remote command:
`CONFigure:GPRF:MEAS<i>:RFSettings:FREQuency`

Expected Nominal Power
Sets the analyzer in accordance with the nominal power of the RF signal to be measured. The nominal power is the average output power at the DUT during the measurement intervals where the RF transmitter is on. The "Ref. Level" is calculated as the expected peak power at the output of the DUT:

Reference level = Expected Nominal Power + User Margin

Note: The actual input power at the connectors (i.e. the "Reference Level" minus the "External Attenuation (Input)" value, if all power settings are configured correctly) must be within the level range of the selected RF input connector; refer to the data sheet.

Remote command:
`CONFigure:GPRF:MEAS<i>:RFSettings:ENPower`

User Margin
Margin that the R&S CMW adds to the "Expected Nominal Power" in order to determine its reference power ("Ref. Level"). The "User Margin" is typically used to account for the known variations of the RF input signal power, e.g. the variations due to a specific channel configuration.

The appropriate values depends on the signal properties, e.g. on the modulation scheme.

Remote command:
`CONFigure:GPRF:MEAS<i>:RFSettings:UMARgin`

Mixer Level Offset
Varies the input level of the mixer in the analyzer path. A negative offset reduces the mixer input level, a positive offset increases it. Optimize the mixer input level according to the properties of the measured signal.

Mixer Level Offset	Advantages	Possible Shortcomings
< 0 dB	Suppression of distortion (e.g. of the inter-modulation products generated in the mixer)	Lower dynamic range (due to smaller signal-to-noise ratio)
> 0 dB	High signal-to-noise ratio, higher dynamic range	Risk of intermodulation, smaller overdrive reserve

Remote command:
`CONFigure:GPRF:MEAS<i>:RFSettings:MLOFfset`

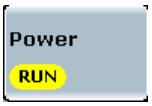
3.3.2 Power: Parameters and Settings

The "Power" measurement provides several groups of settings. The most important measurement settings are also displayed in the measurement dialog. The measurement dialog provides all measurement results.

3.3.2.1 Measurement Control

The measurement is turned on or off using the ON | OFF or RESTART | STOP keys.

See also: "Measurement Control" in the R&S CMW user manual, chapter "System Overview"



Power (Softkey)
The softkey shows the current measurement state. Additional measurement substates may be retrieved via remote control.

Remote command:
`INITiate:GPRF:MEAS<i>:POWer` etc.
`FETCh:GPRF:MEAS<i>:POWer:STATe?`
`FETCh:GPRF:MEAS<i>:POWer:STATe:ALL?`

3.3.2.2 Power Configuration

The "Power" measurement is configured using the parameters in the "Power Configuration" dialog. The RF input path settings in the upper part of the dialog are also used by other GPRF measurements; see Signal Routing and Analyzer Settings.

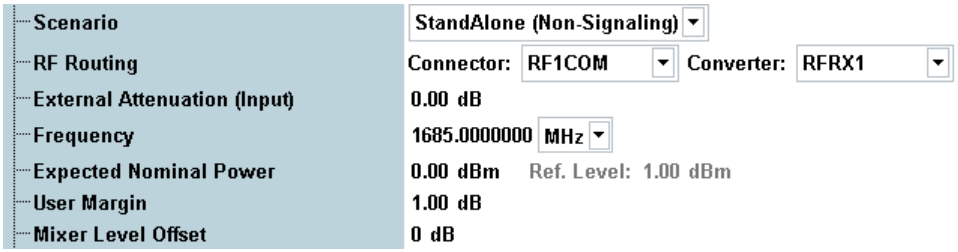


Fig. 3-34: GPRF measurements: Signal routing and analyzer settings

3.3.2.3 Power Configuration > Measurement Control

The "Measurement Control" parameters define how the R&S CMW acquires measurement data.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "System Overview"

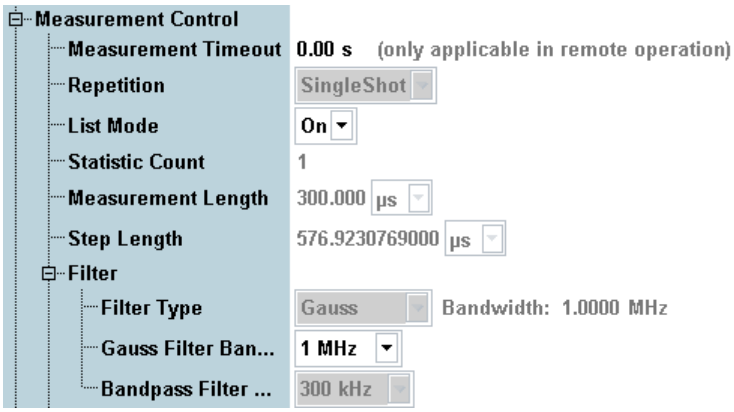


Fig. 3-35: Power Configuration: Measurement Control

Measurement Timeout
Defines a timeout for the "Power" measurement in remote operation. "0.00 s" means that the measurement will never run into a timeout. See detailed information in the remote command description.

Remote command:
`CONFigure:GPRF:MEAS<i>:POWer:TOUT`

Repetition
Defines how often the measurement is repeated if it is not stopped explicitly or by a failed limit check.

- **Continuous:** The measurement is continued until it is explicitly terminated; the results are periodically updated.

- **Single-Shot:** The measurement is stopped after one statistics cycle.

Single-shot is preferable if only a single measurement result is required under fixed conditions, which is typical for remote-controlled measurements. Continuous mode is suitable for monitoring the evolution of the measurement results in time and observe how they depend on the measurement configuration, which is typically done in manual control. The reset/preset values therefore differ from each other.

Remote command:
`CONFigure:GPRF:MEAS<i>:POWer:REPetition`

List Mode
Enables or disables the list mode. "Off" means that the "Power" measurement yields results at a single power and frequency. If the "List Mode" is switched on, the R&S CMW measures a list of power/frequency steps in accordance with the "List Mode" settings.

This parameter is also available in the "List Configuration" section.

Remote command:
`CONFigure:GPRF:MEAS<i>:POWer:LIST`

Statistic Count
Defines the number of measurement intervals per measurement cycle (statistics cycle, single-shot measurement). This value is also relevant for continuous measurements, because the averaging procedures depend on the statistic count.

In the "Power" measurement, the length of a measurement interval depends on the List Mode:

- If the list mode is switched off, a measurement interval is completed after a single power/frequency step.
- If the list mode is on, the measurement interval comprises the entire sequence of power/frequency steps (sweep).

See also: "Statistical Results" in the R&S CMW user manual, chapter "System Overview"

Remote command:
`CONFigure:GPRF:MEAS<i>:POWer:SCOunt`

Measurement Length
Sets the length of the averaging intervals that the R&S CMW uses to calculate the "Power" results for each measurement step. The measurement data is acquired continuously, however, data outside the measurement length is discarded. The first evaluation interval starts immediately after the trigger event plus a possible "Trigger Offset" (for triggered measurements) or after the measurement is started ("Free Run" measurement).

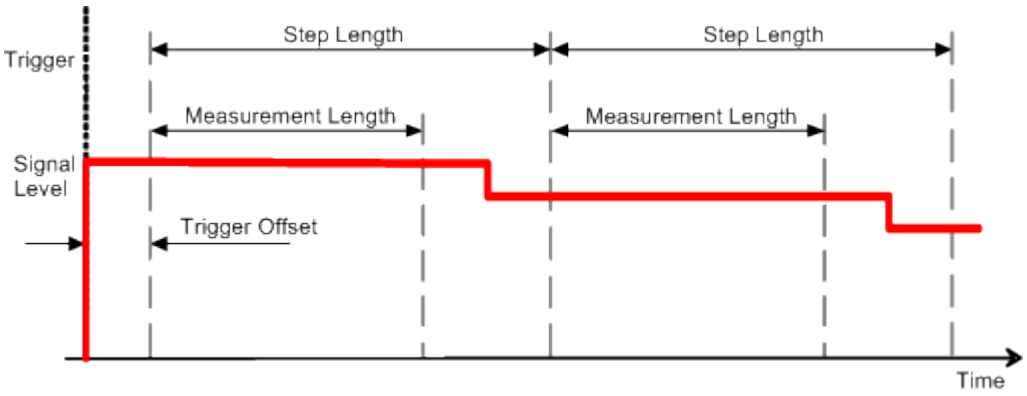


Fig. 3-36: Measurement Length, Step Length and Trigger Offset

Select your measurement length smaller than the actual width of the power steps to avoid the transients caused by the power steps of your input signal. A shortened first step or a trigger offset can shift the "Measurement Length" relative to the power steps; see Single Step vs. List Mode.

Remote command:

`CONFigure:GPRF:MEAS<i>:POWer:MLENgth`

Step Length

Sets the time between the beginning of two consecutive measured power steps. If no gaps occur between the steps the step length should be simply set to the length of each step. Together with the "Measurement Length", the step length determines the time intervals where the R&S CMW evaluates the acquired data; see below.

The step length must be set precisely in accordance with the properties of the input signal, especially if the R&S CMW measures many steps without a new trigger event (e.g. large "Statistic Count" and "Sub Trigger Mode: Trigger Once"). Inaccurate settings result in a drift of the evaluation intervals with respect to the power steps of the input signal, so that eventually the power is measured across subsequent steps.

Remote command:

`CONFigure:GPRF:MEAS<i>:POWer:SLENgth`

Filter

Sets the type and bandwidth of the measurement filter (IF filter). The R&S CMW provides filters of Gaussian shape with 3-dB bandwidths between 10 Hz and 10 MHz and band-pass filters with 3-dB bandwidths between 1 kHz and 40 MHz.

The bandpass filters are designed as root-raised cosine (RRC) filters with a roll-off of 0.1. This ensures steep filter edges with a wide, flat passband (90 % of the filter bandwidth). Compared to Gaussian filters, the bandpass filters require longer settling times and therefore increase the measurement duration.

In addition to the Gaussian and bandpass filters with selectable bandwidth, the R&S CMW provides the following channel filters of fixed shape:

- The RRC filter with a roll-off = 0.22 and a 3.84 MHz bandwidth specified for many WCDMA TX tests, e.g. the "Transmit OFF Power" test ("WCDMA" filter, see specification 3GPP 34.121).

- The RRC filter with a roll-off = 0.22 and a 1.28 MHz bandwidth specified for TD-SCDMA TX tests ("TD-SCDMA" filter, see specification 3GPP 34.122).
- The 1.2288 MHz-wide channel filter specified for CDMA 2000 TX tests ("CDMA" filter).

Remote command:

```
CONFigure:GPRF:MEAS<i>:POWer:FILTer:TYPE
CONFigure:GPRF:MEAS<i>:POWer:FILTer:GAUSs:BWIDth
CONFigure:GPRF:MEAS<i>:POWer:FILTer:BANDpass:BWIDth
```

3.3.2.4 Power Configuration > Parameter Sets

A parameter set is a combination of measurement control settings. The "Parameter Set List" contains 32 possibly different parameter sets which you may assign to the individual measurement steps in list mode. See also "List > Parameter Set" on page 128.

Parameter Set List	Filter	Bandwidth	Step Length	Measurement Length	Trigger Offset
Parameter List [0]	Gauss	1 MHz	576.923 µs	300.000 µs	0.100 ms
Parameter List [1]	Gauss	1 MHz	576.923 µs	300.000 µs	0.100 ms
Parameter List [2]	Gauss	1 MHz	576.923 µs	300.000 µs	0.100 ms
Parameter List [3]	Gauss	1 MHz	576.923 µs	300.000 µs	0.100 ms
Parameter List [4]	Gauss	1 MHz	576.923 µs	300.000 µs	0.100 ms

Fig. 3-37: Power Configuration > Parameter Set List

Parameter Set List
Defines 32 different sets of measurement control settings, to be used in retriggered list mode ("Trigger > Trigger Mode > Retrigger Preselect"). The parameters correspond to the general settings described in chapter 3.3.2.3, "Power Configuration > Measurement Control", on page 118. The default values for all parameter sets are equal.

Remote command:

```
CONFigure:GPRF:MEAS<i>:POWer:PSET:FILTer:TYPE
CONFigure:GPRF:MEAS<i>:POWer:PSET:FILTer:TYPE:ALL
CONFigure:GPRF:MEAS<i>:POWer:PSET:FILTer:GAUSs:BWIDth
CONFigure:GPRF:MEAS<i>:POWer:PSET:FILTer:GAUSs:BWIDth:ALL
CONFigure:GPRF:MEAS<i>:POWer:PSET:FILTer:BANDpass:BWIDth
CONFigure:GPRF:MEAS<i>:POWer:PSET:FILTer:BANDpass:BWIDth:ALL
CONFigure:GPRF:MEAS<i>:POWer:PSET:SLENgth
CONFigure:GPRF:MEAS<i>:POWer:PSET:SLENgth:ALL
CONFigure:GPRF:MEAS<i>:POWer:PSET:MLENgth
CONFigure:GPRF:MEAS<i>:POWer:PSET:MLENgth:ALL
TRIGger:GPRF:MEAS<i>:POWer:PSET:OFFSet
TRIGger:GPRF:MEAS<i>:POWer:PSET:OFFSet:ALL
```

3.3.2.5 Power Configuration > Trigger Settings

The "Trigger" parameters configure the trigger system for the "Power" measurement.

Fig. 3-38: Power Configuration: Trigger

Trigger Source
Selects the source of the trigger event. Some of the trigger sources require additional options.

"Free Run" The measurement starts immediately after it is initiated; no trigger is used. The remaining trigger settings are not relevant for "Free Run" measurements.

"IF Power" The measurement is triggered by the measured power steps. The trigger event is generated after down-conversion of the measured RF signal to the IF band. The "Trigger Slope", "Trigger Threshold", "Trigger Offset", and the remaining trigger settings are valid for this trigger source; they should be adjusted to the measured power steps.

"...External..." External trigger signal fed in via TRIG A or TRIG B on the rear panel of the instrument.

"GPRF Gen..." Trigger event provided by the arbitrary waveform generator of a "GPRF Generator" application (option R&S CMW-B110A). The "GPRF Gen..." trigger events are generated while an ARB file is processed.

Remote command:
`TRIGger:GPRF:MEAS<i>:POWer:CATalog:SOURce?`
`TRIGger:GPRF:MEAS<i>:POWer:SOURce`

Trigger Slope
Qualifies whether the trigger event is generated at the rising or at the falling edge of the trigger pulse. This setting has no influence on "Free Run" measurements and for evaluation of trigger pulses provided by other firmware applications.

Remote command:
`TRIGger:GPRF:MEAS<i>:POWer:SLOPe`

Trigger Threshold
Defines the input signal power where the trigger condition is satisfied and a trigger event is generated. The trigger threshold is valid for power trigger sources. It is a dB value, relative to the reference level minus the external attenuation (<Ref. Level> – <External Attenuation (Input)> – <Frequency Dependent External Attenuation>). If the reference level is set to the actual maximum output power of the DUT, and the external attenuation settings are in accordance with the test setup, then the trigger threshold is referenced to the actual maximum RF input power at the R&S CMW.

A low threshold may be required to ensure that the R&S CMW can always detect the input signal. A higher threshold can prevent unintended trigger events.

Remote command:
`TRIGger:GPRF:MEAS<i>:POWer:THReshold`

Trigger Offset
Defines a time delaying the start of the measurement relative to the trigger event. This setting has no influence on "Free Run" measurements.

See also Measurement Length.

Remote command:
`TRIGger:GPRF:MEAS<i>:POWer:OFFSet`

Trigger Timeout
Sets a time after which an initiated measurement must have received a trigger event. If no trigger event is received, a trigger timeout is indicated in manual operation mode. In remote control mode the measurement is automatically stopped. The parameter can be disabled so that no timeout occurs.

This setting has no influence on "Free Run" measurements.

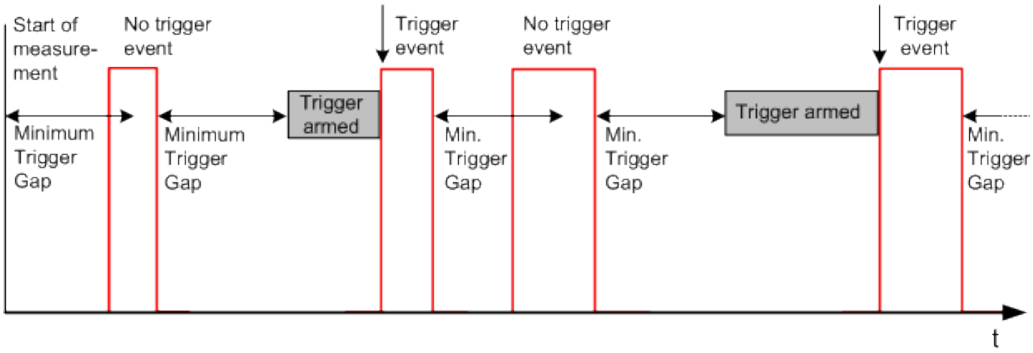
Remote command:
`TRIGger:GPRF:MEAS<i>:POWer:TOUT`

Minimum Trigger Gap
Defines a minimum duration of the power-down periods (gaps) between two triggered power pulses. This setting is valid for an "(IF) Power" trigger source.

The trigger system is controlled by means of a timer which is reset to zero in the following instances:

- At the IF power-down ramp of each triggered or untriggered pulse, even though the previous counter may not have elapsed yet. A power-down ramp is detected when the signal power falls below the trigger threshold.
- At the beginning of each measurement: The minimum gap defines the minimum time between the start of the measurement and the first trigger event.

The trigger system is re-armed as soon as the timer has reached the specified minimum gap.



The "Minimum Trigger Gap" can be used to prevent unwanted trigger events due to fast power variations. Such events may occur e.g. for measurements on 8PSK-modulated bursts where the power can drop for a short time.

Remote command:

`TRIGger:GPRF:MEAS<i>:POWer:MGAP`

Trigger Mode

Defines the trigger scheme for the measured step sequence. Each trigger event (e.g. an event derived from the RF input power ramp) can trigger a single measurement step or a series of consecutive measurement steps. This setting has no impact on "Free Run" measurements.

For details on the "Trigger Mode" refer to Trigger Modes. The power steps for the "Retrigger Preselect" mode are selected in the "List Configuration" section.

Remote command:

`TRIGger:GPRF:MEAS<i>:POWer:MODE`

3.3.2.6 Power Configuration > List Configuration

The "List Configuration" parameters activate and configure the list mode of the GPRF "Power" measurement. See also Single Step vs. List Mode.

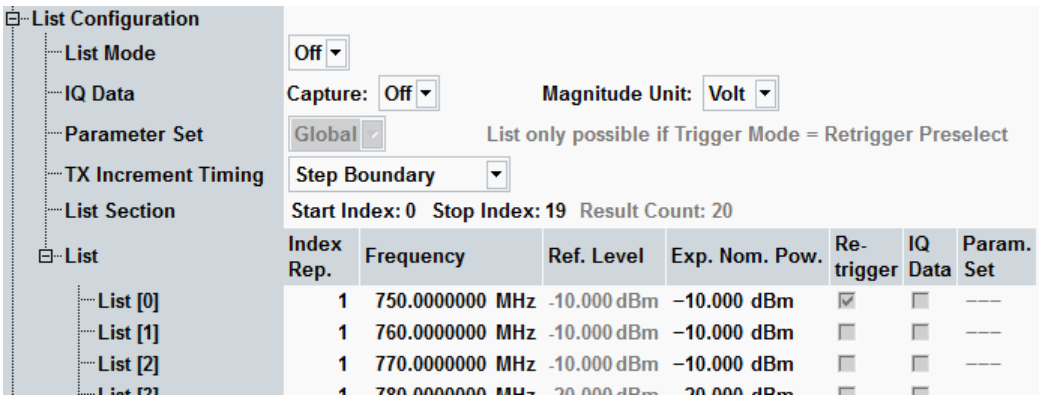


Fig. 3-39: Power Configuration: List Configuration

List Mode
Enables or disables the list mode. "Off" means that the "Power" measurement yields results at a single power and frequency. If the "List Mode" is switched on, the R&S CMW measures a list of power steps in accordance with the "List Mode" settings.

This parameter is also available in the "Measurement Control" section.

Remote command:
`CONFigure:GPRF:MEAS<i>:POWer:LIST`

IQ Data > Capture
Enables or disables the I/Q data measurement. For a general introduction refer to chapter 3.2.1.6, "I/Q Data Measurement", on page 87.

Remote command:
`CONFigure:GPRF:MEAS<i>:POWer:LIST:IQData:CAPTure`

IQ Data > Magnitude Unit
Selets the physical unit for I/Q measurement results. The R&S CMW returns the I/Q amplitudes either in "Voltage" units (into a 50 Ω load impedance) or as linear "Raw" amplitudes in Int16 format (value range –32768 to +32767). The maximum raw amplitude value (full scale value) corresponds to the selected reference level (see "Expected Nominal Power" on page 116).

Irrespective of the selected magnitude unit, it is possible to retrieve the I/Q data in ASCII format or as binary 32-bit IEEE 754 floating point numbers. These data formats are the same as in the "I/Q Recorder" measurement; see chapter 3.2.4.3, "ASCII and Binary Data Formats", on page 103.

Remote command:
`CONFigure:GPRF:MEAS<i>:POWer:LIST:MUNit`

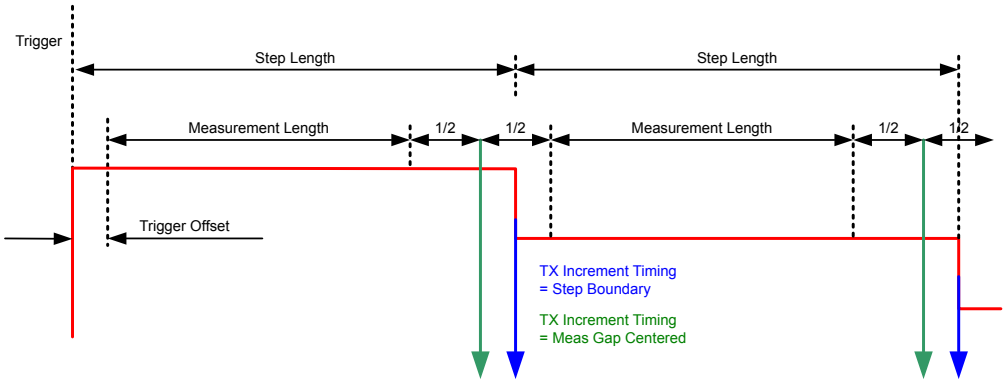
Parameter Set
Selects the measurement control settings for the power measurement. This parameter only affects the last column in the frequency/level list.

- "Global" means that the global settings in the "Measurement Control" section are used. If the list mode is enabled, the global settings are used for all frequency/level steps, irrespective of the "Parameter Set" selection in the list.
- "List" is available only while the "Retrigger Preselect" mode is active ("Trigger > Trigger Mode: Retrigger Preselect"). If "List" is selected and the list mode is active ("List Configuration > List Mode: On"), the R&S CMW can change its measurement control settings at each retriggered frequency/level step.

Remote command:
`CONFigure:GPRF:MEAS<i>:POWer:PSET`

TX Increment Timing
Specifies the timing of the "GPRF Meas<i>:Power" trigger the Power Measurement provides in List Mode.

Trigger signals can either be generated at every "Step Boundary" or in the middle of the gaps between subsequent measurement intervals ("Meas Gap Centered").



Remote command:

```
CONFigure:GPRF:MEAS<i>:POWer:LIST:TXITiming
```

List Section

Defines the segment range to be used in list mode. The R&S CMW measures all list segments between the "Start Index" and the "Stop Index"; the number of measurement results ("Count"; the sum of all "Index Rep." values between the start index and the stop index) is displayed for information.

Note:

- The list contains 4000 segments; only the section between "Start Index" and "Stop Index" is displayed at the GUI
- The measurement of an individual list segment is repeated "Index Rep." times, yielding "Index Rep." measurement results for this segment
- The total number of results ("Count") is limited to 10000

Remote command:

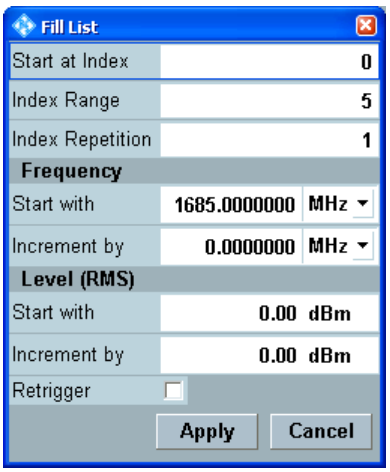
```
CONFigure:GPRF:MEAS<i>:POWer:LIST:STARt
CONFigure:GPRF:MEAS<i>:POWer:LIST:STOP
CONFigure:GPRF:MEAS<i>:POWer:LIST:SSTop
CONFigure:GPRF:MEAS<i>:POWer:LIST:COUNt?
```

List > Frequency / Exp. Nom. Pow.

Definition of (up to) 4000 list segments. The value range for the frequency covers the entire configurable input frequency range of the instrument, the level range depends on the selected RF connector. Each segment can be repeated a selectable number of times ("Index Rep."), however, the total number of steps ("Count") must not exceed 10000.

The power values in the list configure the analyzer of the R&S CMW in accordance with the input power of the measured RF signal. Selecting (approximately) correct values can improve the accuracy of the "Power" measurement. To avoid an overload of the input path, the "User Margin" should account for possible power variations of the input signal (crest factor).

The "List Config. > Fill List..." hotkey opens a dialog which considerably simplifies the configuration of the frequency/level list. The dialog defines a list segment of arbitrary start index ("Start at Index") and length ("Index Range"). Within the segment, the frequency and expected nominal power increase or decrease in equal steps.



Remote command:

```
CONFigure:GPRF:MEAS<i>:POWer:LIST:FREQuency
CONFigure:GPRF:MEAS<i>:POWer:LIST:FREQuency:ALL
CONFigure:GPRF:MEAS<i>:POWer:LIST:ENPower
CONFigure:GPRF:MEAS<i>:POWer:LIST:ENPower:ALL
CONFigure:GPRF:MEAS<i>:POWer:LIST:IREPetition
CONFigure:GPRF:MEAS<i>:POWer:LIST:IREPetition:ALL
```

List > Retrigger

Enables the steps for "Retrigger Preselect" mode (see Trigger Mode).

Note: If a list step contains an "Index Rep." > 1 in combination with an enabled retrigger, the retrigger setting applies to the first frequency/level step in the index repetition range only. The following list definitions are equivalent.

List [#]	Index Rep.	Frequency	Exp. Nom. Power	Retrigger
0	1	1000 MHz	0 dBm	on
1	1	1000 MHz	0 dBm	off
2	1	1000 MHz	0 dBm	off
3	1	1000 MHz	–30 dBm	off
4	1	2000 MHz	0 dBm	on
5	1	2000 MHz	0 dBm	off
6	1	2000 MHz	0 dBm	off
7	1	3000 MHz	0 dBm	on

List [#]	Index Rep.	Frequency	Exp. Nom. Power	Retrigger
0	3	1000 MHz	0 dBm	on
1	1	1000 MHz	–30 dBm	off

List [#]	Index Rep.	Frequency	Exp. Nom. Power	Retrigger
2	3	2000 MHz	0 dBm	on
3	1	3000 MHz	0 dBm	on

Remote command:
`CONFigure:GPRF:MEAS<i>:POWer:LIST:RETRigger`
`CONFigure:GPRF:MEAS<i>:POWer:LIST:RETRigger:ALL`

List > IQ Data
Enables the I/Q data measurement in the frequency/level steps. The I/Q data is available in addition to the other power measurement results and can be retrieved using remote control commands. See chapter 3.2.1.6, "I/Q Data Measurement", on page 87.

Remote command:
`CONFigure:GPRF:MEAS<i>:POWer:LIST:IQData`
`CONFigure:GPRF:MEAS<i>:POWer:LIST:IQData:ALL`

List > Parameter Set
Selects one of the predefined measurement control parameter sets. The selection is available for each retriggered power step ("Retrigger Preselect" mode). The parameter set remains valid until the next retriggered step with a different parameter set is measured. See also chapter 3.3.2.4, "Power Configuration > Parameter Sets ", on page 121.

Remote command:
`CONFigure:GPRF:MEAS<i>:POWer:LIST:PSET`
`CONFigure:GPRF:MEAS<i>:POWer:LIST:PSET:ALL`

3.3.2.7 Power Configuration > Display

The "Display" parameters configure the appearance of the measurement menu and select the displayed results.

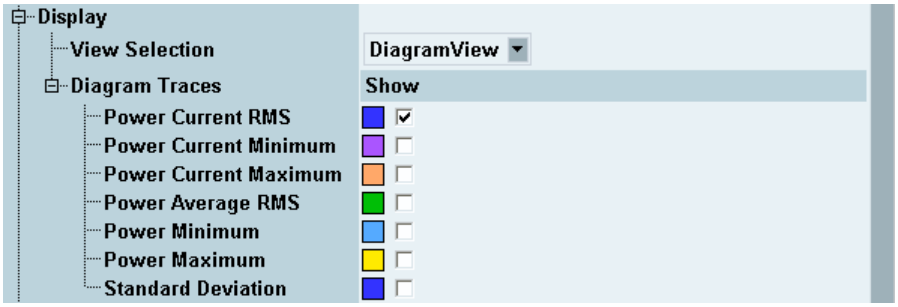


Fig. 3-40: Power Configuration: Display Parameters

Display - View Selection
Selects the diagram view or the table view to display the Measurement Results.

Display - Diagram Traces
Selects the statistical results to be shown in the diagram view.

See also: "Statistical Results" in the R&S CMW user manual, chapter "System Overview"

Remote command:
Measurement results are selected by means of the `CURRent, AVERage, MINimum, MAXimum` mnemonics in the command headers; see Measurement Results: Single Step Power Evaluation and List Mode.

3.3.2.8 Measurement Results

The "Power" measurement dialog shows the results in several alternative views; see detailed description in section Measurement Results.

In single step mode and "Power" evaluation mode only the summary statistics are displayed:

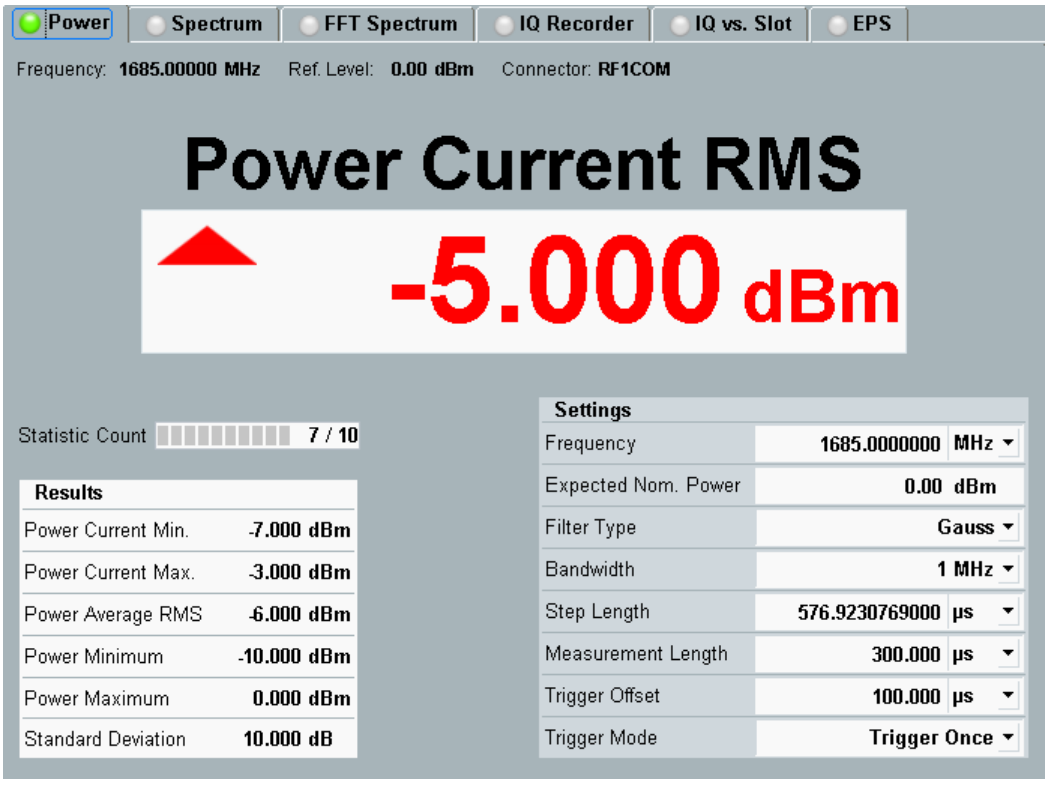


Fig. 3-41: Power measurement results: Single step power diagram (Display Mode: Power)

In list mode, basically the same results are returned, but separately for each step. The diagram view shows a bar graph for the measured power values and tables with the numerical results at a particular power step and the essential measurement settings.

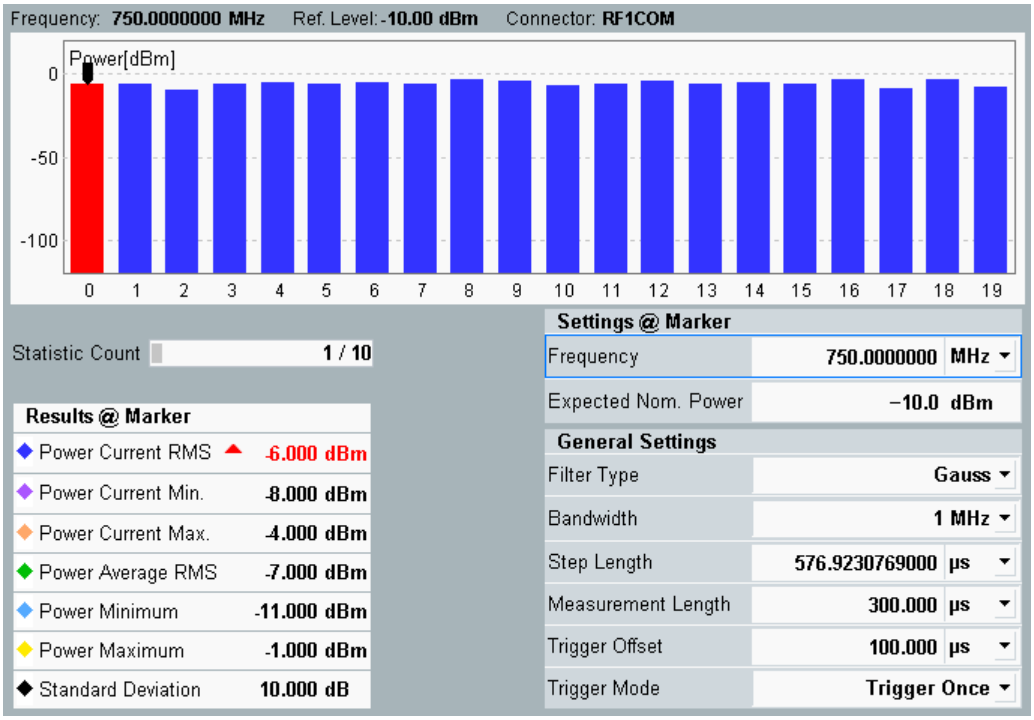
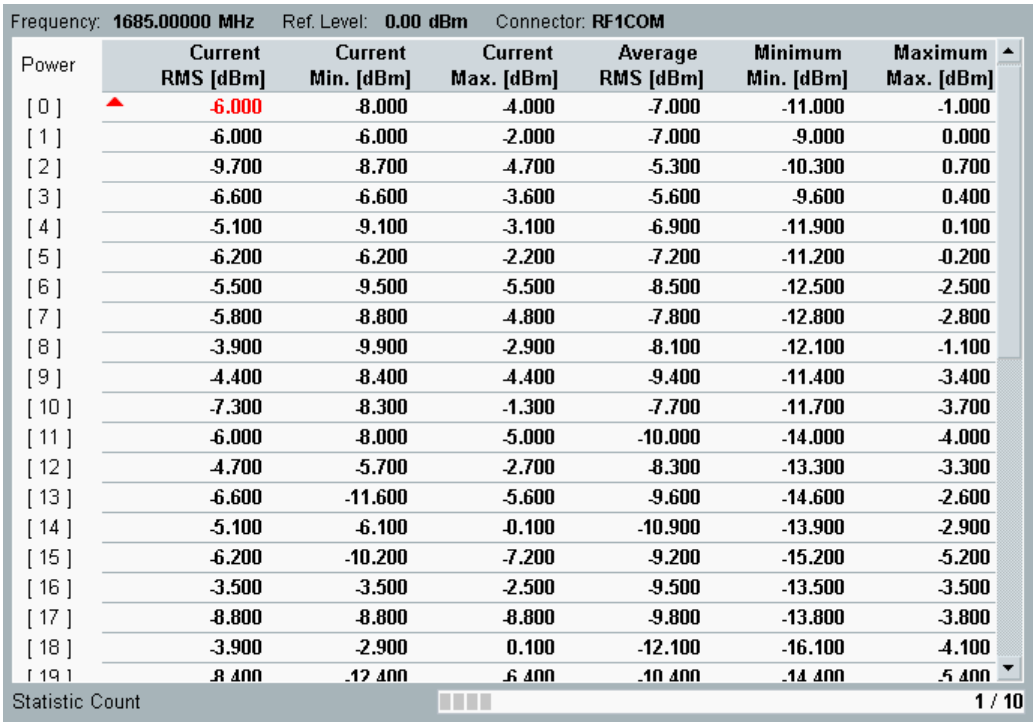


Fig. 3-42: Power measurement results: List mode diagram view

The table view shows the results in the bar graphs of the diagram view as a table with numeric values.



Power	Current RMS [dBm]	Current Min. [dBm]	Current Max. [dBm]	Average RMS [dBm]	Minimum Min. [dBm]	Maximum Max. [dBm]
[0]	-6.000	-8.000	-4.000	-7.000	-11.000	-1.000
[1]	-6.000	-6.000	-2.000	-7.000	-9.000	0.000
[2]	-9.700	-8.700	-4.700	-5.300	-10.300	0.700
[3]	-6.600	-6.600	-3.600	-5.600	-9.600	0.400
[4]	-5.100	-9.100	-3.100	-6.900	-11.900	0.100
[5]	-6.200	-6.200	-2.200	-7.200	-11.200	-0.200
[6]	-5.500	-9.500	-5.500	-8.500	-12.500	-2.500
[7]	-5.800	-8.800	-4.800	-7.800	-12.800	-2.800
[8]	-3.900	-9.900	-2.900	-8.100	-12.100	-1.100
[9]	-4.400	-8.400	-4.400	-9.400	-11.400	-3.400
[10]	-7.300	-8.300	-1.300	-7.700	-11.700	-3.700
[11]	-6.000	-8.000	-5.000	-10.000	-14.000	-4.000
[12]	-4.700	-5.700	-2.700	-8.300	-13.300	-3.300
[13]	-6.600	-11.600	-5.600	-9.600	-14.600	-2.600
[14]	-5.100	-6.100	-0.100	-10.900	-13.900	-2.900
[15]	-6.200	-10.200	-7.200	-9.200	-15.200	-5.200
[16]	-3.500	-3.500	-2.500	-9.500	-13.500	-3.500
[17]	-8.800	-8.800	-8.800	-9.800	-13.800	-3.800
[18]	-3.900	-2.900	0.100	-12.100	-16.100	-4.100
[19]	-8.400	-12.400	-6.400	-10.400	-14.400	-5.400

Fig. 3-43: Power measurement results: Table View

In single step mode and "Statistic" evaluation mode, the diagram view shows the statistical distribution/density of the measured power samples (to be more precise: their deviation from the average power):

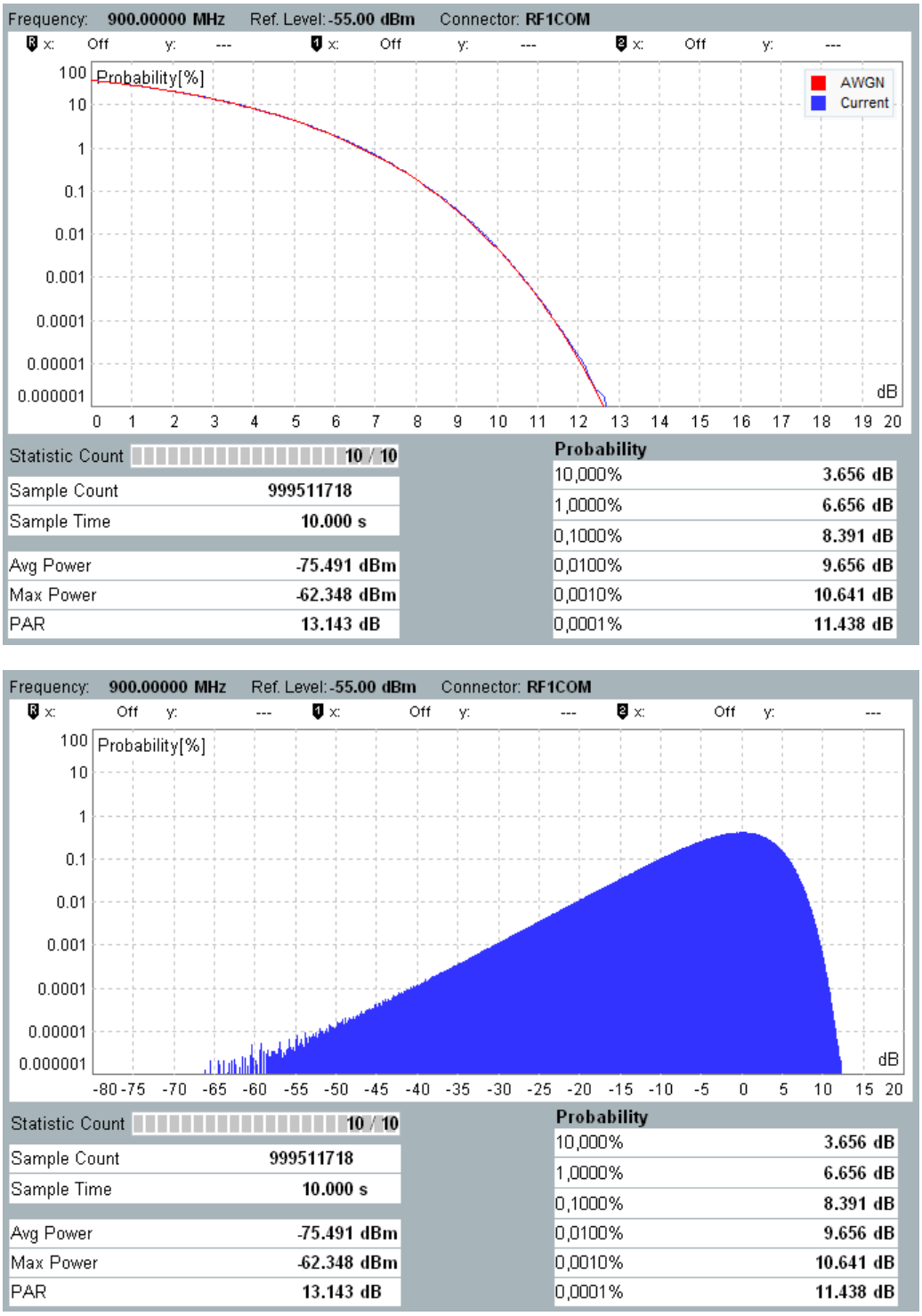


Fig. 3-44: Power measurement results: Single step statistic diagrams (Display Mode: Statistic)

SCPI command:

CONFigure:GPRF:MEAS<i>:POWer:MODE

FETCh:GPRF:MEAS<i>:POWer:CURRent? etc., see Measurement Results: Single Step Power Evaluation and List Mode

FETCh:GPRF:MEAS<i>:POWer:CCDF?, FETCh:GPRF:MEAS<i>:POWer:APD?, FETCh:GPRF:MEAS<i>:POWer:CCDF:PROBability? etc.

FETCh:GPRF:MEAS<i>:POWer:ESTatistics?

FETCh:GPRF:MEAS<i>:POWer:IQData?

3.3.3 Spectrum Analyzer: Parameters and Settings

The Spectrum Analyzer provides several groups of settings. The measurement dialog provides all measurement results.

Spectrum Analyzer measurement requires option CMW-KM010.

3.3.3.1 Measurement Control

The measurement is turned on or off using the ON | OFF or RESTART | STOP keys.

See also: "Measurement Control" in the R&S CMW user manual, chapter "System Overview"

Spectrum (Softkey)
The softkey shows the current measurement state. Additional measurement substates may be retrieved via remote control.

Remote command:
INITiate:GPRF:MEAS<i>:SPECtrum
STOP:GPRF:MEAS<i>:SPECtrum
ABORt:GPRF:MEAS<i>:SPECtrum
FETCh:GPRF:MEAS<i>:SPECtrum:STATe?
FETCh:GPRF:MEAS<i>:SPECtrum:STATe:ALL?

3.3.3.2 Spectrum Configuration

The spectrum measurement is configured using the parameters in the "Spectrum Configuration" dialog. The RF input path settings in the upper part of the dialog are also used by other GPRF measurements; see Signal Routing and Analyzer Settings.

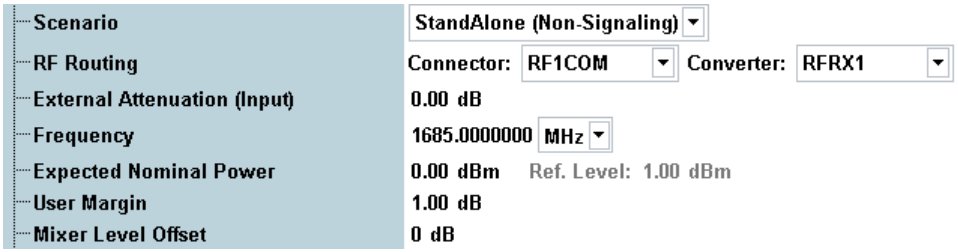


Fig. 3-45: GPRF measurements: Signal routing and analyzer settings

In "Combined Signal Path" measurement scenarios the frequency sweep mode cannot be used.

3.3.3.3 Spectrum Configuration: Measurement Control

The "Measurement Control" parameters define how the R&S CMW acquires measurement data.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "System Overview"

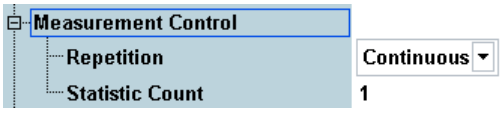


Fig. 3-46: Spectrum Configuration: Measurement Control

Repetition
Defines how often the measurement is repeated if it is not stopped explicitly.

- **Continuous:** The measurement is continued until it is explicitly terminated; the results are periodically updated.
- **Single-Shot:** The measurement is stopped after one statistics cycle.

Single-shot is preferable if only a single measurement result is required under fixed conditions, which is typical for remote-controlled measurements. Continuous mode is suitable for monitoring the evolution of the measurement results in time and observe how they depend on the measurement configuration, which is typically done in manual control. The reset/preset values therefore differ from each other.

Remote command:
`CONFigure:GPRF:MEAS<i>:SPECtrum:REPetition`

Statistic Count
Defines the number of measurement intervals per measurement cycle (statistics cycle, single-shot measurement). This value is also relevant for continuous measurements, because the averaging procedures depend on the statistic count.

In the spectrum measurement, a measurement interval is a complete frequency sweep.

Remote command:
`CONFigure:GPRF:MEAS<i>:SPECtrum:SCOunt`

3.3.3.4 Spectrum Configuration: Trigger Settings

The "Trigger" parameters configure the trigger system for the zero span mode of the spectrum analyzer measurement. The corresponding branch of the configuration tree is inactive if the spectrum analyzer is in "Frequency Sweep" mode (default).

Fig. 3-47: Spectrum Configuration: Trigger

Trigger Source
Selects the source of the trigger event. Some of the trigger sources require additional options.

"Free Run" The measurement starts immediately after it is initiated; no trigger is used. The remaining trigger settings are not relevant for "Free Run" measurements.

"IF Power" The measurement is triggered by the measured video power steps. The trigger event is generated after down-conversion of the measured RF signal to the IF band and subsequent video filtering (if any). The "Trigger Slope", "Trigger Threshold", "Trigger Offset", and the remaining trigger settings are valid for this trigger source; they should be adjusted to the measured power steps.

"...External..." External trigger signal fed in via TRIG A or TRIG B on the rear panel of the instrument.

Remote command:
`TRIGger:GPRF:MEAS<i>:SPECtrum:CATalog:SOURce?`
`TRIGger:GPRF:MEAS<i>:SPECtrum:SOURce`

Trigger Slope
Qualifies whether the trigger event is generated at the rising or at the falling edge of the trigger pulse. This setting has no influence on "Free Run" measurements and for evaluation of trigger pulses provided by other firmware applications.

Remote command:
`TRIGger:GPRF:MEAS<i>:SPECtrum:SLOPe`

Trigger Threshold
Defines the input signal power where the trigger condition is satisfied and a trigger event is generated. The trigger threshold is valid for power trigger sources. It is a dB value, relative to the reference level minus the external attenuation (<Ref. Level> – <External Attenuation (Input)> – <Frequency Dependent External Attenuation>). If the reference level is set to the actual maximum output power of the DUT, and the external attenuation settings are in accordance with the test setup, then the trigger threshold is referenced to the actual maximum RF input power at the R&S CMW.

A low threshold may be required to ensure that the R&S CMW can always detect the input signal. A higher threshold can prevent unintended trigger events.

Remote command:
`TRIGger:GPRF:MEAS<i>:SPECtrum:THReshold`

Trigger Offset
The "Trigger Offset" parameter defines the start of a triggered "Zero Span" (time domain) measurement relative to the corresponding trigger event.

Remote command:
`TRIGger:GPRF:MEAS<i>:SPECtrum:OFFSet`

Trigger Timeout
Sets a time after which an initiated measurement must have received a trigger event. If no trigger event is received, a trigger timeout is indicated in manual operation mode. In remote control mode the measurement is automatically stopped. The parameter can be disabled so that no timeout occurs.

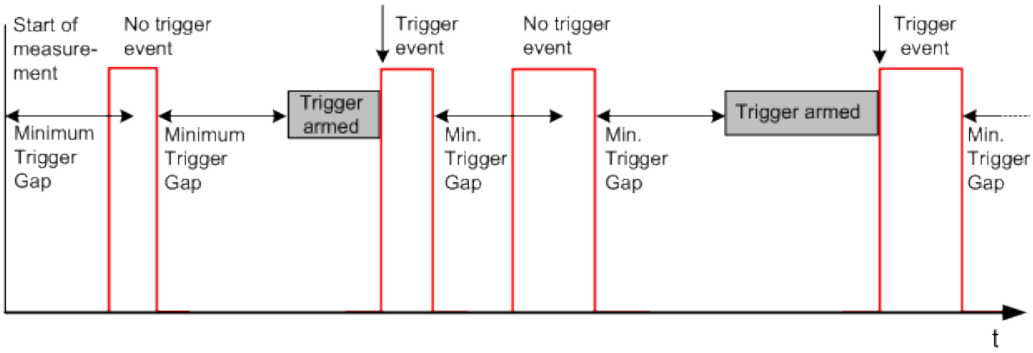
This setting has no influence on "Free Run" measurements.

Minimum Trigger Gap
Defines a minimum duration of the power-down periods (gaps) between two triggered power pulses. This setting is valid for the "IF Power" (Video) trigger source.

The trigger system is controlled by means of a timer which is reset to zero in the following instances:

- At the IF power-down ramp of each triggered or untriggered pulse, even though the previous counter may not have elapsed yet. A power-down ramp is detected when the signal power falls below the trigger threshold.
- At the beginning of each measurement: The minimum gap defines the minimum time between the start of the measurement and the first trigger event.

The trigger system is re-armed as soon as the timer has reached the specified minimum gap.



The "Minimum Trigger Gap" can be used to prevent unwanted trigger events due to fast power variations. Such events may occur e.g. for measurements on 8PSK-modulated bursts where the power can drop for a short time.

3.3.3.5 Spectrum Configuration: Analyzer Settings

First and most important the "Analyzer Settings" determine the domain ("Span Mode") of the "Spectrum" measurement:

- **Frequency domain** ("Frequency Sweep" mode): a swept spectrum analysis is performed using a Gaussian Filter with configurable resolution bandwidth.
  The frequency range can be specified either by its center and span or by its start and stop frequency.
- **Time domain** ("Zero Span" mode): the spectrum analyzer remains tuned to the specified "Center" frequency and the (IF) signal is filtered by a Gaussian or bandpass filter with configurable bandwidth.

For both domains a video filter with configurable bandwidth can be applied to the resulting amplitude values and an appropriate detector can be selected for the display.

Measurements above 3.3 GHz require option R&S CMW-KB036.

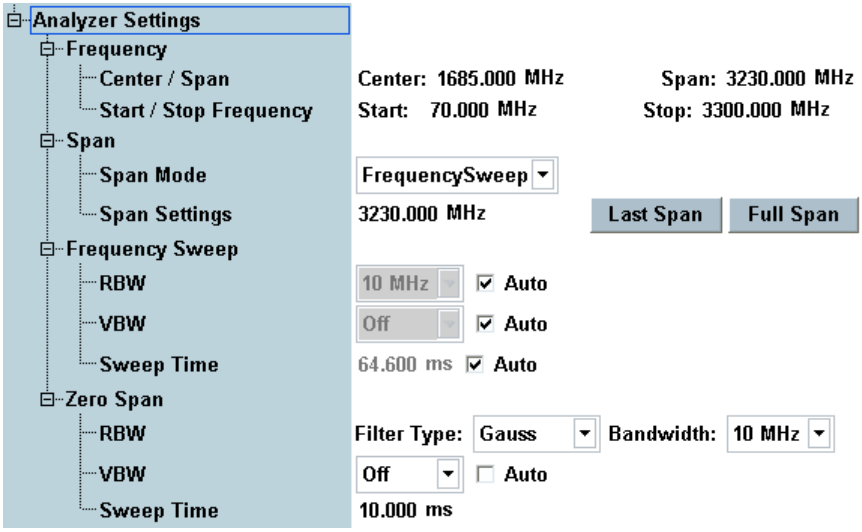


Fig. 3-48: Spectrum Configuration: Analyzer Settings

Frequency > Center
Defines the center frequency of the spectrum measurement.

In frequency sweep mode, setting the center frequency will adjust the start and stop frequency

- keeping the frequency span constant, if neither the start frequency reaches its lower limit (70 MHz) nor the stop frequency reaches its upper limit (6000 MHz)
- reducing the frequency span to the maximum possible value compatible with the supported frequency band (70 MHz to 6000 MHz), if either the start frequency reaches its lower limit (70 MHz) or the stop frequency reaches its upper limit (6000 MHz)

In zero span mode, setting the center frequency will leave the start frequency, stop frequency and span unchanged. These values will be adjusted according to the new center frequency and (appropriately reduced) span as soon as the frequency sweep mode is selected.

Remote command:
`CONFigure:GPRF:MEAS<i>:SPECtrum:FREQuency:CENTer`

Frequency > Span
Defines the frequency span for the "Frequency Sweep" mode. The minimum possible span is 500 Hz, the maximum possible span is limited by the supported frequency band (70 MHz to 6000 MHz).

In the "Frequency Sweep" mode the span setting adjusts the x-axis scale of the spectrum diagram.

Remote command:
`CONFigure:GPRF:MEAS<i>:SPECtrum:FREQuency:SPAN`

Frequency > Start / Stop Frequency
Defines the frequency range for the "Frequency Sweep" mode by setting start/stop frequency.

Remote command:
`CONFigure:GPRF:MEAS<i>:SPECtrum:FREQuency:STARt`
`CONFigure:GPRF:MEAS<i>:SPECtrum:FREQuency:STOP`

Span Mode
Setting the "Span Mode" activates either the "Frequency Sweep" mode or the "Zero Span" mode.

The spectrum diagram is adjusted according to the selected mode:

- In "Frequency Sweep" mode the x-axis represents the sweept frequencies and is scaled according to the configured frequency range. The y axis represents the signal power. By default the R&S CMW automatically sets the RBW, VBW and sweep time.
- In "Zero Span" mode the x-axis represents time and is scaled according to the configured single shot measurement ("Sweep") time. The y axis represents the signal power. The VBW can be automatically set.

Remote command:
`CONFigure:GPRF:MEAS<i>:SPECtrum:FREQuency:SPAN:MODE`

Span Settings
The meaning of the "Span" value was explained above.

With the "Last Span" and "Full Span" buttons, the span can be set to

- its previous value in the history of span values
- its maximum value of 5930 MHz, implying a "Start Frequency" of 70 MHz and a "Stop Frequency" of 6000 MHz

respectively.

Remote command:
`CONFigure:GPRF:MEAS<i>:SPECtrum:FREQuency:SPAN`

Frequency Sweep > RBW
The minimum RBW is 100 Hz, the maximum RBW is 10 MHz.

With "Auto" RBW selection, the R&S CMW sets the RBW to 2% of the span, rounded up to the next possible RBW value - if such a value exists. Otherwise the maximum possible RBW of 10 MHz is selected.

Remote command:
`CONFigure:GPRF:MEAS<i>:SPECtrum:FSWeep:RBW`
`CONFigure:GPRF:MEAS<i>:SPECtrum:FSWeep:RBW:AUTO`

Frequency Sweep > VBW
The minimum VBW is 10 Hz, the maximum is 10 MHz.

With "Auto" VBW selection, the R&S CMW sets VBW = 3 x RBW, rounded up to the next possible VBW value if such a value exists. Otherwise the video filter is switched off.

A restricted bandwidth of the logarithmic video signal causes signal averaging and thus results in a too low indication of the power.

Remote command:

```
CONFigure:GPRF:MEAS<i>:SPECtrum:FSWeep:VBW
CONFigure:GPRF:MEAS<i>:SPECtrum:FSWeep:VBW:AUTO
```

Frequency Sweep > Sweep Time

The time required to record the whole frequency spectrum that is of interest is described as sweep time.

Remote command:

```
CONFigure:GPRF:MEAS<i>:SPECtrum:FSWeep:SWT
CONFigure:GPRF:MEAS<i>:SPECtrum:FSWeep:SWT:AUTO
```

Zero Span > RBW > Filter Type

In Zero Span mode it is possible to select the IF filter type that shall be used for signal analysis. Either gaussian or bandpass filtering can be selected.

Remote command:

```
CONFigure:GPRF:MEAS<i>:SPECtrum:ZSPan:RBW:TYPE
```

Zero Span > RBW > Bandwidth

In Zero Span mode the RBW determines the frequency band around the center frequency whose power shall be measured

For Gauss filters, the minimum RBW is 100 Hz, the maximum RBW is 10 MHz. The bandpass filter is 40 MHz wide.

Remote command:

```
CONFigure:GPRF:MEAS<i>:SPECtrum:ZSPan:RBW:GAUSs
CONFigure:GPRF:MEAS<i>:SPECtrum:ZSPan:RBW:BANDpass
```

Zero Span > VBW

The minimum VBW is 10 Hz, the maximum is 10 MHz.

With "Auto" VBW selection, the R&S CMW sets VBW = 3 x RBW, rounded up to the next possible VBW value if such a value exists. Otherwise the video filter is switched off.

A restricted bandwidth of the logarithmic video signal causes signal averaging and thus results in a too low indication of the power.

Remote command:

```
CONFigure:GPRF:MEAS<i>:SPECtrum:ZSPan:VBW
CONFigure:GPRF:MEAS<i>:SPECtrum:ZSPan:VBW:AUTO
```

Zero Span > Sweep Time

The time spent on recording the signal power.

Remote command:

```
CONFigure:GPRF:MEAS<i>:SPECtrum:FSWeep:SWT
CONFigure:GPRF:MEAS<i>:SPECtrum:FSWeep:SWT:AUTO
```

3.3.3.6 Additional Hotkeys

Detector
Defines how the result traces (1001 values) are calculated from the raw set of samples (per "pixel").

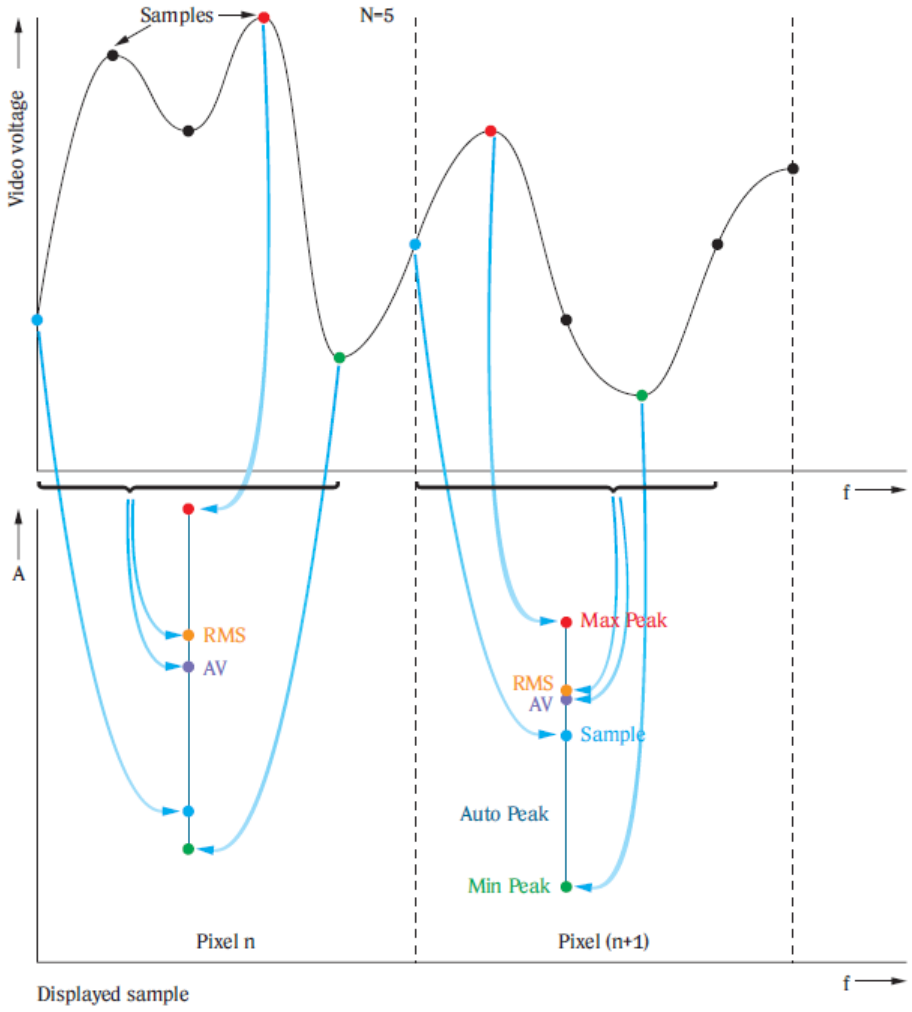


Fig. 3-49: Detectors> Spectrum Meausrement

See also: "Statistical Results" in the R&S CMW user manual, chapter "System Overview"

"Average"	The logarithmic or linear average of the sample values is displayed (see averaging mode).
"RMS"	The RMS value of the sample values is displayed.
"Sample"	The value of the first sample is displayed.
"AutoPeak"	The range between MinPeak and MaxPeak is displayed.
"MinPeak"	The smallest sample power is displayed.

"MaxPeak" The largest sample power is displayed.

Remote command:
-/-

Averaging Mode
Defines how the R&S CMW calculates the average traces from the current results.

"Logarithmic" Averaging of the displayed current dBm values. In frequency ranges where the trace shows random variations (noise), logarithmic averaging will decrease the displayed signal level.

"Linear" Averaging of the linear powers: The current dBm values are converted to linear power values (in W) and averaged; the result is re-converted into a dBm value and displayed. The result is the true average measured power at any trace point including random effects.

Remote command:
`CONFigure:GPRF:MEAS<i>:SPECtrum:AMODe`

3.3.3.7 Measurement Results

Depending on the selected span mode, the "Spectrum" tab either displays the signal spectrum or the time domain representation of the signal power:

Trace Results
Signal spectrum

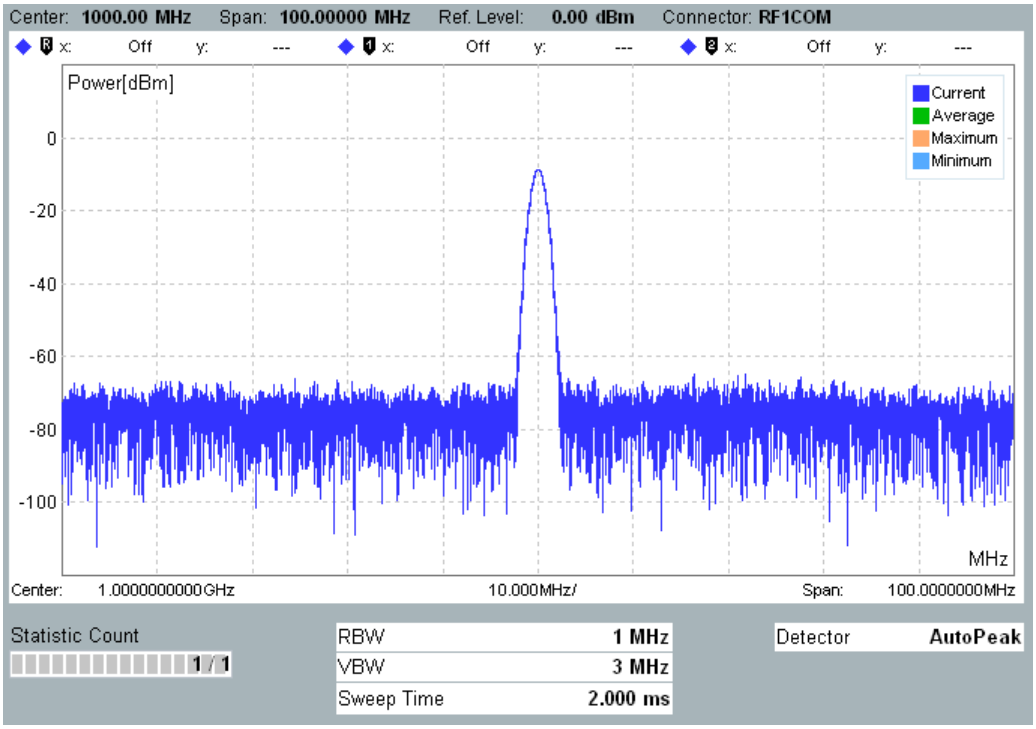


Fig. 3-50: Spectrum: Frequency Sweep Results

or power vs. time results.

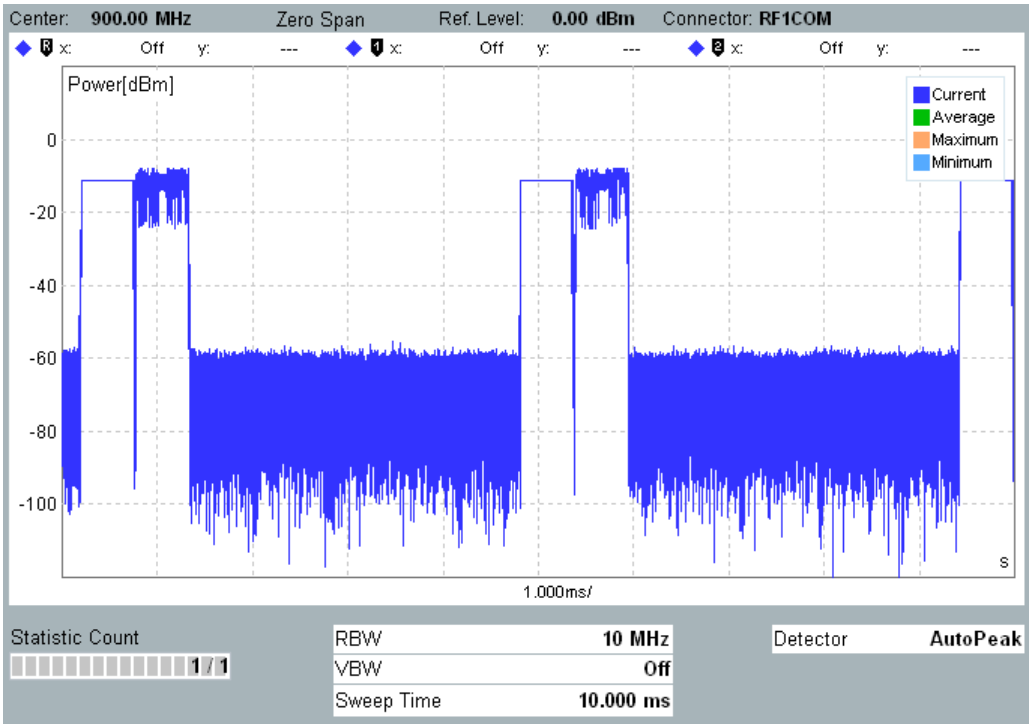


Fig. 3-51: Spectrum: Zero Span Results

Remote command:

`FETCh:GPRF:MEAS<i>:SPECtrum:AVERage:CURRent?`,
`FETCh:GPRF:MEAS<i>:SPECtrum:MAXimum:CURRent?`
`FETCh:GPRF:MEAS<i>:SPECtrum:MINimum:CURRent?`
`FETCh:GPRF:MEAS<i>:SPECtrum:RMS:CURRent?`
`FETCh:GPRF:MEAS<i>:SPECtrum:SAMPle:CURRent?` etc.

3.3.4 FFT Spectrum Analyzer: Parameters and Settings

The FFT Spectrum Analyzer provides several groups of settings. The most important measurement settings are also displayed in the measurement dialog. The measurement dialog provides all measurement results.

3.3.4.1 Measurement Control

The measurement is turned on or off using the ON | OFF or RESTART | STOP keys.

See also: "Measurement Control" in the R&S CMW user manual, chapter "System Overview"

FFT (Softkey)
The softkey shows the current measurement state. Additional measurement substates may be retrieved via remote control.

Remote command:
`INITiate:GPRF:MEAS<i>:FFTSanalyzer` etc.
`FETCh:GPRF:MEAS<i>:FFTSanalyzer:STATe?`
`FETCh:GPRF:MEAS<i>:FFTSanalyzer:STATe:ALL?`

3.3.4.2 FFT Spectrum Analyzer Configuration

The "FFT Spectrum Analyzer" is configured using the parameters in the "FFT Configuration" dialog. The RF input path settings in the upper part of the dialog are also used by other GPRF measurements; see Signal Routing and Analyzer Settings.

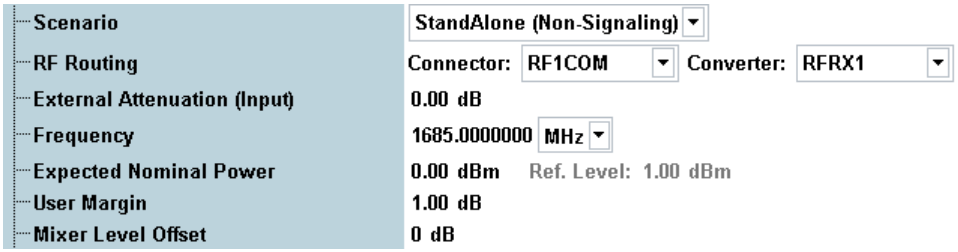


Fig. 3-52: GPRF measurements: Signal routing and analyzer settings

3.3.4.3 FFT Configuration: Measurement Control

The "Measurement Control" parameters define how the R&S CMW acquires measurement data.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "System Overview"

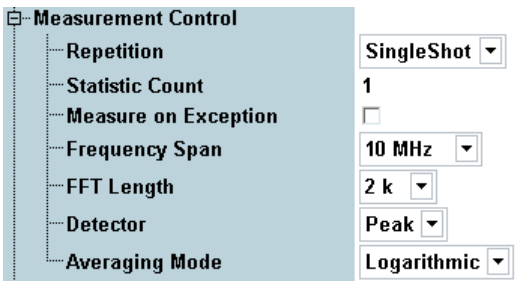


Fig. 3-53: FFT Configuration: Measurement Control

Repetition
Defines how often the measurement is repeated if it is not stopped explicitly or by a failed limit check.

- **Continuous:** The measurement is continued until it is explicitly terminated; the results are periodically updated.
- **Single-Shot:** The measurement is stopped after one statistics cycle.

Single-shot is preferable if only a single measurement result is required under fixed conditions, which is typical for remote-controlled measurements. Continuous mode is suitable for monitoring the evolution of the measurement results in time and observe how they depend on the measurement configuration, which is typically done in manual control. The reset/preset values therefore differ from each other.

Remote command:
`CONFigure:GPRF:MEAS<i>:FFTSanalyzer:REPetition`

Statistic Count
Defines the number of measurement intervals per measurement cycle (statistics cycle, single-shot measurement). This value is also relevant for continuous measurements, because the averaging procedures depend on the statistic count.

In the "FFT Spectrum Analyzer" measurement, a "measurement interval" is a complete measurement, comprising the number of samples defined by the "FFT Length".

Remote command:
`CONFigure:GPRF:MEAS<i>:FFTSanalyzer:SCOunt`

Measure on Exception
Specifies whether measurement results that the R&S CMW identifies as faulty or inaccurate are rejected. A faulty result occurs e.g. when an overload is detected. In remote control, the cause of the error is indicated by the "reliability indicator".

- **Off:** Faulty results are rejected. The measurement is continued; the statistical counters are not re-set. Use this mode to ensure that a single faulty result does not affect the entire measurement.
- **On:** Results are never rejected. Use this mode e.g. for development purposes, if you want to analyze the reason for occasional wrong transmissions.

Remote command:
`CONFigure:GPRF:MEAS<i>:FFTSanalyzer:MOEXception`

Frequency Span
Defines the frequency span for the "FFT Spectrum Analyzer" and adjusts the x-axis scale of the spectrum diagram.

The R&S CMW adjusts the sampling rate to ensure that the FFT result covers the selected span. The time domain diagram is re-scaled according to the new time record length. The span leaves the number of samples ("FFT Length") unchanged but affects the resolution bandwidth (RBW); see Frequency Settings and Resolution Bandwidth. Both the sampling rate and the RBW increase with the selected span.

Remote command:
`CONFigure:GPRF:MEAS<i>:FFTSanalyzer:FSPan`

FFT Length
Sets the number of samples that the R&S CMW uses for the FFT analysis. The sampling rate is not affected so that the total time record length is proportional to the "FFT length". The time domain diagram is re-scaled according to the new time record length; the frequency span (and thus the spectrum diagram) remains unchanged.

The number of samples is always an integer power of two. A "1k" length corresponds to 1024 samples, a "16k" length corresponds to 16384 samples. A large FFT length improves the frequency resolution, at the expense of the measurement speed; see Frequency Settings and Resolution Bandwidth.

The "Frequency Span" and "FFT Length" settings both affect the resolution bandwidth (RBW). To improve the frequency resolution (i.e. decrease the RBW) you can:

- Select a smaller span (if you do not want to slow down the measurement and do not need a large span).
- Select a large FFT length (if you need a large span).

Remote command:
`CONFigure:GPRF:MEAS<i>:FFTSanalyzer:FFTLength`

Detector
Defines how the spectrum curve is calculated from the total set of frequency domain samples.

See also: "Statistical Results" in the R&S CMW user manual, chapter "System Overview"

- For a "1k" FFT length, the passband of the receiver filter contains 4 * 801 samples. The factor 4 is due to upsampling. The detector combines 4 adjacent samples into a single frequency point.
- For a "nk" length (n = 2, 4, 8, 16), the passband contains 4 * n * 801 samples. The detector combines 4 * n adjacent samples into a single frequency point.

"Peak" The sample with the largest power is displayed. This ensures that narrow peaks will not be smoothed out due to averaging.

"RMS" The RMS value of the n samples is displayed. Over-estimation of stochastic signals (noise) is avoided.

Remote command:
`CONFigure:GPRF:MEAS<i>:FFTSanalyzer:DETector`

Averaging Mode
Defines how the R&S CMW calculates the average FFT trace from the current results.

"Logarithmic" Averaging of the displayed current dBm values. In frequency ranges where the trace shows random variations (noise), logarithmic averaging will decrease the displayed signal level.

"Linear" Averaging of the linear powers: The current dBm values are converted to linear power values (in W) and averaged; the result is re-converted into a dBm value and displayed. The result is the true average measured power at any trace point including random effects.

Remote command:
`CONFigure:GPRF:MEAS<i>:FFTSanalyzer:AMODe`

3.3.4.4 FFT Configuration: Trigger Settings

The "Trigger" parameters configure the trigger system for the "FFT Spectrum Analyzer".

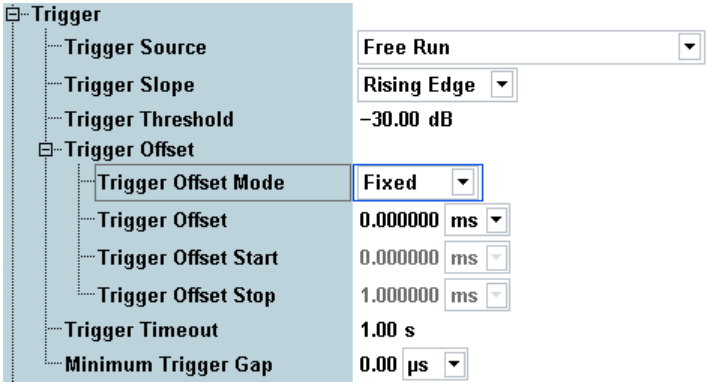


Fig. 3-54: FFT Configuration: Trigger

Trigger Source
Selects the source of the trigger event. Some of the trigger sources require additional options.

"Free Run" The measurement starts immediately after it is initiated; no trigger is used. The remaining trigger settings are not relevant for "Free Run" measurements.

"IF Power" The measurement is triggered by the measured power steps. The trigger event is generated after down-conversion of the measured RF signal to the IF band. The "Trigger Slope", "Trigger Threshold", "Trigger Offset", and the remaining trigger settings are valid for this trigger source; they should be adjusted to the measured power steps.

"...External..." External trigger signal fed in via TRIG A or TRIG B on the rear panel of the instrument.

"GPRF Gen..." Trigger event provided by the arbitrary waveform generator of a "GPRF Generator" application (option R&S CMW-B110A). The "GPRF Gen..." trigger events are generated while an ARB file is processed.

Remote command:
`TRIGger:GPRF:MEAS<i>:FFTSanalyzer:CATalog:SOURce?`
`TRIGger:GPRF:MEAS<i>:FFTSanalyzer:SOURce`

Trigger Slope
Qualifies whether the trigger event is generated at the rising or at the falling edge of the trigger pulse. This setting has no influence on "Free Run" measurements and for evaluation of trigger pulses provided by other firmware applications.

Remote command:
`TRIGger:GPRF:MEAS<i>:FFTSanalyzer:SLOPe`

Trigger Threshold
Defines the input signal power where the trigger condition is satisfied and a trigger event is generated. The trigger threshold is valid for power trigger sources. It is a dB value, relative to the reference level minus the external attenuation (<Ref. Level> – <External Attenuation (Input)> – <Frequency Dependent External Attenuation>). If the reference level is set to the actual maximum output power of the DUT, and the external attenuation settings are in accordance with the test setup, then the trigger threshold is referenced to the actual maximum RF input power at the R&S CMW.

A low threshold may be required to ensure that the R&S CMW can always detect the input signal. A higher threshold can prevent unintended trigger events.

Remote command:
`TRIGger:GPRF:MEAS<i>:FFTSanalyzer:THReshold`

Trigger Offset
The "Trigger Offset" parameters define the center of the FFT window (and thus the time domain diagram) relative to the trigger events. Depending on the "Trigger Offset Mode", the center is shifted by a "Fixed" time value or is "Variable", between the selected start and stop times.

The purpose of a variable trigger offset is to modify the calculation of average FFT spectrum analyzer results, excluding repeated data patterns in consecutive measurements. The window position is calculated as a function of the "Trigger Offset Start" and the "Trigger Offset Stop" values and the "Statistic Count":

$$T_{Offset}(n) = T_{Offset\ Start} + (n-1) \cdot \frac{T_{Offset\ Stop} - T_{Offset\ Start}}{< Statistic\ Count > - 1}$$

In the formula above, n runs from 1 to the <Statistic Count> value. For <Statistic Count> = 1, the variable trigger offset corresponds to a fixed trigger offset at $T_{Offset\ Start}$. An example for a variable trigger offset for a bursty signal with "IF Power" trigger and an FFT window length which is much smaller than the burst length is shown below.

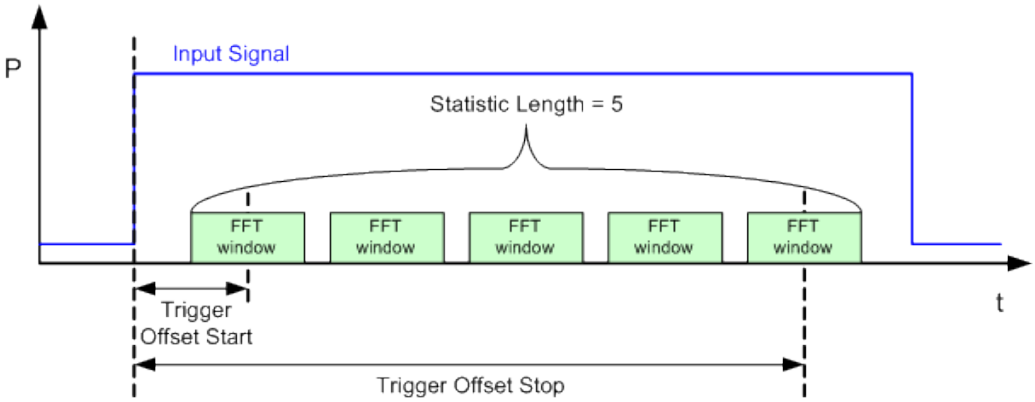


Fig. 3-55: Variable trigger offset

For a sequence of triggered bursts which carry identical data patterns, the variable trigger offset can provide uncorrelated average results, corresponding to random data within the consecutive shifted FFT windows.

Remote command:

```
TRIGger:GPRF:MEAS<i>:FFTSanalyzer:OMODe
TRIGger:GPRF:MEAS<i>:FFTSanalyzer:OFFSet
TRIGger:GPRF:MEAS<i>:FFTSanalyzer:OSSTop
```

Trigger Timeout

Sets a time after which an initiated measurement must have received a trigger event. If no trigger event is received, a trigger timeout is indicated in manual operation mode. In remote control mode the measurement is automatically stopped. The parameter can be disabled so that no timeout occurs.

This setting has no influence on "Free Run" measurements.

Remote command:

```
TRIGger:GPRF:MEAS<i>:FFTSanalyzer:TOUT
```

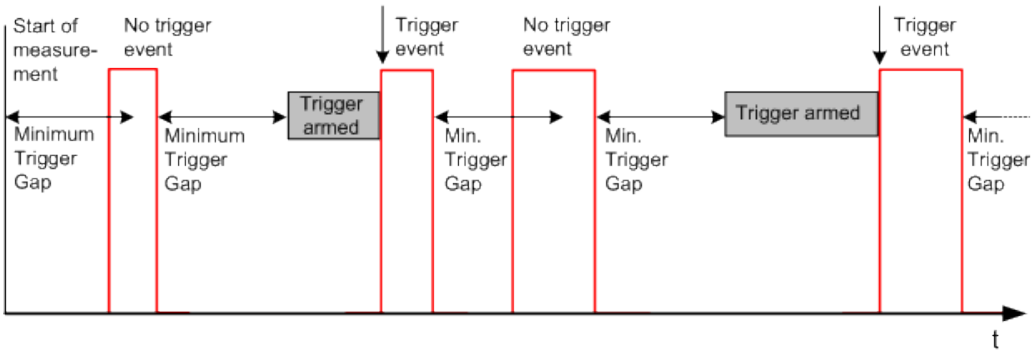
Minimum Trigger Gap

Defines a minimum duration of the power-down periods (gaps) between two triggered power pulses. This setting is valid for an "(IF) Power" trigger source.

The trigger system is controlled by means of a timer which is reset to zero in the following instances:

- At the IF power-down ramp of each triggered or untriggered pulse, even though the previous counter may not have elapsed yet. A power-down ramp is detected when the signal power falls below the trigger threshold.
- At the beginning of each measurement: The minimum gap defines the minimum time between the start of the measurement and the first trigger event.

The trigger system is re-armed as soon as the timer has reached the specified minimum gap.



The "Minimum Trigger Gap" can be used to prevent unwanted trigger events due to fast power variations. Such events may occur e.g. for measurements on 8PSK-modulated bursts where the power can drop for a short time.

Remote command:

```
TRIGger:GPRF:MEAS<i>:FFTSanalyzer:MGAP
```

3.3.4.5 Additional Hotkeys

The "FFT Spectrum Analyzer" provides some softkey/hotkey combinations which have no equivalent in the configuration dialog. Most of these hotkeys provide display configurations (like diagram scaling). They are self-explanatory and do not have any remote control commands assigned.

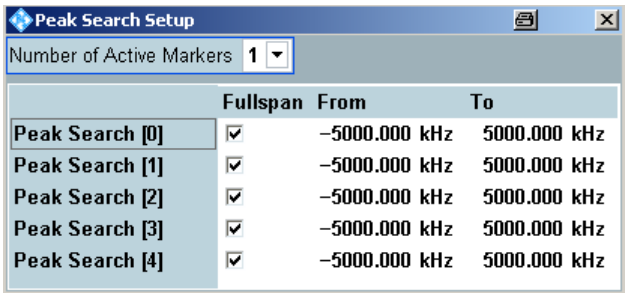
The following hotkeys provide additional features.

Display - IQ Display Mode
Specify whether or not the time diagrams show the influence of the Gaussian window. The frequency-domain results are always calculated from windowed time domain data.

Remote command:
n/a

Marker - Peak Search Ranges
Defines five areas where the R&S CMW searches for peaks of the spectrum trace. A marker is assigned to the first n areas to read the power and frequency values. <n> is given by the selected "Number of Active Markers". You can locate several peaks in frequency ranges where several areas overlap.

The peak search is particularly suited for exact frequency measurements of narrow-band (CW) signals in the spectrum.



If "Full Span" is selected, the specified frequency range is ignored; the R&S CMW searches the peak power in the whole frequency span.

Remote command:
`CONFigure:GPRF:MEAS<i>:FFTSanalyzer:PSEarch:NOAMarkers`
`CONFigure:GPRF:MEAS<i>:FFTSanalyzer:PSEarch`

3.3.4.6 Measurement Results

The "FFT Spectrum Analyzer" dialog shows all results in three diagrams and a table with statistical values; see detailed description in section Measurement Results.

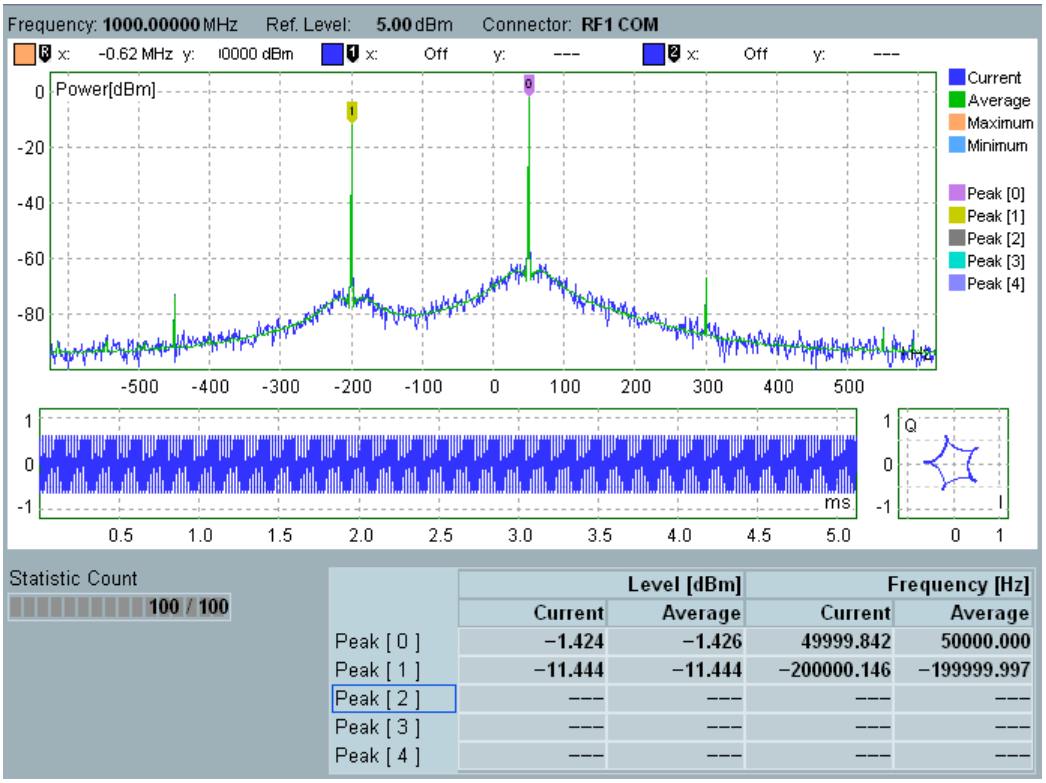


Fig. 3-56: FFT Spectrum Analyzer results

Spectrum diagram
Power vs. frequency results.

Remote command:
`FETCh:GPRF:MEAS<i>:FFTSanalyzer:POWer:CURRent?` etc.

Power vs. time IQ constellation diagram
Normalized I/Q amplitudes: The raw data acquired in time domain.

Remote command:
`FETCh:GPRF:MEAS<i>:FFTSanalyzer:I?` etc.

Peak table
Results of the peak search.

Remote command:
`FETCh:GPRF:MEAS<i>:FFTSanalyzer:PEAKs:CURRent?` etc.

3.3.5 I/Q Recorder: Parameters and Settings

A configuration dialog provides settings for the "I/Q Recorder" measurement. Additional settings (e.g. the list mode settings) are available via remote control only. The measurement results are written to a file, the GUI does not show any results.

3.3.5.1 Measurement Control

The measurement is turned on or off using the ON | OFF or RESTART | STOP keys.

See also: "Measurement Control" in the R&S CMW user manual, chapter "System Overview"

IQ Recorder (Softkey)
The softkey shows the current measurement state. Additional measurement substates may be retrieved via remote control.

Remote command:
`INITiate:GPRF:MEAS<i>:IQRecorder` etc.
`FETCh:GPRF:MEAS<i>:IQRecorder:STATe?`
`FETCh:GPRF:MEAS<i>:IQRecorder:STATe:ALL?`

3.3.5.2 I/Q Recorder Configuration

The "I/Q Recorder" measurement is configured using the parameters in the "I/Q Recorder Configuration" dialog. The dialog is opened automatically when the measurement is selected (e.g. from the task bar). The RF input path settings in the upper part of the dialog are also used by other GPRF measurements; see Signal Routing and Analyzer Settings.

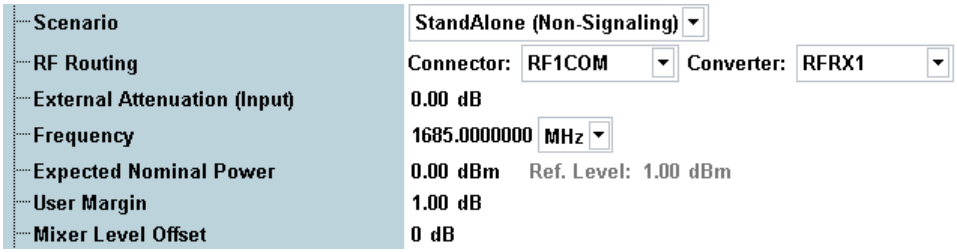


Fig. 3-57: GPRF measurements: Signal routing and analyzer settings

3.3.5.3 I/Q Recorder Configuration: Measurement Control

The "Measurement Control" parameters define how the R&S CMW acquires measurement data.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "System Overview"

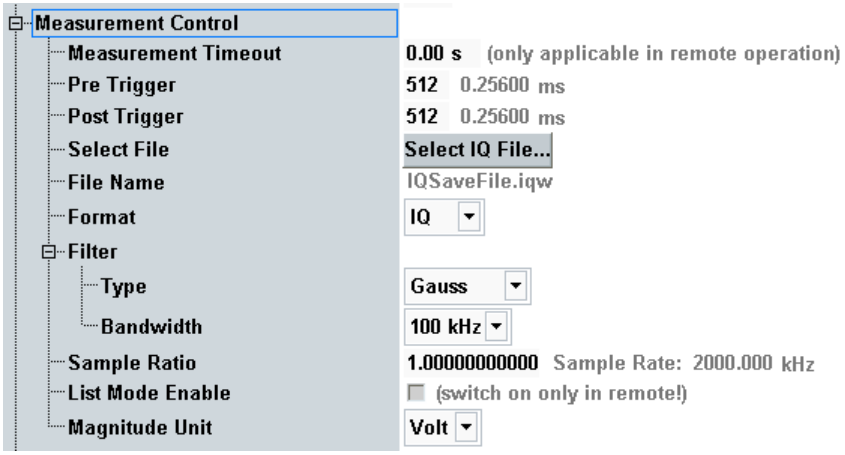


Fig. 3-58: I/Q Recorder Configuration: Measurement Control

Pre Trigger, Post Trigger
Defines the total number of samples and their position relative to the trigger event. The total number of samples is equal to the sum of the "Pre Trigger" and "Post Trigger" settings. The R&S CMW continuously acquires raw measurement data, so it is possible to evaluate results prior to the actual trigger event ("Pre Trigger" samples).

For free run measurements the individual "Pre Trigger" and "Post Trigger" settings are not relevant; the R&S CMW starts measuring immediately, acquiring the selected total number of samples.

Remote command:
`CONFigure:GPRF:MEAS<i>:IQRecorder:CAPTure`

Select File, File Name
Selects the name and path of a file that is used to store the I/Q Recorder results in binary format. To write the file the I/Q Recorder measurement must be started using the measurement control softkey.

Remote command:
`CONFigure:GPRF:MEAS<i>:IQRecorder:IQFile`

Format
Selects the coordinates that are used to represent the I/Q Recorder results: cartesian ("IQ") or polar ("RPhi").

Remote command:
`CONFigure:GPRF:MEAS<i>:IQRecorder:FORMat`

Filter
Sets the type and bandwidth of the measurement filter (IF filter). The R&S CMW provides filters of Gaussian shape with 3-dB bandwidths between 1 kHz and 10 MHz and bandpass filters with 3-dB bandwidths between 1 kHz and 40 MHz.

The bandpass filters are designed as root-raised cosine (RRC) filters with a roll-off of 0.1. This ensures steep filter edges with a wide, flat passband (90 % of the filter bandwidth). Compared to Gaussian filters, the bandpass filters require longer settling times and therefore increase the measurement duration.

Remote command:

```
CONFigure:GPRF:MEAS<i>:IQRecorder:FILTer:TYPE
CONFigure:GPRF:MEAS<i>:IQRecorder:FILTer:GAUSs:BWIDth
CONFigure:GPRF:MEAS<i>:IQRecorder:FILTer:BANDpass:BWIDth
```

Sample Ratio

Reduces the sampling rate (as defined by the filter settings) by a factor ≤1 and thus extends the total measurement time. See chapter 3.2.4.2, "Filter Settings and Samples", on page 102.

The resulting sampling rate is displayed for information purposes only.

Remote command:

```
CONFigure:GPRF:MEAS<i>:IQRecorder:RATio
CONFigure:GPRF:MEAS<i>:IQRecorder:IQSettings:SRATe
```

List Mode Enable

Indicates whether the list mode has been enabled via remote control command. See chapter 3.2.4.4, "List Mode", on page 104.

Remote command:

```
CONFigure:GPRF:MEAS<i>:IQRecorder:LIST
```

Magnitude Unit

Seletcs the physical unit for I/Q measurement results. The R&S CMW returns the I/Q amplitudes either in "Voltage" units (into a 50 Ω load impedance) or as linear "Raw" amplitudes in Int16 format (value range –32768 to +32767). The maximum raw amplitude value (full scale value) corresponds to the selected reference level (see "Expected Nominal Power" on page 116).

Irrespective of the selected magnitude unit, it is possible to retrieve the I/Q data in ASCII format or as binary 32-bit IEEE 754 floating point numbers; see chapter 3.2.4.3, "ASCII and Binary Data Formats", on page 103.

Remote command:

```
CONFigure:GPRF:MEAS<i>:IQRecorder:MUNit
```

3.3.5.4 I/Q Recorder Configuration: Trigger Settings

The "Trigger" parameters configure the trigger system for the "I/Q Recorder" measurement.

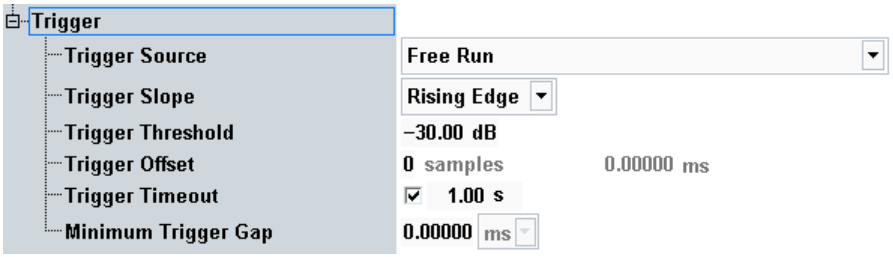


Fig. 3-59: I/Q Recorder Configuration: Trigger

Trigger Source
Selects the source of the trigger event. Some of the trigger sources require additional options.

"Free Run" The measurement starts immediately after it is initiated; no trigger is used. The remaining trigger settings are not relevant for "Free Run" measurements. See also "Pre Trigger, Post Trigger" on page 152.

"IF Power" The measurement is triggered by the measured power steps. The trigger event is generated after down-conversion of the measured RF signal to the IF band. "Trigger Slope", "Trigger Threshold" and the remaining trigger settings are valid for this trigger source; they should be adjusted to the measured power steps.

"...External..." External trigger signal fed in via TRIG A or TRIG B on the rear panel of the instrument.

"GPRF Gen..." Trigger event provided by the arbitrary waveform generator of a "GPRF Generator" application (option R&S CMW-B110A). The "GPRF Gen..." trigger events are generated while an ARB file is processed.

Remote command:
`TRIGger:GPRF:MEAS<i>:IQRecorder:CATalog:SOURce?`
`TRIGger:GPRF:MEAS<i>:IQRecorder:SOURce`

Trigger Slope
Qualifies whether the trigger event is generated at the rising or at the falling edge of the trigger pulse. This setting has no influence on "Free Run" measurements and for evaluation of trigger pulses provided by other firmware applications.

Remote command:
`TRIGger:GPRF:MEAS<i>:IQRecorder:SLOPe` on page 260

Trigger Offset
Defines a delay time for triggered measurements. The trigger offset delays the start of the measurement relative to the trigger event.

Remote command:
`TRIGger:GPRF:MEAS<i>:IQRecorder:OFFSet`

Trigger Threshold
Defines the input signal power where the trigger condition is satisfied and a trigger event is generated. The trigger threshold is valid for power trigger sources. It is a dB value, relative to the reference level minus the external attenuation (<Ref. Level> – <External Attenuation (Input)> – <Frequency Dependent External Attenuation>). If the reference level is set to the actual maximum output power of the DUT, and the external attenuation settings are in accordance with the test setup, then the trigger threshold is referenced to the actual maximum RF input power at the R&S CMW.

A low threshold may be required to ensure that the R&S CMW can always detect the input signal. A higher threshold can prevent unintended trigger events.

Remote command:
`TRIGger:GPRF:MEAS<i>:IQRecorder:THReshold`

Trigger Timeout
Sets a time after which an initiated measurement must have received a trigger event. If no trigger event is received, a trigger timeout is indicated in manual operation mode. In remote control mode the measurement is automatically stopped. The parameter can be disabled so that no timeout occurs.

This setting has no influence on "Free Run" measurements.

Remote command:
`TRIGger:GPRF:MEAS<i>:IQRecorder:TOUT`

Minimum Trigger Gap
Sets a minimum time during which the IF signal must be below the trigger threshold before the trigger is armed so that an IF power trigger event can be generated.

The I/Q Recorder measurement is always performed in single-shot mode, therefore it is controlled by a single trigger event. As a consequence the minimum trigger gap condition is valid between the start of the measurement and the first trigger event only.

Remote command:
`TRIGger:GPRF:MEAS<i>:IQRecorder:MGAP`

3.3.6 I/Q vs. Slot: Parameters and Settings

The "I/Q vs. Slot" measurement provides several groups of settings. The most important measurement settings are also displayed in the measurement dialog. The measurement dialog provides all measurement results.

I/Q vs. Slot measurement requires option CMW-KM011.

3.3.6.1 Measurement Control

The measurement is turned on or off using the ON | OFF or RESTART | STOP keys.

See also: "Measurement Control" in the R&S CMW user manual, chapter "System Overview"

I/Q vs. Slot (Softkey)
The softkey shows the current measurement state. Additional measurement substates may be retrieved via remote control.

Remote command:
`INITiate:GPRF:MEAS<i>:IQVSlot` etc.
`FETCh:GPRF:MEAS<i>:IQVSlot:STATe?`
`FETCh:GPRF:MEAS<i>:IQVSlot:STATe:ALL?`

3.3.6.2 I/Q vs. Slot Configuration

The "I/Q vs. Slot" measurement is configured using the parameters in the "I/Q vs. Slot Configuration" dialog. The RF input path settings in the upper part of the dialog are also used by other GPRF measurements; see Signal Routing and Analyzer Settings.

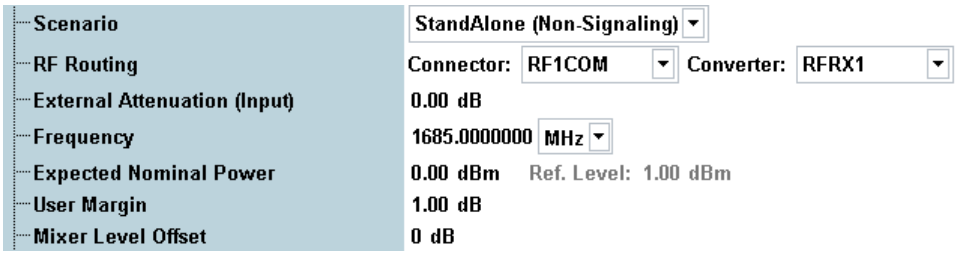


Fig. 3-60: GPRF measurements: Signal routing and analyzer settings

3.3.6.3 I/Q vs. Slot Configuration: Measurement Control

The "Measurement Control" parameters define how the R&S CMW acquires measurement data.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "System Overview"

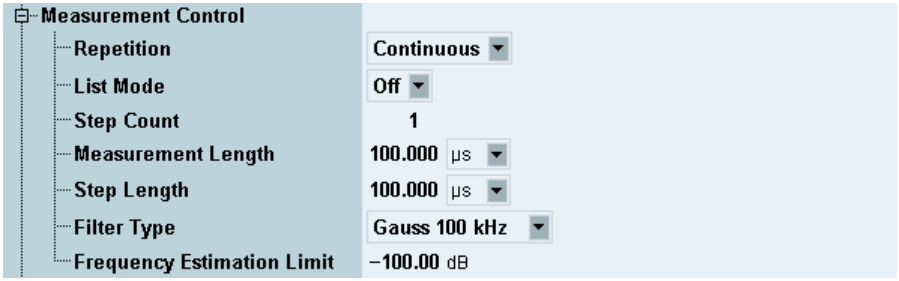


Fig. 3-61: I/Q vs. Slot Configuration: Measurement Control

Repetition
Defines how often the measurement is repeated if it is not stopped explicitly or by a failed limit check.

- **Continuous:** The measurement is continued until it is explicitly terminated; the results are periodically updated.
- **Single-Shot:** The measurement is stopped after one statistics cycle.

Single-shot is preferable if only a single measurement result is required under fixed conditions, which is typical for remote-controlled measurements. Continuous mode is suitable for monitoring the evolution of the measurement results in time and observe how they depend on the measurement configuration, which is typically done in manual control. The reset/preset values therefore differ from each other.

In the "I/Q vs. Slot" measurement, the meaning of one statistics cycle depends on the I/Q vs. Slot Configuration: List Configuration:

- With disabled list mode, the statistics cycle is equal to one subsweep comprising <Step Count> measurement steps.
- In list mode, the statistics cycle comprises the selected number of subsweeps.

Remote command:
`CONFigure:GPRF:MEAS<i>:IQVSlot:REPetition`

Step Count
Defines the number of measurement steps per subsweep; see Power Steps and Subsweeps.

Note: The number of steps, i.e. the step count times the number of subsweeps (in list mode) must not exceed 3000. The R&S CMW auto-adjusts the settings if an excess step count or number of subsweeps is entered.

Remote command:
`CONFigure:GPRF:MEAS<i>:IQVSlot:SCOunt`

Step Length
Sets the time between the beginning of two consecutive measured power steps. If no gaps occur between the steps the step length should be simply set to the length of each step. Together with the "Measurement Length", the step length determines the time intervals where the R&S CMW evaluates the acquired data; see below.

The step length must be set precisely in accordance with the properties of the input signal, especially if the R&S CMW measures many steps without a new trigger event (large "Step Count", see Power Steps and Subsweeps). Inaccurate settings result in a drift of the evaluation intervals with respect to the power steps of the input signal, so that eventually the power is measured across subsequent steps.

Remote command:

`CONFigure:GPRF:MEAS<i>:IQVSlot:SLENgth`

Measurement Length

Sets the length of the averaging intervals that the R&S CMW uses to calculate the "I/Q vs. Slot" results for each measurement step. The measurement data is acquired continuously, however, data outside the measurement length is discarded. The first evaluation interval starts immediately after the trigger event plus a possible "Trigger Offset" (for triggered measurements) or after the measurement is started ("Free Run" measurement).

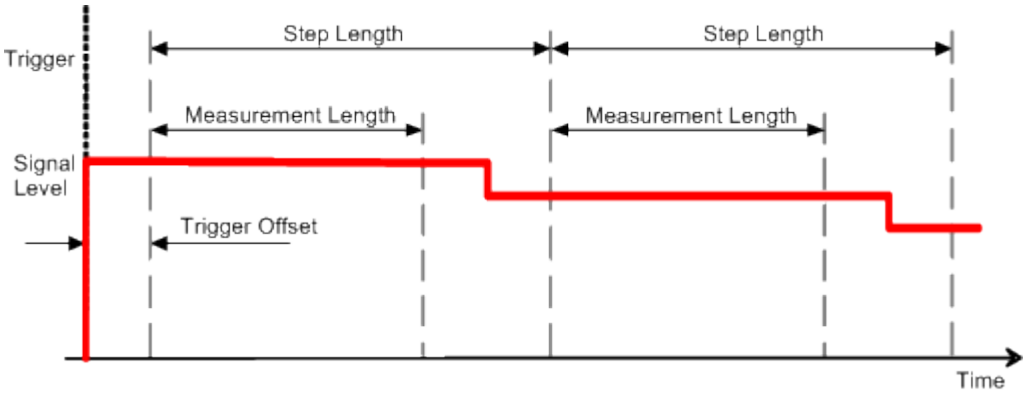


Fig. 3-62: Measurement Length, Step Length and Trigger Offset

Select your measurement length smaller than the actual width of the power steps to avoid the transients caused by the power steps of your input signal. A shortened first step or a trigger offset can shift the "Measurement Length" relative to the power steps; see Power Steps and Subsweeps.

Remote command:

`CONFigure:GPRF:MEAS<i>:IQVSlot:MLENgth`

Filter Type

Sets the type and bandwidth of the measurement filter (IF filter). The R&S CMW provides a filter of Gaussian shape and a Nyquist filter with 3-dB bandwidths of 100 kHz. Due to its shorter settling time, the Gaussian filter is particularly suited for short step lengths.

Remote command:

`CONFigure:GPRF:MEAS<i>:IQVSlot:FTYPe`

Frequency Estimation Limit

Defines a minimum average signal level for all measurement steps to be considered for the calculation of the average frequency per subsweep and the "Overall Frequency Error". The limit is defined in dB, relative to the "Expected Nominal Power" of each subsweep.

The "Frequency Estimation Limit" can be used to exclude steps where no signal is transmitted. Measurement steps below the "Frequency Estimation Limit" are still displayed with their measured I/Q amplitudes, however, a possible measurement inaccuracy will not affect the frequency correction and the "Overall Frequency Error".

See also description of the Measurement Procedure.

Remote command:

```
CONFigure:GPRF:MEAS<i>:IQVSlot:FELimit
```

3.3.6.4 I/Q vs. Slot Configuration: Trigger Settings

The "Trigger" parameters configure the trigger system for the "I/Q vs. Slot" measurement.

Fig. 3-63: I/Q vs. Slot Configuration: Trigger

Trigger Source
Selects the source of the trigger event. Some of the trigger sources require additional options.

"Free Run" The measurement starts immediately after it is initiated; no trigger is used. The remaining trigger settings are not relevant for "Free Run" measurements.

"IF Power" The measurement is triggered by the measured power steps. The trigger event is generated after down-conversion of the measured RF signal to the IF band. The "Trigger Slope", "Trigger Threshold", "Trigger Offset", and the remaining trigger settings are valid for this trigger mode; they should be adjusted to the measured power steps. Each trigger event starts an entire measurement comprising the selected number of subsweeps.

"...External..." External trigger signal fed in via TRIG A or TRIG B on the rear panel of the instrument.

"GPRF Gen..." Trigger event provided by the arbitrary waveform generator of a "GPRF Generator" application (option R&S CMW-B110A). The "GPRF Gen..." trigger events are generated while an ARB file is processed.

Remote command:

```
TRIGger:GPRF:MEAS<i>:IQVSlot:CATalog:SOURce?
TRIGger:GPRF:MEAS<i>:IQVSlot:SOURce
```

Trigger Slope
Qualifies whether the trigger event is generated at the rising or at the falling edge of the trigger pulse. This setting has no influence on "Free Run" measurements and for evaluation of trigger pulses provided by other firmware applications.

Remote command:
`TRIGger:GPRF:MEAS<i>:IQVSlot:SLOPe`

Trigger Threshold
Defines the input signal power where the trigger condition is satisfied and a trigger event is generated. The trigger threshold is valid for power trigger sources. It is a dB value, relative to the reference level minus the external attenuation (<Ref. Level> – <External Attenuation (Input)> – <Frequency Dependent External Attenuation>). If the reference level is set to the actual maximum output power of the DUT, and the external attenuation settings are in accordance with the test setup, then the trigger threshold is referenced to the actual maximum RF input power at the R&S CMW.

A low threshold may be required to ensure that the R&S CMW can always detect the input signal. A higher threshold can prevent unintended trigger events.

Remote command:
`TRIGger:GPRF:MEAS<i>:IQVSlot:THReshold`

Trigger Offset
Defines a time delaying the start of the measurement relative to the trigger event. This setting has no influence on "Free Run" measurements.

See also Measurement Length.

Remote command:
`TRIGger:GPRF:MEAS<i>:IQVSlot:OFFSet`

Trigger Timeout
Sets a time after which an initiated measurement must have received a trigger event. If no trigger event is received, a trigger timeout is indicated in manual operation mode. In remote control mode the measurement is automatically stopped. The parameter can be disabled so that no timeout occurs.

This setting has no influence on "Free Run" measurements.

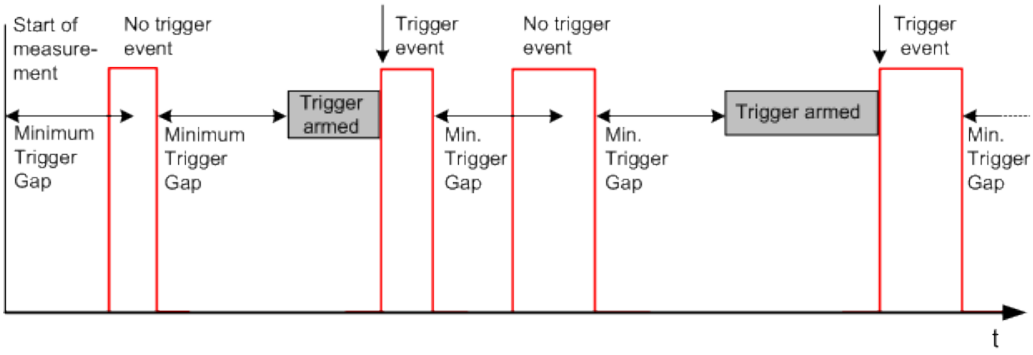
Remote command:
`TRIGger:GPRF:MEAS<i>:IQVSlot:TOUT`

Minimum Trigger Gap
Defines a minimum duration of the power-down periods (gaps) between two triggered power pulses. This setting is valid for an "(IF) Power" trigger source.

The trigger system is controlled by means of a timer which is reset to zero in the following instances:

- At the IF power-down ramp of each triggered or untriggered pulse, even though the previous counter may not have elapsed yet. A power-down ramp is detected when the signal power falls below the trigger threshold.
- At the beginning of each measurement: The minimum gap defines the minimum time between the start of the measurement and the first trigger event.

The trigger system is re-armed as soon as the timer has reached the specified minimum gap.



The "Minimum Trigger Gap" can be used to prevent unwanted trigger events due to fast power variations. Such events may occur e.g. for measurements on 8PSK-modulated bursts where the power can drop for a short time.

Remote command:

`TRIGger:GPRF:MEAS<i>:IQVSlot:MGAP`

Trigger Mode

Defines the trigger scheme for the measured step sequence. Each trigger event (e.g. an event derived from the RF input power ramp) can trigger an entire measurement cycle or a subsweep. This setting has no impact on "Free Run" measurements.

For details on the "Trigger Mode" refer to chapter 3.2.5.3, "Trigger Modes", on page 107. The subsweeps for the "Retrigger Preselect" mode are selected in the "List Configuration" section.

Remote command:

`TRIGger:GPRF:MEAS<i>:IQVSlot:MODE`

3.3.6.5 I/Q vs. Slot Configuration: List Configuration

The "List Configuration" parameters activate and configure the list mode. In this mode the GPRF "I/Q vs. Slot" measurement extends over a series of consecutive subsweeps with individual analyzer settings; see Power Steps and Subsweeps.

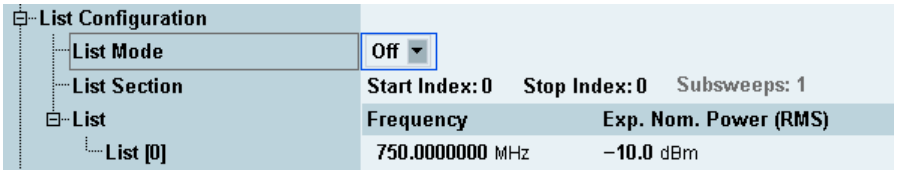


Fig. 3-64: I/Q vs. Slot Configuration: List Configuration

List Mode
Enables or disables the list mode. "Off" means that the "I/Q vs. Slot" measurement yields results for a single series of steps at constant analyzer settings (one subsweep). If the "List Mode" is switched on, the R&S CMW measures a series of subsweeps in accordance with the "Freq. / Exp. Nom Pow. List" settings.

Remote command:
```
CONFigure:GPRF:MEAS<i>:IQVSlot:LIST
```

List Section
Defines the number of measured subsweeps. The R&S CMW measures all subsweeps between the "Start Index" and the "Stop Index" in the list; the number of "Subsweeps" measured (Subsweeps = Stop Index - Start Index + 1) is displayed for information.

Note: The number of steps, i.e. the "Step Count" times the number of subsweeps must not exceed 3000. The R&S CMW auto-adjusts the settings if an excess step count or number of subsweeps is entered.

Remote command:
```
CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:STARt
CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:STOP
CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:SSTop
CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:COUNt?
```

List
Definition of up to 200 not necessarily different pairs of frequencies and levels. The value range for the frequency covers the entire configurable input frequency range of the instrument, the level range depends on the selected RF connector.

The power values in the list configure the analyzer of the R&S CMW in accordance with the input power of the measured RF signal. Selecting (approximately) correct values can improve the accuracy of the "I/Q vs. Slot" measurement. To avoid an overload of the input path, the "User Margin" should account for possible power variations of the input signal (crest factor).

Remote command:
```
CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:FREQuency
CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:FREQuency:ALL
CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:ENPower
CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:ENPower:ALL
CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:RETRigger
CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:RETRigger:ALL
```

3.3.6.6 I/Q vs. Slot Configuration: Display Configuration

The "Display" parameters configure the appearance of the measurement menu and select the displayed results.

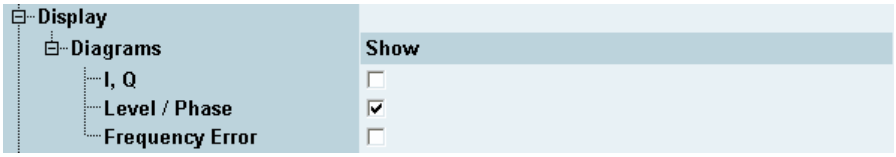


Fig. 3-65: I/Q vs. Slot Configuration: Display Parameters

Display - Diagrams
Switches between "Level / Phase" and I, Q representation, and shows or hides the frequency error diagram; see Measurement Results.

3.3.6.7 Measurement Results

The "I/Q vs. Slot" measurement dialog shows all measurement results plus the essential measurement settings; see detailed description in section Measurement Results.

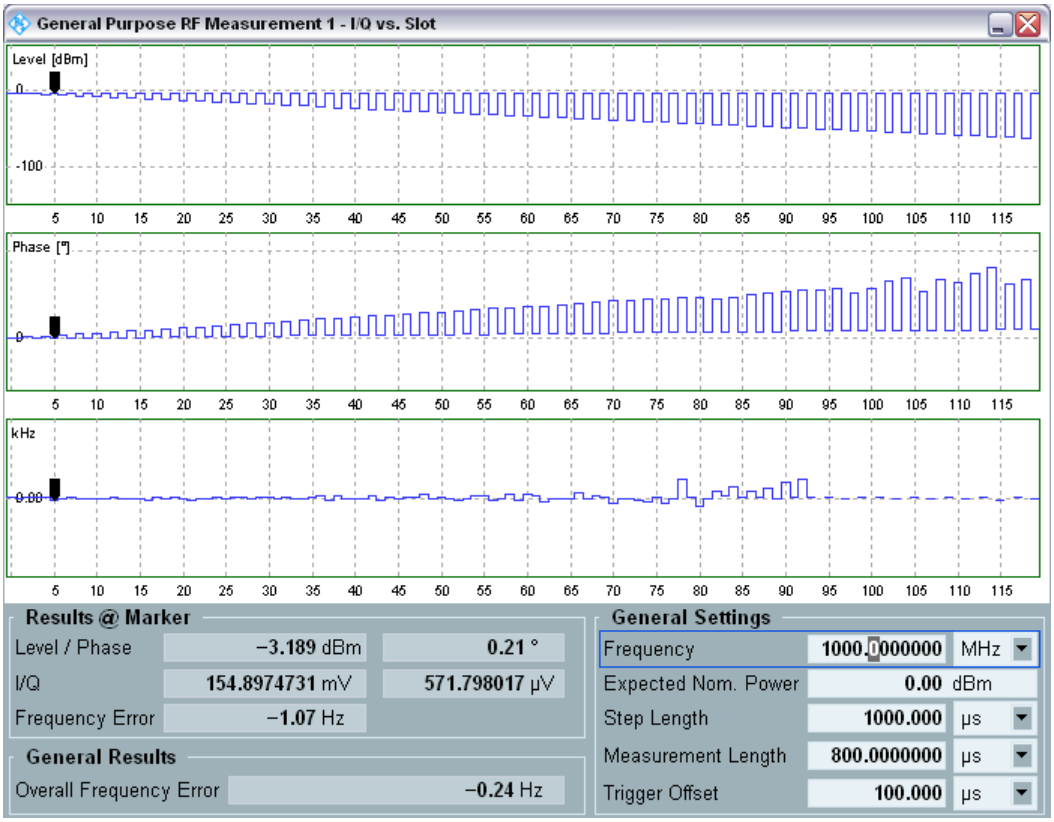


Fig. 3-66: I/Q vs. Slot measurement results: Diagram View

- **Diagrams**:
  "I/Q vs. Slot" results at all measurement steps.
- **Result panels**:
  Measurement results at the current marker position and overall (averaged) frequency error.
- **Settings panels**:

Overview of the essential current settings of the "I/Q vs. Slot" measurement.

SCPI command:

`FETCh:GPRF:MEAS<i>:IQVSlot:LEVel?` etc., see Measurement Results

3.3.7 External Power Sensor: Parameters and Settings

The External Power Sensor measurement provides several groups of settings. The most important measurement settings are also displayed in the measurement dialog. The measurement dialog provides all measurement results.

3.3.7.1 Measurement Control

The measurement is turned on or off using the ON | OFF or RESTART | STOP keys.

See also: "Measurement Control" in the R&S CMW user manual, chapter "System Overview"

EPS (Softkey)
The softkey shows the current measurement state. Additional measurement substates may be retrieved via remote control.

Remote command:

`INITiate:GPRF:MEAS<i>:EPSensor` etc.

`FETCh:GPRF:MEAS<i>:EPSensor:STATe?`

`FETCh:GPRF:MEAS<i>:EPSensor:STATe:ALL?`

`FETCh:GPRF:MEAS<i>:EPSensor:IDN?`

Start Zeroing
Initiates Zeroing of the external power sensor. The "Start Zeroing" hotkey is associated with the "EPS" measurement control softkey.

Remote command:

`CALibration:GPRF:MEAS<i>:EPSensor:ZERO`

3.3.7.2 External Power Sensor Configuration

The External Power Sensor measurement is configured using the parameters in the External Power Sensor Configuration dialog described below.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "System Overview"

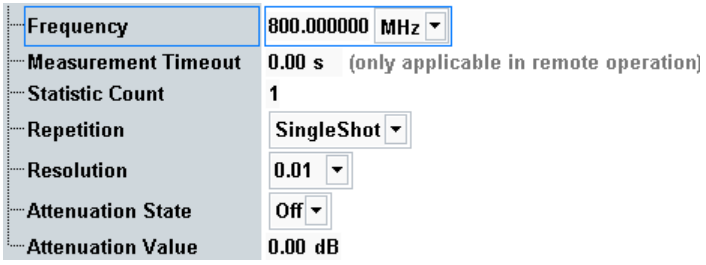


Fig. 3-67: External Power Sensor configuration

Frequency
Specifies the input frequency at the power sensor. The value is used for the frequency response correction of the sensor measurement result.

Although R&S NRP sensors measure the RF power over a wide bandwidth, the correct frequency of the RF signal should be entered for maximum accuracy.

Remote command:
`CONFigure:GPRF:MEAS<i>:EPSensor:FREQuency`

Measurement Timeout
Defines a timeout for the remote measurement.

Remote command:
`CONFigure:GPRF:MEAS<i>:EPSensor:TOUT`

Statistic Count
Defines the number of measurement intervals per measurement cycle (statistics cycle, single-shot measurement). This value is also relevant for continuous measurements, because the averaging procedures depend on the statistic count.

In the External Power Sensor measurement, the statistic count corresponds to the number of power results requested from the power sensor.

See also: "Statistical Results" in the R&S CMW user manual, chapter "System Overview"

Remote command:
`CONFigure:GPRF:MEAS<i>:EPSensor:SCOunt`

Repetition
Defines how often the measurement is repeated if it is not stopped explicitly or by a failed limit check.

- **Continuous:** The measurement is continued until it is explicitly terminated; the results are periodically updated.
- **Single-Shot:** The measurement is stopped after one statistics cycle.

Single-shot is preferable if only a single measurement result is required under fixed conditions, which is typical for remote-controlled measurements. Continuous mode is suitable for monitoring the evolution of the measurement results in time and observe how they depend on the measurement configuration, which is typically done in manual control. The reset/preset values therefore differ from each other.

Remote command:
`CONFigure:GPRF:MEAS<i>:EPSensor:REPetition`

Resolution
Defines the number of digits of the power results in the measurement dialog.

Remote command:
`CONFigure:GPRF:MEAS<i>:EPSensor:RESolution`

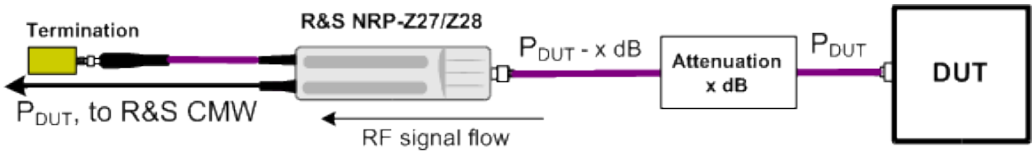
Attenuation State
Enable or disables an external input "Attenuation Value" for the external power sensor measurement; see below.

Remote command:
`CONFigure:GPRF:MEAS<i>:EPSensor:ATTenuation:STATe`

Attenuation Value
If it is enabled ("Attenuation State: ON"), the attenuation factor corrects the power reading of the external power sensor.

An external attenuation is suitable if the test setup contains attenuation pads or amplifiers, e.g. to adjust the output power of the DUT to the input power range of the sensor. An appropriate attenuation value ensures that the measured powers are referenced to the output of the DUT.

- Positive values increase the power reading, compensating for an attenuation.
- Negative values reduce the power reading, compensating for an amplification factor.



Remote command:
`CONFigure:GPRF:MEAS<i>:EPSensor:ATTenuation`

3.3.7.3 Measurement Results

The "External Power Sensor" measurement dialog shows all results; see detailed description in section Measurement Results.

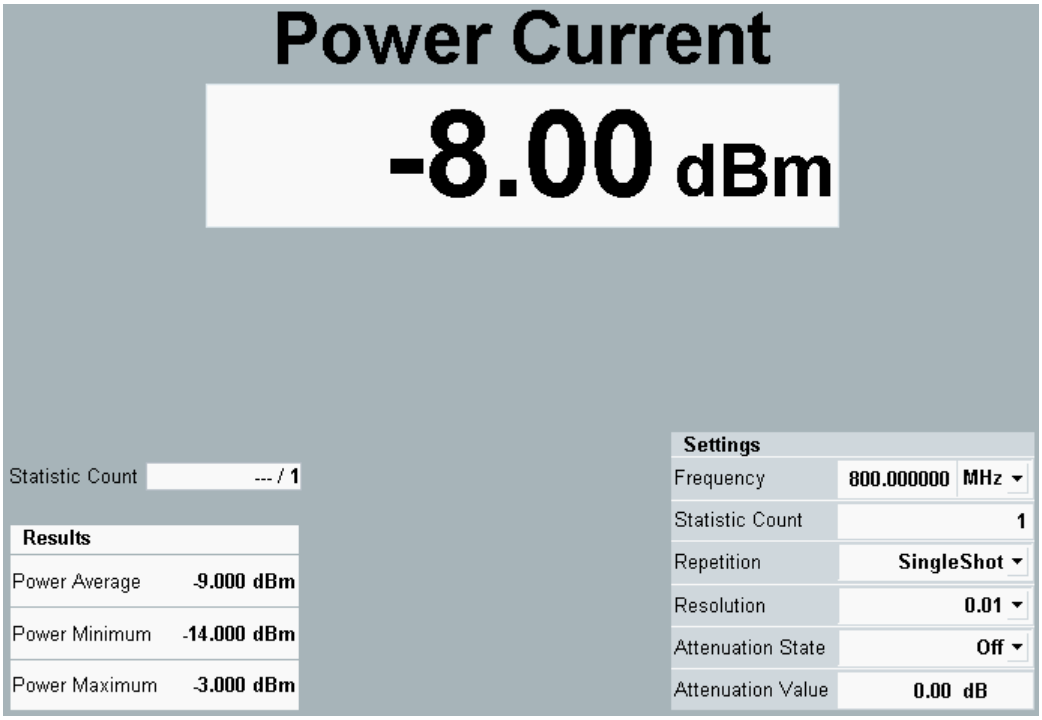


Fig. 3-68: External Power Sensor: Measurement results

- **Statistic Count and Power Results**:
  Statistical evaluation of the sensor power results at the selected frequency.
  SCPI command:
  `FETCh:GPRF:MEAS<i>:EPSensor?` etc.
- **Settings panels**:
  Overview of the essential current settings of the "External Power Sensor" measurement.

See also: "Statistical Results" in the R&S CMW user manual, chapter "System Overview"

3.4 Programming

The following sections provide programming examples for the General Purpose RF (GPRF) measurements.

See also: "Remote Control" in the R&S CMW user manual

3.4.1 Power Measurement

The following examples show how to configure the "Power" measurement via a remote control program and retrieve measurement results.

3.4.1.1 Key Features

The "Power" measurement is programmed as follows:

- The measurement is controlled by SCPI commands with the following syntax: `...GPRF:MEAS:POWer...`
- Use general commands of the type `...:GPRF:MEAS...` (no `:POWer` mnemonic) to define the signal routing and perform RF and analyzer settings.
- After a `*RST`, the measurement is switched off. Use `READ:GPRF:MEAS:POWer?` to initiate a single-shot measurement and retrieve the results.

Advanced settings

You can also run the measurement in continuous mode and retrieve the results using `FETCh:GPRF:MEAS:POWer...?`.

3.4.1.2 Specifying General Measurement Settings

```
// ***************************************************************************
// System-Reset
// ***************************************************************************
*RST; *OPC?
*CLS; *OPC?

// ***************************************************************************
// Test activating "Combined Signal Path" and a "Measure @ Protocol Test",
// Select a standalone measurement,
// define signal routing, perform RF and analyzer settings
// for a 20 dBm GSM signal at a GSM900-specific frequency (channel no. 1)
// ***************************************************************************

ROUTe:GPRF:MEAS:SCENario:CATalog:CSPath?
ROUTe:GPRF:MEAS:SCENario:CSPath "GSM Sig1"
ROUTe:GPRF:MEAS:SCENario:MAPRotocol

ROUTe:GPRF:MEAS:SCENario:SALone RF1C, RX1
ROUTe:GPRF:MEAS:SCENario?
```

```
ROUTe:GPRF:MEAS?

CONFigure:GPRF:MEAS:RFSettings:EATTenuation 2
CONFigure:GPRF:MEAS:RFSettings:FREQuency 890.2E+6
CONFigure:GPRF:MEAS:RFSettings:ENPower 20
CONFigure:GPRF:MEAS:RFSettings:UMARgin 5
CONFigure:GPRF:MEAS:RFSettings:MLOFfset 2
```

3.4.1.3 Specifying Measurement-Specific Settings

```
// ***************************************************************************
// Set a measurement-specific timeout value of 1 s.
// Define step in accordance with GSM timeslot
// and measurement length
// ***************************************************************************

CONFigure:GPRF:MEAS:POWer:TOUT 1
CONFigure:GPRF:MEAS:POWer:SLENgth 577.9230769E-6
CONFigure:GPRF:MEAS:POWer:MLENgth 400E-6

// ***************************************************************************
// Define measurement statistics (5 GSM timeslots)
// ***************************************************************************
CONFigure:GPRF:MEAS:POWer:SCOunt 5

// ***************************************************************************
// Select 30 kHz Gauss measurement filter
// ***************************************************************************
CONFigure:GPRF:MEAS:POWer:FILTer:TYPE GAUSs
CONFigure:GPRF:MEAS:POWer:FILTer:GAUSs:BWIDth 30E+3

// ***************************************************************************
// Configure power measurement trigger
// ***************************************************************************
TRIGger:GPRF:MEAS:POWer:SOURce 'IF Power'
TRIGger:GPRF:MEAS:POWer:SLOPe REDGe
TRIGger:GPRF:MEAS:POWer:THReshold -25
TRIGger:GPRF:MEAS:POWer:OFFSet 50E-6
TRIGger:GPRF:MEAS:POWer:TOUT 2
TRIGger:GPRF:MEAS:POWer:MGAP 0.0001
TRIGger:GPRF:MEAS:POWer:MODE ONCE

WAITKEY >Configuration completed, press "OK" to start measurement<
```

3.4.1.4 Performing a Single-Shot Measurement

```
// ***************************************************************************
// Start single-shot measurement, return RMS-averaged power in last
// measured timeslot. Repeat measurement, return average power over the
```

```
// entire statistics cycle of 5 slots. Check error codes; query the
// measurement state (should be "RDY").
// ******************************************************************************
READ:GPRF:MEAS:POWer:RMS:CURRent?
READ:GPRF:MEAS:POWer:RMS:AVERage?
CALCulate:GPRF:MEAS:POWer:AVERage?
FETCh:GPRF:MEAS:POWer:STATe?

WAITKEY >Single-slot measurement completed, press "OK" to configure list mode<
```

3.4.1.5 Configuring the List Mode

```
// ******************************************************************************
// Set up a measurement in list mode and over 8 slots (1 GSM frame).
// Query no. of measured slots (8). Query and modify the frequency and
// expected nominal power of the first and second slot using two
// different methods.
// ******************************************************************************
CONFigure:GPRF:MEAS:POWer:LIST ON
CONFigure:GPRF:MEAS:POWer:LIST:STARt 0
CONFigure:GPRF:MEAS:POWer:LIST:STOP 7
CONFigure:GPRF:MEAS:POWer:LIST:COUNt?
CONFigure:GPRF:MEAS:POWer:LIST:FREQuency? 0
CONFigure:GPRF:MEAS:POWer:LIST:FREQuency 0, 7.55E+8; FREQuency 1, 7.56E+8
CONFigure:GPRF:MEAS:POWer:LIST:FREQuency:ALL 7.55E+8, 7.56E+8
CONFigure:GPRF:MEAS:POWer:LIST:ENPower? 0
CONFigure:GPRF:MEAS:POWer:LIST:ENPower 0, -5; ENPower 1, -5
CONFigure:GPRF:MEAS:POWer:LIST:ENPower:ALL -5, -5
```

3.4.1.6 Single-Shot and Continuous Power Measurements

```
// ******************************************************************************
// Start single-shot measurement, return RMS-averaged power in last
// measured timeslot. Return standard deviation of the RMS power results
// (without repeating the measurement).
// Query the measurement state (should be "RDY").
// ******************************************************************************
INIT:GPRF:MEAS:POWer
FETCh:GPRF:MEAS:POWer:CURRent?
FETCh:GPRF:MEAS:POWer:SDEViation?
FETCh:GPRF:MEAS:POWer:STATe?

// ******************************************************************************
// Start continuous measurement; wait for 5 ms and return last valid result
// for the power in last measured timeslot of the current measurement
// cycle. Query measurement state and substates (should be "RUN,ADJ,ACT").
// ******************************************************************************
CONFigure:GPRF:MEAS:POWer:REPetition CONTinuous
INIT:GPRF:MEAS:POWer
```

```
Pause 5000
FETCh:GPRF:MEAS:POWer:CURRent?
FETCh:GPRF:MEAS:POWer:STATe:ALL?
FETCh:GPRF:MEAS:POWer:ESTatistics?
```

3.4.1.7 Performing an I/Q Data Measurement

```
// ***************************************************************************
// System-Reset
// ***************************************************************************
*RST; *OPC?
*CLS; *OPC?

// ***************************************************************************
// Configure the extended list mode:
// Parameter set no. 1 for WCDMA, parameter set 2 for GSM
// ***************************************************************************

CONFigure:GPRF:MEAS:POWer:PSET:FILTer:TYPE 0, BANDpass
CONFigure:GPRF:MEAS:POWer:PSET:FILTer:TYPE 1, GAUSs
CONFigure:GPRF:MEAS:POWer:PSET:FILTer:TYPE:ALL?
CONFigure:GPRF:MEAS:POWer:PSET:FILTer:BWIDth 0, 5MHz
CONFigure:GPRF:MEAS:POWer:PSET:FILTer:BWIDth 1, 500kHz
CONFigure:GPRF:MEAS:POWer:PSET:FILTer:BWIDth:ALL?
CONFigure:GPRF:MEAS:POWer:PSET:SLENgth 0, 666.667us
CONFigure:GPRF:MEAS:POWer:PSET:SLENgth 1, 576.923us
CONFigure:GPRF:MEAS:POWer:PSET:SLENgth:ALL?
CONFigure:GPRF:MEAS:POWer:PSET:MLENgth 0, 566.667us
CONFigure:GPRF:MEAS:POWer:PSET:MLENgth 1, 476.923us
CONFigure:GPRF:MEAS:POWer:PSET:MLENgth:ALL?
TRIGger:GPRF:MEAS:POWer:PSET:OFFSet 0, 5.0e-5
TRIGger:GPRF:MEAS:POWer:PSET:OFFSet 1, 5.0e-5
TRIGger:GPRF:MEAS:POWer:PSET:OFFSet:ALL?

// ***************************************************************************
// Activate extended list mode: ensure appropriate trigger settings,
// assign parameter set no. 1 and 2 to the first two steps.
// ***************************************************************************

CONFigure:GPRF:MEAS:POWer:LIST ON
CONFigure:GPRF:MEAS:POWer:LIST:STARt 0
CONFigure:GPRF:MEAS:POWer:LIST:STOP 1
CONFigure:GPRF:MEAS:POWer:LIST:RETrigger 1, ON
TRIGger:GPRF:MEAS:POWer:MODE PRESelect
CONFigure:GPRF:MEAS:POWer:PSET LIST

CONFigure:GPRF:MEAS:POWer:LIST:PSET 0, 0
CONFigure:GPRF:MEAS:POWer:LIST:PSET 1, 1
CONFigure:GPRF:MEAS:POWer:LIST:PSET:ALL?
```

```
// ***************************************************************************
// Activate I/Q data measurement for both steps.
// ***************************************************************************

CONFigure:GPRF:MEAS:POWer:LIST:IQData:CAPTure ON
CONFigure:GPRF:MEAS:POWer:LIST:MUNit VOLT
CONFigure:GPRF:MEAS:POWer:LIST:IQData 0, ON
CONFigure:GPRF:MEAS:POWer:LIST:IQData 1, ON
CONFigure:GPRF:MEAS:POWer:LIST:IQData:ALL?

// ***************************************************************************
// Check sampling rate for I/Q data measurement and number of samples
// (the total no. of samples must be below 4.000.000).
// Start single shot measurement and return I/Q data in both steps.
// ***************************************************************************

FETCh:GPRF:MEAS:POWer:IQINfo? 0
FETCh:GPRF:MEAS:POWer:IQINfo? 1
INITiate:GPRF:MEAS:POWer; *WAI
FETCh:GPRF:MEAS:POWer:IQData? 0
FETCh:GPRF:MEAS:POWer:IQData? 1
FETCh:GPRF:MEAS:POWer:IQData:BIN? 0
FETCh:GPRF:MEAS:POWer:IQData:BIN? 1
SYSTem:ERRor?
```

3.4.2 I/Q vs. Slot Measurement

The following examples show how to configure the "I/Q vs. Slot" measurement via a remote-control program and retrieve measurement results.

3.4.2.1 Key Features

The "I/Q vs. Slot" measurement is programmed as follows:

- The measurement is controlled by SCPI commands with the following syntax: `...GPRF:MEAS:IQVSlot...`
- Use general commands of the type `...:GPRF:MEAS...` (no `:IQVSlot` mnemonic) to define the signal routing and perform RF and analyzer settings.
- After a `*RST`, the measurement is switched off. Use `READ:GPRF:MEAS:IQVSlot?` to initiate a single-shot measurement and retrieve the results.

Advanced settings

You can also run the measurement in continuous mode and retrieve the results using `FETCh:GPRF:MEAS:IQVSlot...?`.

Use the list mode to perform measurements over several consecutive sweeps.

3.4.2.2 Specifying General Measurement Settings

```
// ***************************************************************************
// System-Reset
// ***************************************************************************
*RST; *OPC?
*CLS; *OPC?

// ***************************************************************************
// Define signal routing, perform RF and analyzer settings
// for a 20 dBm RF signal
// ***************************************************************************
ROUTe:GPRF:MEAS:RFSettings:CONNector RF1C
CONFigure:GPRF:MEAS:RFSettings:EATTenuation 2
CONFigure:GPRF:MEAS:RFSettings:ENPower 20
CONFigure:GPRF:MEAS:RFSettings:UMARgin 5
CONFigure:GPRF:MEAS:RFSettings:FREQuency 890.2E+6
```

3.4.2.3 Specifying Measurement-Specific Settings

```
// ***************************************************************************
// Set a measurement-specific timeout value of 1 s.
// Define step in accordance with GSM timeslot
// and measurement length, exclude steps smaller than -80 dB
// from the calculation of the average frequency error
// ***************************************************************************

CONFigure:GPRF:MEAS:IQVSlot:TOUT 1
CONFigure:GPRF:MEAS:IQVSlot:SLENgth 577.9230769E-6
CONFigure:GPRF:MEAS:IQVSlot:MLENgth 400E-6
CONFigure:GPRF:MEAS:IQVSlot:FELimit -8.000000E+001

// ***************************************************************************
// Define measurement statistics (8 GSM timeslots)
// ***************************************************************************
CONFigure:GPRF:MEAS:IQVSlot:SCOunt 8

// ***************************************************************************
// Select 100 kHz Gauss measurement filter
// ***************************************************************************
CONFigure:GPRF:MEAS:IQVSlot:FTYPe GAUSs

// ***************************************************************************
```

```
// Select an IF power trigger with appropriate characteristics
// ******************************************************************************
TRIGger:GPRF:MEAS:IQVSlot:CATalog:SOURce?
TRIGger:GPRF:MEAS:IQVSlot:SOURce "IF Power"
TRIGger:GPRF:MEAS:IQVSlot:SLOPe REDGe
TRIGger:GPRF:MEAS:IQVSlot:THReshold -25
TRIGger:GPRF:MEAS:IQVSlot:OFFSet 50E-6
TRIGger:GPRF:MEAS:IQVSlot:TOUT 2
TRIGger:GPRF:MEAS:IQVSlot:MGAP 550E-6
TRIGger:GPRF:MEAS:IQVSlot:MODE ONCE

WAITKEY >Configuration completed, press "OK" to start measurement<
```

3.4.2.4 Performing a Single-Shot Measurement

```
// ******************************************************************************
// Start single-shot measurement, return average level in 8 steps.
// Re-start the measurement and return average phase.
// ******************************************************************************
READ:GPRF:MEAS:IQVSlot:LEVel?
READ:GPRF:MEAS:IQVSlot:PHASe?

WAITKEY >Single-slot measurement completed, press "OK" to configure list mode<
```

3.4.2.5 Configuring the List Mode

```
// ******************************************************************************
// Set up a measurement in list mode and over 5 subsweeps.
// Query no.of measurement steps (5 times the step count = 40)
// Configure the list frequencies and expected nominal powers
// ******************************************************************************
CONFigure:GPRF:MEAS:IQVSlot:LIST ON
CONFigure:GPRF:MEAS:IQVSlot:LIST:STARt 0
CONFigure:GPRF:MEAS:IQVSlot:LIST:STOP 4
CONFigure:GPRF:MEAS:IQVSlot:LIST:COUNt?
CONFigure:GPRF:MEAS:IQVSlot:LIST:FREQuency? 0
CONFigure:GPRF:MEAS:IQVSlot:LIST:FREQuency 0, 7.55E+8; FREQuency 1, 7.56E+8
CONFigure:GPRF:MEAS:IQVSlot:LIST:FREQuency:ALL 7.55E+8, 7.56E+8
CONFigure:GPRF:MEAS:IQVSlot:LIST:ENPower:ALL?
CONFigure:GPRF:MEAS:IQVSlot:LIST:ENPower? 0
CONFigure:GPRF:MEAS:IQVSlot:LIST:ENPower 0, -5; ENPower 1, -5
CONFigure:GPRF:MEAS:IQVSlot:LIST:ENPower:ALL -5, -5
```

3.4.2.6 Single-Shot and Continuous Measurements

```
// ******************************************************************************
// Start single-shot measurement and query measurement state.
// Return the average I and Q amplitudes and the frequency error
```

```
// for each step (without repeating the measurement).
// ******************************************************************************
INIT:GPRF:MEAS:IQVSlot
FETCh:GPRF:MEAS:IQVSlot:STATe?
FETCh:GPRF:MEAS:IQVSlot:I?
FETCh:GPRF:MEAS:IQVSlot:Q?
FETCh:GPRF:MEAS:IQVSlot:FERRor?

// ******************************************************************************
// Start continuous measurement, return last valid result for
// the average level per step and the overall frequency error.
// Query measurement state and substates (should be "RUN,ADJ,ACT").
// ******************************************************************************
ABORt:GPRF:MEAS:IQVSlot
FETCh:GPRF:MEAS:IQVSlot:STATe?
CONFigure:GPRF:MEAS:IQVSlot:REPetition CONTinuous
INIT:GPRF:MEAS:IQVSlot
FETCh:GPRF:MEAS:IQVSlot:STATe?
FETCh:GPRF:MEAS:IQVSlot:LEVel?
FETCh:GPRF:MEAS:IQVSlot:OFERror?
FETCh:GPRF:MEAS:IQVSlot:STATe?
FETCh:GPRF:MEAS:IQVSlot:STATe:ALL?
```

3.4.3 I/Q Recorder Measurement

The following examples show how to configure the "I/Q Recorder" measurement via a remote-control program and retrieve measurement results.

3.4.3.1 Key Features

The "I/Q Recorder" measurement is programmed as follows:

- The measurement is controlled by SCPI commands with the following syntax: `...GPRF:MEAS:IQRecorder...`
- Use general commands of the type `...:GPRF:MEAS...` (no `:IQRecorder` mnemonic) to define the signal routing and perform RF and analyzer settings.
- After a `*RST`, the measurement is switched off. Use `READ:GPRF:MEAS:IQRecorder?` to initiate a single-shot measurement and retrieve the results.

Advanced settings

You can also start the measurement using the `INITiate:GPRF:MEAS:IQRecorder` command and retrieve the results using `FETCh:GPRF:MEAS:IQRecorder?`

The following features provide additional flexibility:

- Use an optional `ON` parameter after the `INITiate:GPRF:MEAS:IQRecorder` command to write the measurement results to a text file.
- Use `FORMAT:BASE:DATA` to select ASCII or REAL (binary) data transfer format.

3.4.3.2 Specifying General Measurement Settings

```
// ***************************************************************************
// System-Reset
// ***************************************************************************
*RST; *OPC?
*CLS; *OPC?

// ***************************************************************************
// Define signal routing, perform RF and analyzer settings
// for a 20 dBm RF signal
// ***************************************************************************
ROUTe:GPRF:MEAS:RFSettings:CONNector RF1C
CONFigure:GPRF:MEAS:RFSettings:EATTenuation 2
CONFigure:GPRF:MEAS:RFSettings:ENPower 20
CONFigure:GPRF:MEAS:RFSettings:UMARgin 5
CONFigure:GPRF:MEAS:RFSettings:FREQuency 890.2E+6
```

3.4.3.3 Specifying Measurement-Specific Settings

```
// ***************************************************************************
// Set a measurement-specific timeout value of 1 s.
// Select 1 kHz Gauss measurement filter and linear ("Raw") magnitude units
// ***************************************************************************

CONFigure:GPRF:MEAS:IQRecorder:TOUT 1
CONFigure:GPRF:MEAS:IQRecorder:FILTer:TYPe GAUSs
CONFigure:GPRF:MEAS:IQRecorder:FILTer:BANDpass:BWIDth 1000
CONFigure:GPRF:MEAS:IQRecorder:MUNit RAW

// ***************************************************************************
// Read list of possible trigger sources (for development purposes)
// ***************************************************************************
TRIGger:GPRF:MEAS:IQRecorder:CATalog:SOURce?

// ***************************************************************************
// Select an IF power trigger with appropriate characteristics,
// Measure 1000 samples, starting at the trigger event
// ***************************************************************************
```

```
TRIGger:GPRF:MEAS:IQRecorder:SOURce "IF Power"
TRIGger:GPRF:MEAS:IQRecorder:SLOPe REDGe
TRIGger:GPRF:MEAS:IQRecorder:THReshold -25
TRIGger:GPRF:MEAS:IQRecorder:TOUT 2
TRIGger:GPRF:MEAS:IQRecorder:MGAP 550E-6
CONFigure:GPRF:MEAS:IQRecorder:CAPTure 1, 1000

WAITKEY >Configuration completed, press "OK" to start measurement<
```

3.4.3.4 Performing a Single-Shot Measurement

```
// ***************************************************************************
// Query sampling rate,
// then start single-shot measurement and return results in ASCII format.
// Query reliability indicator and measurement state (should be 'RDY')
// ***************************************************************************
FETCh:GPRF:MEAS:IQRecorder:SRATe?
READ:GPRF:MEAS:IQRecorder?
FETCh:GPRF:MEAS:IQRecorder:RELiability?
FETCh:GPRF:MEAS:IQRecorder:STATe?

// ***************************************************************************
// Set up a measurement in list mode and over 5 subsweeps.
// Query no.of measurement steps (5 times the step count = 40)
// Configure the list frequencies and expected nominal powers
// ***************************************************************************
CONFigure:GPRF:MEAS:IQRecorder:LIST ON
CONFigure:GPRF:MEAS:IQRecorder:LIST:SLENgth 0.001
CONFigure:GPRF:MEAS:IQRecorder:LIST:STARt 0
CONFigure:GPRF:MEAS:IQRecorder:LIST:STOP 100
CONFigure:GPRF:MEAS:IQRecorder:LIST:COUNt?
CONFigure:GPRF:MEAS:IQRecorder:LIST:FREQuency? 0
CONFigure:GPRF:MEAS:IQRecorder:LIST:FREQuency 0, 7.55E+8; FREQuency 1, 7.56E+8
CONFigure:GPRF:MEAS:IQRecorder:LIST:FREQuency:ALL 7.55E+8, 7.56E+8
CONFigure:GPRF:MEAS:IQRecorder:LIST:ENPower:ALL?
CONFigure:GPRF:MEAS:IQRecorder:LIST:ENPower? 0
CONFigure:GPRF:MEAS:IQRecorder:LIST:ENPower 0, -5; ENPower 1, -5
CONFigure:GPRF:MEAS:IQRecorder:LIST:ENPower:ALL -5, -5
READ:GPRF:MEAS:IQRecorder?

// ***************************************************************************
// Select file for storing I/Q data,
// Re-start the measurement, retrieving the results in REAL (binary) format
// and storing the results to the selected file,
// query measurement substates (should be 'RDY,ADJ, ACT')
// ***************************************************************************
CONFigure:GPRF:MEAS:IQRecorder:IQFile 'C:\Temp\IQRecorder\Results\IQSave_1.txt'
FORMAT:BASE:DATA REAL, 32
FETCh:GPRF:MEAS:IQRecorder?
```

```
FORMAT:BASE:DATA ASCII
FETCh:GPRF:MEAS:IQRecorder:STATe:ALL?
```

3.4.3.5 Post-Processing with MATLAB®

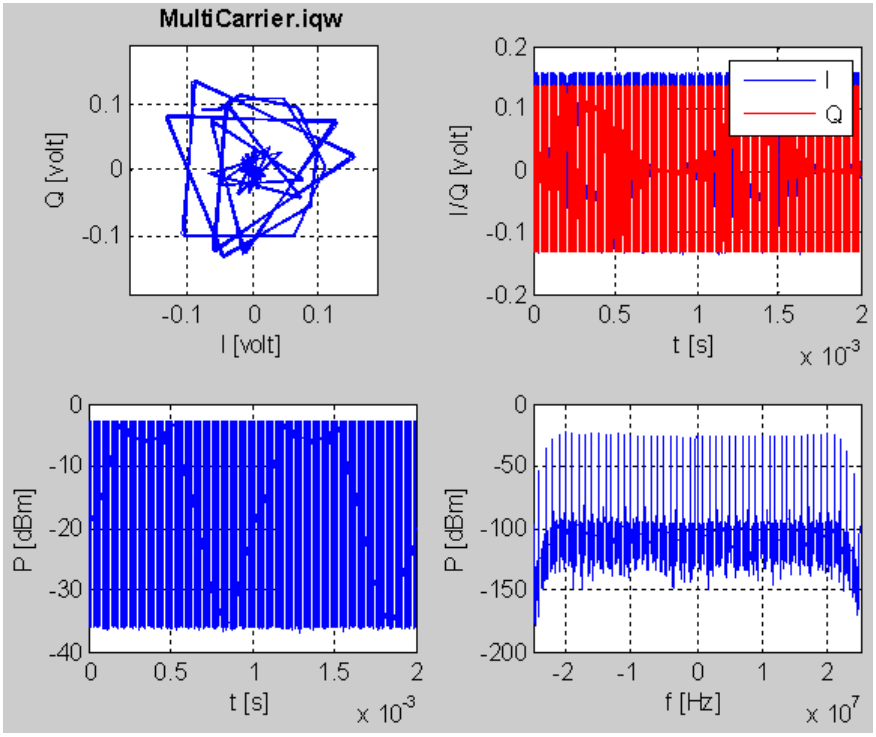
The following MATLAB® routines post-process the result of an I/Q recorder measurement.

```
% ************************************************************************
%   [IQ, Message] = ReadIqw(FileName)
%
%   SPECIFICATION:
%   Converts the selected *.iqw file into a matlab IQ vector.
%
%   INPUT:
%   FileName: String containing the name of the file to be converted.
%
%   OUTPUT:
%   IQ: Resulting complex matlab vector
%   Message: Returns a system dependent error message if the open is not
%   successful
%
%   EXAMPLE:
%   [IQ, Message] = ReadIqw('MultiCarrier.iqw')
% ************************************************************************
%
%
function [IQ, Message]=ReadIqw(FileName)
[fid, Message] =fopen(FileName);
if fid == -1
    IQ = nan;
else
    x = fread(fid,'single');
    IQ = x(1:2:end)+1i*x(2:2:end);
    fclose(fid);
end

% ************************************************************************
%   [Info] = ReadInfo(FileName)
%
%   SPECIFICATION:
%   Converts the selected *.info file into a matlab structure.
%
%   INPUT:
%   FileName: String containing the name of the file to be converted.
%
%   OUTPUT:
%   Info: Resulting Matlab structure
%
%   EXAMPLE:
```

```
%   [Info] = ReadInfo('MultiCarrier.info')
% ************************************************************************
%
%
function [Info] = ReadInfo(FileName)
[fid] = fopen(FileName);
if fid == -1
    Info = '';
else
    tline = fgetl(fid);
    i = 1;
    while ischar(tline)
        VarName{i} = tline(1:findstr('=',tline)-1);
        VarValue{i} = tline(findstr('=',tline)+1:end);
        tline = fgetl(fid);
        i = i+1;
    end
    Info = cell2struct(VarValue, VarName, 2);
    fclose(fid);
end

% ************************************************************************
%   [IQ, Info] = ReadIqRecord(FileName, PlotData)
%
%   SPECIFICATION:
%   Reads *.iqw and *.info and plots the IQ data.
%   Need the functions ReadIqw and ReadInfo.
%
%   INPUT:
%   FileName: String containing the filename without extension.
%   PlotData: If 1, then IQ data is plotted
%
%   OUTPUT:
%   IQ: Resulting complex matlab vector
%   Info: Resulting Matlab structure
%
%   EXAMPLE:
%   [IQ, Info] = ReadIqRecord('MultiCarrier', 1)
% ************************************************************************
%
%
function [IQ, Info] = ReadIqRecord(FileName, PlotData)
if nargin < 2
    PlotData = 0;
end
[pathstr, name, ext, versn] = fileparts(FileName);
[IQ, Message] = ReadIqw([name, '.iqw']);
if isnan(IQ)
    error(Message)
end
```

```
Info = ReadInfo([name, '.info']);

if isempty(Info)
    t = 0:length(IQ)-1;
    TimeLabel = 'samples';
    f = -0.5:1/length(IQ):0.5-1/length(IQ);
    FreqLabel = 'f/f_s_a_m_p_l_e';
else
    t = (0:length(IQ)-1)/str2double(Info.SampleRate);
    TimeLabel = 't [s]';
    f = (-0.5:1/length(IQ):0.5-1/length(IQ))*str2double(Info.SampleRate);
    FreqLabel = 'f [Hz]';
end

if PlotData
    Impedance = 50;

    subplot(2,2,1); plot(IQ); axis square; grid on;
    Scale = 1.1 * max(max(abs(real(IQ))), max(abs(imag(IQ))));
    set(gca, 'XLim', 1.1*[-Scale, Scale], 'YLim', 1.1*[-Scale, Scale]);
    xlabel('I [volt]'); ylabel('Q [volt]');
    title([name, '.iqw'], 'FontWeight', 'Bold');

    subplot(2,2,2); plot(t, real(IQ),'b'); hold on; plot(t, imag(IQ),'r');
    set(gca, 'XLim', [min(t) max(t)]); grid on;
    xlabel(TimeLabel); ylabel('I/Q [volt]');
    legend('I', 'Q'); hold off;

    subplot(2,2,3); plot(t,30+10*log10(abs(IQ).^2/Impedance));
    set(gca, 'XLim', [min(t) max(t)]); grid on;
    xlabel(TimeLabel); ylabel('P [dBm]');

    w = gausswin(length(IQ), 3.8);
    Gain = 20*log10(abs(sum(w)/length(w)));
    subplot(2,2,4);
    plot(f,-Gain+30+10*log10(abs(fftshift...
        (fft(IQ.*w/length(IQ))).^2/Impedance)));
    set(gca, 'XLim', [min(f) max(f)]); grid on;
    xlabel(FreqLabel); ylabel('P [dBm]');
end
end
```

Resulting plot:



3.4.4 External Power Sensor Measurement

The following examples show how to configure the External Power Sensor measurement via a remote-control program and retrieve measurement results.

3.4.4.1 Key Features

The External Power Sensor measurement is programmed as follows:

- The measurement is controlled by SCPI commands with the following syntax: `...GPRF:MEAS:EPSensor...`
- After a `*RST`, the measurement is switched off. Use `READ:GPRF:MEAS:EPSensor?` to initiate a single-shot measurement and retrieve the results.

Advanced settings

A zeroing procedure is recommended to improve the accuracy.

You can also run the measurement in continuous mode and retrieve the results using `FETCh:GPRF:MEAS:EPSensor?`.

3.4.4.2 Performing a Single-Shot Measurement

```
// ***************************************************************************
// System-Reset
// ***************************************************************************
*RST; *OPC?
*CLS; *OPC?

// ***************************************************************************
// Set a measurement-specific timeout value of 1 s.
// Configure statistics, sensor frequency, and an external attenuation
// factor of 2 dB to correct the sensor reading, display results with
// low resolution (rounded to 1 dB, this does not affect remote control).
// ***************************************************************************

CONFigure:GPRF:MEAS:EPSensor:TOUT 1
CONFigure:GPRF:MEAS:EPSensor:SCOunt 20
CONFigure:GPRF:MEAS:EPSensor:FREQuency 1.922E+9
CONFigure:GPRF:MEAS:EPSensor:ATTenuation:STATe ON
CONFigure:GPRF:MEAS:EPSensor:ATTenuation 2
CONFigure:GPRF:MEAS:EPSensor:RESolution PD0

// ***************************************************************************
// Start the measurement, return results and state (should be RDY)
// Query all measurement states (should be RDY, ADJ, ACT); read sensor ID
// ***************************************************************************
READ:GPRF:MEAS:EPSensor?
FETCh:GPRF:MEAS:EPSensor:STATe?
FETCh:GPRF:MEAS:EPSensor:STATe:ALL?
CONFigure:GPRF:MEAS:EPSensor:IDN?
```

3.4.4.3 Zeroing the External Sensor

```
REM The measured RF signal must be switched off for this step!
// ***************************************************************************
// Initiate zeroing of the power sensor
// ***************************************************************************
CALibration:GPRF:MEAS:EPSensor:ZERO
// ***************************************************************************
// This may take 3 to 10 seconds ...
// ***************************************************************************
Waitkey >Sensor zeroing initiated, press OK to read sensor state and continue<
CALibration:GPRF:MEAS:EPSensor:ZERO?
REM Switch on RF signal again to continue the measurement!
```

3.4.4.4 Continuous Sensor Measurement

```
// ***************************************************************************
// Configure a continuous measurement.
```

```
// Return results and meas. state (should be RUN)
// ******************************************************************************
INITiate:GPRF:MEAS:EPSensor
FETCh:GPRF:MEAS:EPSensor?
FETCh:GPRF:MEAS:EPSensor:STATe?
```

3.4.5 FFT Spectrum Analyzer

The following examples show how to configure the "FFT Spectrum Analyzer" via a remote-control program and retrieve measurement results.

3.4.5.1 Key Features

The "FFT Spectrum Analyzer" is programmed as follows:

- The measurement is controlled by SCPI commands with the following syntax: `...GPRF:MEAS:FFTSanalyzer...`
- Use general commands of the type `...:GPRF:MEAS...` (no `:FFTSanalyzer` mnemonic) to define the signal routing and perform RF and analyzer settings.
- After a `*RST`, the measurement is switched off. Use `READ:GPRF:MEAS:FFTSanalyzer?` to initiate a single-shot measurement and retrieve the results.

Advanced settings

You can also run the measurement in continuous mode and retrieve the results using `FETCh:GPRF:MEAS:FFTSanalyzer...?`.

3.4.5.2 Specifying General Measurement Settings

```
// ******************************************************************************
// System-Reset
// ******************************************************************************
*RST; *OPC?
*CLS; *OPC?

// ******************************************************************************
// Define signal routing, perform RF and analyzer settings
// for a 20 dBm RF signal with a 5 dBm crest factor.
// ******************************************************************************
ROUTe:GPRF:MEAS:RFSettings:CONNector RF1C
CONFigure:GPRF:MEAS:RFSettings:EATTenuation 2
CONFigure:GPRF:MEAS:RFSettings:ENPower 20
```

```
CONFigure:GPRF:MEAS:RFSettings:UMARgin 5
CONFigure:GPRF:MEAS:RFSettings:FREQuency 890.2E+6
```

3.4.5.3 Specifying Measurement-Specific Settings

```
// ***************************************************************************
// Set a measurement-specific timeout value of 1 s.
// Increase the frequency span (and thus the sampling rate). Use maximum
// FFT length for minimum resolution bandwidth. Use the RMS detector,
// logarithmic averaging, and keep potentially faulty or inaccurate
// measurement results. Show the time window in the I/Q diagrams
// ***************************************************************************

CONFigure:GPRF:MEAS:FFTSanalyzer:TOUT 1
CONFigure:GPRF:MEAS:FFTSanalyzer:FSPan 2e+07
CONFigure:GPRF:MEAS:FFTSanalyzer:FFTLength MAX
CONFigure:GPRF:MEAS:FFTSanalyzer:DETector RMS
CONFigure:GPRF:MEAS:FFTSanalyzer:AMODe LOG
CONFigure:GPRF:MEAS:FFTSanalyzer:MOEXception ON
CONFigure:GPRF:MEAS:FFTSanalyzer:IQRMode AWINdow

// ***************************************************************************
// Select 5 peak search markers and configure 5 adjacent peak search
// ranges covering the entire frequency span, disable full span search.
// ***************************************************************************
CONFigure:GPRF:MEAS:FFTSanalyzer:PSEarch:NOAMarkers 5
CONFigure:GPRF:MEAS:FFTSanalyzer:PSEarch OFF, -10e+06, -6e-06, OFF, -6e-06,
    -2E-06, OFF, -2E-06, +2E-06, OFF, +2E-06, +6E-06, OFF, +6E-06, +10E-06

// ***************************************************************************
// Read list of possible trigger sources (for development purposes)
// ***************************************************************************
TRIGger:GPRF:MEAS:FFTSanalyzer:CATalog:SOURce?

// ***************************************************************************
// Select an IF power trigger with appropriate characteristics. Shift
// the time domain curve by 1 ms. Check fixed and variable offset mode.
// ***************************************************************************
TRIGger:GPRF:MEAS:FFTSanalyzer:SOURce "IF Power"
TRIGger:GPRF:MEAS:FFTSanalyzer:SLOPe REDGe
TRIGger:GPRF:MEAS:FFTSanalyzer:THReshold -25
TRIGger:GPRF:MEAS:FFTSanalyzer:TOUT 2
TRIGger:GPRF:MEAS:FFTSanalyzer:MGAP 550E-6
TRIGger:GPRF:MEAS:FFTSanalyzer:OMODe FIXed
TRIGger:GPRF:MEAS:FFTSanalyzer:OFFSet 1E-3
TRIGger:GPRF:MEAS:FFTSanalyzer:OMODe VARiable
TRIGger:GPRF:MEAS:FFTSanalyzer:OSStop -1E-3, 1E-3

WAITKEY >Configuration completed, press "OK" to start measurement<
```

3.4.5.4 Single-Shot and Continuous Measurements

```
// ********************************************************************
// Start single-shot measurement and return average FFT trace vs frequency.
// Query meaurement state (should be 'RDY').
// ********************************************************************
READ:GPRF:MEAS:FFTSanalyzer:POWer:AVERage?
FETCh:GPRF:MEAS:FFTSanalyzer:STATe?

// ********************************************************************
// Configure a continuous measurement with a statistic count of 10
// measurement intervals. Initiate the measurement, return peak values
// in the peak search ranges and I/Q amplitudes in time domain.
// Query all measurement states (should be "RUN,ADJ,ACT")
// ********************************************************************
CONFigure:GPRF:MEAS:FFTSanalyzer:REPetition CONTinuous
CONFigure:GPRF:MEAS:FFTSanalyzer:SCOunt 10
INITiate:GPRF:MEAS:FFTSanalyzer
FETCh:GPRF:MEAS:FFTSanalyzer:PEAKs:AVERage?
FETCh:GPRF:MEAS:FFTSanalyzer:I?
FETCh:GPRF:MEAS:FFTSanalyzer:Q?
FETCh:GPRF:MEAS:FFTSanalyzer:STATe:ALL?
```

3.5 Command Reference

The following sections provide detailed reference information on the remote control commands of the General Purpose RF measurements.

3.5.1 Conventions and General Information

The following sections describe the most important conventions and give general information concerning the command reference.

3.5.1.1 MEAS<i>

MEAS<i> is used as abbreviation of "MEASurement<instance>". For better readability only the abbreviated form (which is also accepted by the instrument) is given in the command reference.

The <instance> is relevant for instruments supporting several instances of the same firmware application. It can be omitted if the instrument supports only one instance, or to address the first instance.

See also: "Firmware Applications" in the R&S CMW user manual, chapter "Remote Control"

3.5.1.2 FETCh, READ and CALCulate Commands

All commands are used to retrieve measurement results:

- `FETCh...` returns the results of the current measurement cycle (single-shot measurement) after they are valid. `FETCh...` must be used after the measurement has been started (`INITiate...`, measurement states RUN or RDY).
- `READ...` starts a new single-shot measurement and returns the results.
- `CALCulate...` returns one error indicator (OK, OFL, INV, NAV) per `FETCh` result.

See also: "Retrieving Measurement Results" in the R&S CMW user manual, chapter "Remote Control"

3.5.1.3 Current and Statistical Results

The R&S CMW repeats measurements according to the selected statistic count and repetition mode. Consecutive measurement values are stored and used to calculate statistical results, e.g. average, minimum, maximum and standard deviation.

See also: "Statistical Results" in the R&S CMW user manual, chapter "System Overview"

3.5.1.4 Reliability Indicator

The first value in the output arrays of `FETCh...?`, `READ...?` and `CALCulate...?` queries indicates the most severe error that has occurred during the measurement.

Example for an output array: 0, 10.22, 10.15, 10.01, 10.29, 100 (reliability = 0, followed by 5 numeric measurement values).

The reliability indicator has one of the following values:

- **0 (OK)**:
  Measurement values available, no error detected.
- **1 (Measurement Timeout)**:
  The measurement has been stopped after the (configurable) measurement timeout. Measurement results may be available, however, at least a part of the measurement provides only INValid results or has not completed the full statistic count.
- **2 (Capture Buffer Overflow)**:
  The measurement configuration results in a capture length exceeding the available memory.
- **3 (Overdriven) / 4 (Underdriven)**:
  The accuracy of measurement results may be impaired because the input signal level was too high / too low.

- **6 (Trigger Timeout)**:
  The measurement could not be started or continued because no trigger event was detected.
- **7 (Acquisition Error)**:
  The R&S CMW could not properly decode the RF input signal.
- **8 (Sync Error)**:
  The R&S CMW could not synchronize to the RF input signal.
- **9 (Uncal)**:
  Due to an inappropriate configuration of resolution bandwidth, video bandwidth or sweep time, the measurement results are not within the specified data sheet limits.
- **15 (Reference Frequency Error)**:
  The instrument has been configured to use an external reference signal but the reference oscillator could not be phase locked to the external signal (e.g. signal level too low, frequency out of range or reference signal not available at all).
- **16 (RF Not Available)**:
  The measurement could not be started because the configured RF input path was not active. This problem may occur e.g. when a measurement is started in combined signal path mode and the master application has not yet activated the input path. The LEDs above the RF connectors indicate whether the input and output paths are active.
- **17 (RF Level not Settled) / 18 (RF Frequency not Settled)**:
  The measurement could not be started because the R&S CMW was not yet ready to deliver stable results after a change of the input signal power / the input signal frequency.
- **19 (Call not Established)**:
  For measurements: The measurement could not be started because no signaling connection to the DUT was established.
  For DAU IMS service: Establishing a voice over IMS call failed.
- **20 (Call Type not Usable)**:
  For measurements: The measurement could not be started because the established signaling connection had wrong properties.
  For DAU IMS service: The voice over IMS settings could not be applied.
- **21 (Call Lost)**:
  For measurements: The measurement was interrupted because the signaling connection to the DUT was lost.
  For DAU IMS service: The voice over IMS call was lost.
- **23 (Missing Option)**:
  The ARB file can not be played by the GPRF generator due to a missing option.
- **26 (Resource Conflict)**:
  The application could not be started or has been stopped due to a conflicting hardware resource or software option that is allocated by another application.
  Please stop the application that has allocated the conflicting resources and try again.
- **27 (No Sensor Connected)**:
  The GPRF External Power Sensor measurement could not be started due to missing power sensor.
- **40 (ARB File CRC Error)**:
  The ARB file CRC check failed. The ARB file is corrupt and not reliable.

- **42 (ARB Header Tag Invalid)**:
  The ARB file selected in the GPRF generator contains an invalid header tag.
- **43 (ARB Segment Overflow)**:
  The number of segments in the multi-segment ARB file is higher than the allowed maximum.
- **44 (ARB File not Found)**:
  The selected ARB file could not be found.
- **50 (Startup Error)**:
  The Data Application Unit (DAU), a DAU service or a DAU measurement could not be started. Please execute a DAU selftest.
- **51 (No Reply)**:
  The DAU has received no response, for example for a ping request.
- **52 (Connection Error)**:
  The DAU could not establish a connection to internal components. Please restart the instrument.
- **53 (Configuration Error)**:
  The current DAU configuration by the user is incomplete or wrong and could not be applied. Check especially the IP address configuration.
- **54 (Filesystem Error)**:
  The hard disk of the DAU is full or corrupt. Please execute a DAU selftest.
- **101 (Firmware Error)**:
  Indicates a firmware or software error. If you encounter this error for the first time, restart the instrument.
  If the error occurs again, consider the following hints:
  – Firmware errors can often be repaired by restoring the factory default settings. To restore these settings, restart your instrument and press the "Factory Default" softkey during startup.
  – If a software package (update) has not been properly installed this is often indicated in the "Setup" dialog, section "SW/HW-Equipment > Installed Software".
  – A software update correcting the error may be available. Updates are e.g. provided in the "CMW Customer Web" on GLORIS (registration required): https://extranet.rohde-schwarz.com.

  If you get firmware errors even with the properly installed latest software version, please send a problem report including log files to Rohde & Schwarz.
- **102 (Unidentified Error)**:
  Indicates an error not covered by other reliability values. For troubleshooting please follow the steps described for "101 (Firmware Error)".
- **103 (Parameter Error)**:
  Indicates that the measurement could not be performed due to internal conflicting parameter settings.
  A good approach to localize the conflicting settings is to start with a reset or preset or even restore the factory default settings. Then reconfigure the measurement step by step and check when the error occurs for the first time.
  If you need assistance to localize the conflicting parameter settings please contact Rohde & Schwarz (see http://www.service.rohde-schwarz.com).

3.5.2 General Measurement Settings

The commands valid for all GPRF measurements are divided into the groups listed below.

3.5.2.1 Signal Routing

The following commands select the path and connector for the generator and define an external attenuation value.

ROUTe:GPRF:MEAS<i>:SCENario?

Queries the active scenario.

Return values:

<Scenario> SALone | CSPath | MAPR

Standalone, combined signal path or measure at protocol test (R&S CMW500 only)

Example: See Specifying General Measurement Settings

Usage: Query only

Firmware/Software: V1.0.15.20
V2.0.10: connectors removed

Manual operation: See "Scenario" on page 115

ROUTe:GPRF:MEAS<i>:SCENario:SALone <RXConnector>, <RFConverter>

Activates the standalone scenario and selects the RF input path for the measured RF signal, i.e. the RF connector and the RX module.

Depending on the installed hardware and the active sub-instrument or instance <i> only a subset of the described parameter values is allowed. The *RST values and the mapping of virtual connector names to physical connectors also depend on the active sub-instrument or instance <i>.

All instruments are equipped with the RF 1 and RF 2 connectors and one RX and TX module. Additional RF connectors and RX/TX modules are optionally available for R&S CMW270 and R&S CMW500, but not for R&S CMW280.

See also: "Signal Path Settings" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<RXConnector> RF1C | RF2C | RF3C | RF4C | RFAC | RFBC

RF1C, RF2C, RF3C, RF4C:
RF 1 COM to RF 4 COM front panel connectors

RFAC, RFBC:
Virtual names for the RF COM connectors

*RST: not used

<RFConverter> RX1 | RX2 | RX3 | RX4

RX module for the input path

*RST: not used

Example: See Specifying General Measurement Settings

Firmware/Software: V1.0.15.0
V2.0.10: additional values RF3/4/A/B..., RX2

Manual operation: See "RF Routing" on page 115

ROUTe:GPRF:MEAS<i>:SCENario:CATalog:CSPath?

Queries the possible master firmware applications for a combined signal path scenario. The list contains all installed signaling applications.

Return values:

<CSP Masters> Comma-separated list of string parameters, e.g. "1xEV-DO Sig1", "GSM Sig2". "No Connection" is returned if no signaling application is installed.

Example: See Specifying General Measurement Settings

Usage: Query only

Firmware/Software: V1.0.15.20

Manual operation: See "Scenario" on page 115

ROUTe:GPRF:MEAS<i>:SCENario:CSPath <Master>

Activates the combined signal path scenario and selects a master firmware application for the GPRF measurements. The master controls the signal routing settings and analyzer settings while the combined signal path scenario is active. `ROUTe:GPRF:MEAS<i>:SCENario:CATalog:CSPath?` returns a list of possible master firmware applications.

Parameters:

<Master> String parameter containing the master application, e.g. '1xEV-DO Sig1' or 'GSM Sig2'

Example: See Specifying General Measurement Settings

Firmware/Software: V1.0.15.20

Manual operation: See "RF Routing" on page 115

ROUTe:GPRF:MEAS<i>:SCENario:MAPRotocol

Activates the Measure@ProtocolTest scenario. The signal routing and analyzer settings are ignored by the measurement application. The corresponding settings have to be configured within the protocol test application used in parallel.

Example: See Specifying General Measurement Settings

Usage: Event

Firmware/Software: V1.0.15.20

Manual operation: See "Scenario" on page 115

ROUTe:GPRF:MEAS<i>?

Queries the active test scenario and connector assignment.

Return values:

<Scenario> SALone | CSPath | MAPR
Standalone, combined signal path or measure at protocol test (R&S CMW500 only)

<Master> String variable containing the master application. For combined signal path scenarios, possible values are "1xEV-DO Sig1", "GSM Sig2" ... For other scenarios, "No Connection" is returned.

<RF Connector> RF1C | RF2C | RF3C | RF4C | IQ1I | IQ3I
RF 1 COM to RF 4 COM front panel connectors

<RF Converter> RX1 | RX2 | RX3 | RX4 | IRX1 | IRX2
RX module for the input path

Example: See Specifying General Measurement Settings

Usage: Query only

Firmware/Software: V2.0.10

Manual operation: See "Scenario" on page 115

CONFigure:GPRF:MEAS<i>:RFSettings:EATTenuation <RFInputExtAtt>

Defines an external attenuation (or gain, if the value is negative), to be applied to the RF input connector.

Parameters:

<RFInputExtAtt> Range: -50 dB to 90 dB
*RST: 0 dB
Default unit: dB

Example: See Specifying General Measurement Settings

Firmware/Software: V1.0.0.4

Manual operation: See "External Attenuation (Input)" on page 116

3.5.2.2 Analyzer Settings

The following commands configure the RF input path.

CONFigure:GPRF:MEAS<i>:RFSettings:FREQuency <AnalyzerFreq>

Selects the center frequency of the RF analyzer.

Parameters:

<AnalyzerFreq>
Range: 70E+6 Hz to 6E+9 Hz
Increment: 0.1 Hz
*RST: 1.685E+9 Hz
Default unit: Hz

Example: See Specifying General Measurement Settings

Firmware/Software: V1.0.0.4 (default value changed in V2.0.10)

Manual operation: See "Frequency" on page 116

CONFigure:GPRF:MEAS<i>:RFSettings:ENPower <ExpNomPwr>

Sets the expected nominal power of the measured RF signal.

Parameters:

<ExpNomPwr>
The range of the expected nominal power can be calculated as follows:
Range (Expected Nominal Power) = Range (Input Power) + External Attenuation - User Margin

Range: –55 dBm to +55 dBm for the input power at RF 1 COM and RF 2 COM (please notice also the ranges quoted in the data sheet).
*RST: 0 dBm
Default unit: dBm

Example: See Specifying General Measurement Settings

Firmware/Software: V1.0.0.4

Manual operation: See "Expected Nominal Power" on page 116

CONFigure:GPRF:MEAS<i>:RFSettings:UMARgin <UserMargin>

Sets the margin that the R&S CMW adds to the expected nominal power in order to determine its reference power. The reference power minus the external input attenuation must be within the power range of the selected input connector; refer to the data sheet.

Parameters:

<UserMargin>
Range: 0 dB to 37 dB at RF 1 COM and RF 2 COM
Increment: 0.01 dB
*RST: 0 dB
Default unit: dB

Example: See Specifying General Measurement Settings

Firmware/Software: V1.0.0.4

Manual operation: See "User Margin" on page 116

CONFigure:GPRF:MEAS<i>:RFSettings:MLOFfset <MixLevOffset>

Varies the input level of the mixer in the analyzer path.

Parameters:

<MixLevOffset>
Range: -10 dB to 10 dB
*RST: 0 dB
Default unit: dB

Example: See Specifying General Measurement Settings

Firmware/Software: V1.0.15.0

Manual operation: See "Mixer Level Offset" on page 117

3.5.3 Power Measurement Commands

The commands for the "Power" measurement are divided into the groups listed below.

3.5.3.1 Measurement Control and States

The following commands control the measurement and return the current measurement state.

CONFigure:GPRF:MEAS<i>:POWer:MODE <CCDFMode>

Sets/gets the result mode for the single step power measurement.

Note that the result mode has to be set before the power measurement is started.

Parameters:

<CCDFMode> POWer | STATistic

POWer: In the power mode only summary statistics (minimum, maximum, average, standard deviation) are calculated
STATistic: In the statistic mode power distributions/densities are calculated

Firmware/Software: V3.0.10

INITiate:GPRF:MEAS<i>:POWer
STOP:GPRF:MEAS<i>:POWer
ABORt:GPRF:MEAS<i>:POWer

Starts, stops, or aborts the measurement:

- `INITiate...` starts or restarts the measurement; the R&S CMW enters the "RUN" state.
- `STOP...` causes a running measurement to stop after the current evaluation period is terminated and valid results are available; the R&S CMW enters the "RDY" state.
- `ABORt...` causes a running measurement to stop immediately; the R&S CMW enters the "OFF" state.

Use `FETCh...STATe?` to query the current measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Example: See Single-Shot and Continuous Power Measurements

Usage: Event

Firmware/Software: V1.0.0.4

FETCh:GPRF:MEAS<i>:POWer:STATe?

Queries the main measurement state. Use `FETCh:...:STATe:ALL?` to query the measurement state including the substates. Use `INITiate..., STOP..., ABORt...` to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MeasState> OFF | RDY | RUN

OFF: measurement switched off, no resources allocated, no results available (when entered after `ABORt...`)
RDY: measurement has been terminated, valid results may be available
RUN: measurement running (after `INITiate..., READ...`), synchronization pending or adjusted, resources active or queued

*RST: OFF

Example: See Single-Shot and Continuous Power Measurements

Usage: Query only

Firmware/Software: V1.0.0.4

Manual operation: See "Power (Softkey)" on page 117

FETCh:GPRF:MEAS<i>:POWer:STATe:ALL?

Queries the main measurement state and the measurement substates. Both measurement substates are relevant for running measurements only. Use `FETCh:...:STATe?` to query the main measurement state only. Use `INITiate..., STOP..., ABORt...` to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MainState> OFF | RDY | RUN

OFF: measurement switched off, no resources allocated, no results available (when entered after `STOP...`)
RDY: measurement has been terminated, valid results may be available
RUN: measurement running (after `INITiate..., READ...`), synchronization pending or adjusted, resources active or queued

*RST: OFF

<SyncState> PEND | ADJ | INV

PEND: waiting for resource allocation, adjustment, hardware switching ("pending")
ADJ: all necessary adjustments finished, measurement running ("adjusted")
INV: not applicable because <MainState>: OFF or RDY ("invalid")

<ResourcesState> QUE | ACT | INV

QUE: measurement without resources, no results available ("queued")
ACT: resources allocated, acquisition of results in progress but not complete ("active")
INV: not applicable because <MainState>: OFF or RDY ("invalid")

Example: See Single-Shot and Continuous Power Measurements

Usage: Query only

Firmware/Software: V1.0.0.4

Manual operation: See "Power (Softkey)" on page 117

FETCh:GPRF:MEAS<i>:POWer:ESTatistics?

Returns the reliability indicator and the number of elapsed measurement cycles.

Return values:

<Reliabilty> see Reliability Indicator

<StatCount> Number of measured cycles
Range: 0 to 100E+3

<Reliabilty> identical to the first value

Example: See Single-Shot and Continuous Power Measurements

Usage: Query only

Firmware/Software: V2.0.10

3.5.3.2 Measurement Control Parameters

The following commands define the measurement interval. See also Parameter Set List Settings.

CONFigure:GPRF:MEAS<i>:POWer:TOUT <TCDTimeOut>

Defines a timeout for the measurement. The timer is started when the measurement is initiated via a `READ` or `INIT` command. It is not started if the measurement is initiated manually (ON/OFF key or RESTART/STOP key).

When the measurement has completed the first measurement cycle (first single shot), the statistical depth is reached and the timer is reset.

If the first measurement cycle has not been completed when the timer expires, the measurement is stopped. The measurement state changes to `RDY` and the reliability indicator is set to 1, indicating that a measurement timeout occurred. Still running `READ`, `FETCh` or `CALCulate` commands are completed, returning the available results. At least for some results there are no values at all or the statistical depth has not been reached.

A timeout of 0 s corresponds to an infinite measurement timeout.

Parameters:

<TCDTimeOut> *RST: 1 s
Default unit: s

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V2.0.10

Manual operation: See "Measurement Timeout" on page 118

CONFigure:GPRF:MEAS<i>:POWer:REPetition <Repetition>

Specifies the repetition mode of the measurement. The repetition mode specifies whether the measurement is stopped after a single-shot or repeated continuously. Use `CONFigure:..:MEAS<i>:...:SCOunt` to determine the number of measurement intervals per single shot.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<Repetition> SINGleshot | CONTinuous

SINGleshot: Single-shot measurement
CONTinuous: Continuous measurement

*RST: SING

Example: See Single-Shot and Continuous Power Measurements

Firmware/Software: V1.0.0.4

Manual operation: See "Repetition" on page 118

CONFigure:GPRF:MEAS<i>:POWer:SCOunt <StatisticCount>

Specifies the statistic count of the measurement. The statistic count is equal to the number of measurement intervals per single shot. Use `CONFigure:...:MEAS<i>:...:REPetition SINGleshot | CONTinuous` to select either single-shot or continuous measurements.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<StatisticCount> Number of measurement intervals. A measurement interval comprises a single power/frequency step (list mode switched off) or a sweep (list mode switched on).

Range: 1 to 100E+3
*RST: 10

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.0.4

Manual operation: See "Statistic Count" on page 119

CONFigure:GPRF:MEAS<i>:POWer:MLENgth <MeasLength>

Selects the length of the averaging intervals that the R&S CMW uses to calculate the "Power" results for each measurement step. The measurement length must not exceed the step length (`CONFigure:GPRF:MEAS<i>:POWer:SLENgth`).

Parameters:

<MeasLength>
Range: 10E-6 s to 1 s
*RST: 300E-6 s
Default unit: s

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.0.4

Manual operation: See "Measurement Length" on page 119

CONFigure:GPRF:MEAS<i>:POWer:SLENgth <StepLength>

Selects the time between the beginning of two consecutive measured power steps.

Parameters:

<StepLength>
Range: 50E-6 s to 1 s
*RST: 576.9230769E-6 s (1 GSM timeslot)
Default unit: s

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.0.4

Manual operation: See "Step Length" on page 120

CONFigure:GPRF:MEAS<i>:POWer:FILTer:TYPE <FilterType>

Selects the IF filter type.

Parameters:

<FilterType>
BANDpass | GAUSs | WCDMa | CDMA | TDSCdma

BANDpass: Bandpass filter with selectable bandwidth (`CONFigure:GPRF:MEAS<i>:POWer:FILTer:BANDpass:BWIDth`)
GAUSs: Filter of Gaussian shape with selectable bandwidth (`CONFigure:GPRF:MEAS<i>:POWer:FILTer:GAUSs:BWIDth`)
WCDMA: 3.84 MHz RRC filter with a roll-off = 0.22 for WCDMA TX tests
CDMA: 1.2288 MHz-wide channel filter for CDMA 2000 TX tests
TDSCdma: 1.28 MHz RRC filter with a roll-off = 0.22 for TD-SCDMA TX tests

*RST: GAUS

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.0.4

Manual operation: See "Filter" on page 120

CONFigure:GPRF:MEAS<i>:POWer:FILTer:GAUSs:BWIDth <GaussBW>

Selects the bandwidth for a filter of Gaussian shape.

Parameters:

<GaussBW>
Range: 10 Hz | 30 Hz | 50 Hz | 100 Hz | 300 Hz | 500 Hz | 1 kHz | 3 kHz | 5 kHz | 10 kHz | 30 kHz | 50 kHz | 100 kHz | 300 kHz | 500 kHz | 1 MHz | 3 MHz | 5 MHz | 10 MHz
*RST: 1 MHz
Default unit: Hz

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.0.4 (extension with filters below 1 kHz: V1.0.4.11)

Manual operation: See "Filter" on page 120

CONFigure:GPRF:MEAS<i>:POWer:FILTer:BANDpass:BWIDth <BandpassBW>

Selects the bandwidth for a bandpass filter.

Parameters:

<BandpassBW>
Range: 1 kHz | 3 kHz | 5 kHz | 10 kHz | 30 kHz | 50 kHz | 100 kHz | 300 kHz | 500 kHz | 1 MHz | 3 MHz | 5 MHz | 10 MHz | 30 MHz | 40 MHz
*RST: 300 kHz
Default unit: Hz

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.0.4

Manual operation: See "Filter" on page 120

3.5.3.3 Parameter Set List Settings

The following commands enable and configure the parameter set list.

CONFigure:GPRF:MEAS<i>:POWer:PSET:FILTer:TYPE <Index>, <Filter>
CONFigure:GPRF:MEAS<i>:POWer:PSET:FILTer:TYPE? <Index>

Selects the IF filter type for a particular parameter set <index>.

Parameters:

<Filter> BANDpass | GAUSs | WCDMa | CDMA | TDSCdma

BANDpass: Bandpass filter with selectable bandwidth (`CONFigure:GPRF:MEAS<i>:POWer:FILTer:BANDpass:BWIDth`)
GAUSs: Filter of Gaussian shape with selectable bandwidth (`CONFigure:GPRF:MEAS<i>:POWer:FILTer:GAUSs:BWIDth`)
WCDMA: 3.84 MHz RRC filter with a roll-off = 0.22 for WCDMA TX tests
CDMA: 1.2288 MHz-wide channel filter for CDMA 2000 TX tests
TDSCdma: 1.28 MHz RRC filter with a roll-off = 0.22 for TD-SCDMA TX tests

*RST: GAUS

Parameters for setting and query:

<Index> Number of parameter set in the list

Range: 0 to 31
*RST: n/a

Example: See Performing an I/Q Data Measurement

Firmware/Software: V2.1.25

Manual operation: See "Parameter Set List" on page 121

CONFigure:GPRF:MEAS<i>:POWer:PSET:FILTer:TYPE:ALL <Filter_0>, ..., <Filter_31>

Selects the IF filter type for all parameter sets.

Parameters:

<Filter_0>, ..., <Filter_31>

BANDpass | GAUSs | WCDMa | CDMA | TDSCdma

BANDpass: Bandpass filter with selectable bandwidth (`CONFigure:GPRF:MEAS<i>:POWer:FILTer:BANDpass:BWIDth`)

GAUSs: Filter of Gaussian shape with selectable bandwidth (`CONFigure:GPRF:MEAS<i>:POWer:FILTer:GAUSs:BWIDth`)

WCDMA: 3.84 MHz RRC filter with a roll-off = 0.22 for WCDMA TX tests

CDMA: 1.2288 MHz-wide channel filter for CDMA 2000 TX tests

TDSCdma: 1.28 MHz RRC filter with a roll-off = 0.22 for TD-SCDMA TX tests

*RST: GAUS

Example: See Performing an I/Q Data Measurement

Firmware/Software: V2.1.25

Manual operation: See "Parameter Set List" on page 121

CONFigure:GPRF:MEAS<i>:POWer:PSET:FILTer:GAUSs:BWIDth <Index>, <Bandwidth>

CONFigure:GPRF:MEAS<i>:POWer:PSET:FILTer:GAUSs:BWIDth? <Index>

Selects the bandwidth for a filter of Gaussian shape for a particular parameter set <index>.

Parameters:

<Bandwidth>

Range: 10 Hz | 30 Hz | 50 Hz | 100 Hz | 300 Hz | 500 Hz | 1 kHz | 3 kHz | 5 kHz | 10 kHz | 30 kHz | 50 kHz | 100 kHz | 300 kHz | 500 kHz | 1 MHz | 3 MHz | 5 MHz | 10 MHz

*RST: 1E+6 Hz

Default unit: Hz

Parameters for setting and query:

<Index>

Number of parameter set in the list

Range: 0 to 31

*RST: n/a

Example: See Performing an I/Q Data Measurement

Firmware/Software: V2.1.25

Manual operation: See "Parameter Set List" on page 121

CONFigure:GPRF:MEAS<i>:POWer:PSET:FILTer:GAUSs:BWIDth:ALL <Bandwidth_0>, ..., <Bandwidth_31>

Selects the bandwidth for a filter of Gaussian shape for all parameter sets.

Parameters:

<Bandwidth_0> ... <Bandwidth_31>
Range: 10 Hz | 30 Hz | 50 Hz | 100 Hz | 300 Hz | 500 Hz | 1 kHz | 3 kHz | 5 kHz | 10 kHz | 30 kHz | 50 kHz | 100 kHz | 300 kHz | 500 kHz | 1 MHz | 3 MHz | 5 MHz | 10 MHz
*RST: 1E+6 Hz
Default unit: Hz

Example: See Performing an I/Q Data Measurement

Firmware/Software: V2.1.25

Manual operation: See "Parameter Set List" on page 121

CONFigure:GPRF:MEAS<i>:POWer:PSET:FILTer:BANDpass:BWIDth <Index>, <Bandwidth>
CONFigure:GPRF:MEAS<i>:POWer:PSET:FILTer:BANDpass:BWIDth? <Index>

Selects the bandpass filter bandwidth for a particular parameter set <index>.

Parameters:

<Bandwidth>
Range: 1 kHz | 3 kHz | 5 kHz | 10 kHz | 30 kHz | 50 kHz | 100 kHz | 300 kHz | 500 kHz | 1 MHz | 3 MHz | 5 MHz | 10 MHz | 30 MHz | 40 MHz
*RST: 300E+3 Hz
Default unit: Hz

Parameters for setting and query:

<Index>
Number of parameter set in the list
Range: 0 to 31
*RST: n/a

Example: See Performing an I/Q Data Measurement

Firmware/Software: V2.1.25

Manual operation: See "Parameter Set List" on page 121

CONFigure:GPRF:MEAS<i>:POWer:PSET:FILTer:BANDpass:BWIDth:ALL <Bandwidth_0>, ..., <Bandwidth_31>

Selects the bandpass filter bandwidth for all parameter sets.

Parameters:

<Bandwidth_0> ... <Bandwidth_31>
Range: 1 kHz | 3 kHz | 5 kHz | 10 kHz | 30 kHz | 50 kHz | 100 kHz | 300 kHz | 500 kHz | 1 MHz | 3 MHz | 5 MHz | 10 MHz | 30 MHz | 40 MHz
*RST: 300E+3 Hz
Default unit: Hz

Example: See Performing an I/Q Data Measurement

Firmware/Software: V2.1.25

Manual operation: See "Parameter Set List" on page 121

CONFigure:GPRF:MEAS<i>:POWer:PSET:SLENgth <Index>, <StepLength>
CONFigure:GPRF:MEAS<i>:POWer:PSET:SLENgth? <Index>

Selects the time between the beginning of two consecutive measured power steps for a particular parameter set <index>.

Parameters:

<StepLength>
Range: 50E-6 s to 1 s
*RST: 576.9230769E-6 s (1 GSM timeslot)
Default unit: s

Parameters for setting and query:

<Index>
Number of parameter set in the list
Range: 0 to 31
*RST: n/a

Example: See Performing an I/Q Data Measurement

Firmware/Software: V2.1.25

Manual operation: See "Parameter Set List" on page 121

CONFigure:GPRF:MEAS<i>:POWer:PSET:SLENgth:ALL <StepLength_0>, ..., <StepLength_31>

Selects the time between the beginning of two consecutive measured power steps for all parameter sets.

Parameters:

<StepLength_0> ... <StepLength_31>
Range: 50E-6 s to 1 s
*RST: 576.9230769E-6 s (1 GSM timeslot)
Default unit: s

Example: See Performing an I/Q Data Measurement

Firmware/Software: V2.1.25

Manual operation: See "Parameter Set List" on page 121

CONFigure:GPRF:MEAS<i>:POWer:PSET:MLENgth <Index>, <MeasLength>
CONFigure:GPRF:MEAS<i>:POWer:PSET:MLENgth? <Index>

Selects the length of the averaging intervals that the R&S CMW uses to calculate the "Power" results for a particular parameter set <index>. The measurement length must not exceed the step length (`CONFigure:GPRF:MEAS<i>:POWer:PSET:SLENgth`).

Parameters:

<MeasLength>
Range: 10E-6 s to 576.9230769E-6 s
*RST: 300E-6 s
Default unit: s

Parameters for setting and query:

<Index> Number of parameter set in the list

Range: 0 to 31
*RST: n/a

Example: See Performing an I/Q Data Measurement

Firmware/Software: V2.1.25

Manual operation: See "Parameter Set List" on page 121

CONFigure:GPRF:MEAS<i>:POWer:PSET:MLENgth:ALL <MeasLength_0>, ..., <MeasLength_31>

Selects the length of the averaging intervals that the R&S CMW uses to calculate the "Power" results for all parameter sets. The measurement length must not exceed the step length (`CONFigure:GPRF:MEAS<i>:POWer:PSET:SLENgth:ALL`).

Parameters:

<MeasLength_0>, ..., <MeasLength_31>

Range: 10E-6 s to 1 s
*RST: 300E-6 s
Default unit: s

Example: See Performing an I/Q Data Measurement

Firmware/Software: V2.1.25

Manual operation: See "Parameter Set List" on page 121

TRIGger:GPRF:MEAS<i>:POWer:PSET:OFFSet <Index>, <TriggerOffset>
TRIGger:GPRF:MEAS<i>:POWer:PSET:OFFSet? <Index>

Defines a delay time relative to the trigger event for a particular parameter set <index>.

Parameters:

<TriggerOffset>

Range: 0 s to 1 s
*RST: 100E-6 s
Default unit: s

Parameters for setting and query:

<Index> Number of parameter set in the list

Range: 0 to 31
*RST: n/a

Example: See chapter 3.4.1.7, "Performing an I/Q Data Measurement", on page 171

Firmware/Software: V2.0.20

Manual operation: See "Parameter Set List" on page 121

TRIGger:GPRF:MEAS<i>:POWer:PSET:OFFSet:ALL <TriggerOffset_0>, ..., <TriggerOffset_31>

Defines a delay time relative to the trigger event for all parameter sets.

Parameters:

<TriggerOffset_0> ... <TriggerOffset_31>	Range:	0 s to 1 s
	*RST:	100E-6 s
	Default unit:	s

Example: See chapter 3.4.1.7, "Performing an I/Q Data Measurement", on page 171

Firmware/Software: V2.0.20

Manual operation: See "Parameter Set List" on page 121

3.5.3.4 Trigger Settings

The following commands define the trigger parameters.

TRIGger:GPRF:MEAS<i>:POWer:CATalog:SOURce?

Lists all trigger source values that can be set using `TRIGger:GPRF:MEAS<i>:POWer:SOURce`.

Return values:

'<Source_1>' ... '<Source_n>'	Comma separated list of all supported values. Each value is represented as a string.

Example: See Specifying Measurement-Specific Settings

Usage: Query only

Firmware/Software: V1.0.4.11

Manual operation: See "Trigger Source" on page 122

TRIGger:GPRF:MEAS<i>:POWer:SOURce '<Source>'

Selects the source of the trigger events. Some values are always available in this firmware application. They are listed below. Depending on the installed options additional values may be available. A complete list of all supported values can be displayed using `TRIGger:...:CATalog:SOURce?`.

Parameters:

'<Source>'
'IF Power': IF Power trigger
'Free Run': Free Run (untriggered)
'Base1: External TRIG A': External trigger fed in at TRIG A connector
'Base1: External TRIG B': External trigger fed in at TRIG B connector
*RST: 'Free Run'

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Trigger Source" on page 122

TRIGger:GPRF:MEAS<i>:POWer:SLOPe <Event>

Qualifies whether the trigger event is generated at the rising or at the falling edge of the trigger pulse (valid for external and power trigger sources).

Parameters:

<Event>
REDGe | FEDGe
REDGe: Rising edge
FEDGe: Falling edge
*RST: REDG

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Trigger Slope" on page 122

TRIGger:GPRF:MEAS<i>:POWer:THReshold <Threshold>

Defines the trigger threshold for power trigger sources.

Parameters:

<Threshold>
Range: -50 dB to 0 dB
Increment: 0.001 dB
*RST: -30 dB
Default unit: dB (full scale, i.e. relative to reference level minus external attenuation)

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Trigger Threshold" on page 123

TRIGger:GPRF:MEAS<i>:POWer:OFFSet <Offset>

Defines a delay time for triggered measurements. The trigger offset delays the start of the measurement relative to the trigger event.

Parameters:

<Offset>
Range: 0 s to 1 s
*RST: 100E-6 s
Default unit: s

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Trigger Offset" on page 123

TRIGger:GPRF:MEAS<i>:POWer:TOUT <Timeout>

Selects the maximum time that the R&S CMW will wait for a trigger event before it stops the measurement in remote control mode or indicates a trigger timeout in manual operation mode. This setting has no influence on "Free Run" measurements.

Parameters:

<Timeout>
Range: 0.01 s to 300 s
Increment: 0.01 s
*RST: 1 s
Default unit: s
Additional values: OFF | ON (disables timeout | enables timeout using the previous/default values)

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Trigger Timeout" on page 123

TRIGger:GPRF:MEAS<i>:POWer:MGAP <MinimumGap>

Sets a minimum time during which the IF signal must be below the trigger threshold before the trigger is armed so that an IF power trigger event can be generated.

Parameters:

<MinimumGap>
Range: 0 s to 0.01 s
*RST: 0 s
Default unit: s

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Minimum Trigger Gap" on page 123

TRIGger:GPRF:MEAS<i>:POWer:MODE <Mode>

Selects the measurement sequence that is triggered by each single trigger event. This setting is not valid for "Free Run" measurements.

Parameters:

<Mode> ONCE | SWEep | ALL | PRESelect

ONCE: Trigger Once
SWEep: Retrigger Sweep
ALL: Retrigger All
PRESelect: Retrigger Preselect(ed) steps, see `CONFigure:GPRF:MEAS<i>:POWer:LIST:RETRigger`)

*RST: ONCE

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11 (V2.0.10 for `PRESelect`)

Manual operation: See "Trigger Mode" on page 124

3.5.3.5 List Configuration

The following commands select the sequence mode of the "Power" measurement and configure the list mode.

CONFigure:GPRF:MEAS<i>:POWer:LIST <EnableListMode>

Enables or disables the list mode for the "Power" measurement.

Parameters:

<EnableListMode> OFF | ON

OFF: List mode off (single power step)
ON: List mode on

*RST: OFF

Example: See Configuring the List Mode

Firmware/Software: V1.0.0.4

Options: R&S CMW-KM012

Manual operation: See "List Mode" on page 119

CONFigure:GPRF:MEAS<i>:POWer:LIST:IQData:CAPTure <CaptureIQData>

Enables or disables the I/Q data measurement.

Parameters:

<CaptureIQData> OFF | ON

*RST: OFF

Example: See Performing an I/Q Data Measurement

Firmware/Software: V2.1.25

Options: R&S CMW-KM012

Manual operation: See "IQ Data > Capture" on page 125

CONFigure:GPRF:MEAS<i>:POWer:LIST:MUNit <MagnitudeUnit>

Selets the magnitude unit for I/Q measurement results.

Parameters:

<MagnitudeUnit> VOLT | RAW

Voltage units or raw I/Q data relative to full scale

*RST: VOLT

Example: See Performing an I/Q Data Measurement

Firmware/Software: V2.1.25

Options: R&S CMW-KM012

Manual operation: See "IQ Data > Magnitude Unit" on page 125

CONFigure:GPRF:MEAS<i>:POWer:PSET <ParameterSetMode>

Selects the measurement control settings for the power measurement. The list settings require a Retrigger Preselect trigger mode (`TRIGger:GPRF:MEAS<i>:POWer:MODE PRESelect`). In this mode, the R&S CMW uses the parameter settings defined via `CONFigure:GPRF:MEAS<i>:POWer:LIST:PSET`.

Parameters:

<ParameterSetMode> GLOBal | LIST

Use global setting or independent settings for each list step

*RST: GLOB

Example: See Performing an I/Q Data Measurement

Firmware/Software: V2.1.25

Manual operation: See "Parameter Set" on page 125

CONFigure:GPRF:MEAS<i>:POWer:LIST:TXITiming <Timing>

Specifies the timing of the generated "GPRF Meas<i>:Power" trigger.

Parameters:

<Timing> STEP | CENTered

STEP: trigger signals are generated at the step boundaries
CENTered: trigger signals are generated in the middle of the gaps between subsequent measurement intervals

*RST: STEP

Firmware/Software: V3.0.11

Manual operation: See "TX Increment Timing" on page 125

CONFigure:GPRF:MEAS<i>:POWer:LIST:STARt <StartIndex>

Start index, defines the first segment in the list that shall be measured.

The total number of results (segments with repetitions) in the selected list section must not be higher than 10000.

Parameters:

<StartIndex> Range: 0 to 1999
*RST: 0

Example: See Configuring the List Mode

Firmware/Software: V1.0.0.4

Options: R&S CMW-KM012

Manual operation: See "List Section" on page 126

CONFigure:GPRF:MEAS<i>:POWer:LIST:STOP <StopIndex>

Stop index, defines the last segment in the list that shall be measured.

The total number of results (segments with repetitions) in the selected list section must not be higher than 10000.

Parameters:

<StopIndex> Range: 0 to 3999
*RST: 19

Example: See Configuring the List Mode

Firmware/Software: V1.0.0.4
V3.0.12 List size increased from 2000 to 4000

Options: R&S CMW-KM012

Manual operation: See "List Section" on page 126

CONFigure:GPRF:MEAS<i>:POWer:LIST:SSTop <StartIndex>, <StopIndex>

Start and stop index of the list section to be measured.

The total number of results (segments with repetitions) in the list section must not be higher than 10000.

Parameters:

<StartIndex> Range: 0 to 3999
*RST: 0

<StopIndex> Range: 0 to 3999
*RST: 19

Firmware/Software: V3.0.10
V3.0.12 List size increased from 2000 to 4000

Options: R&S CMW-KM012

Manual operation: See "List Section" on page 126

CONFigure:GPRF:MEAS<i>:POWer:LIST:COUNt?

Queries the total number of steps (results) in the selected list section.

The total number of results (segments with repetitions) is limited by 10000.

Return values:

<ResultCount> Range: 1 to 10E+3
*RST: 20

Example: See Configuring the List Mode

Usage: Query only

Firmware/Software: V1.0.0.4

Options: R&S CMW-KM012

Manual operation: See "List Section" on page 126

CONFigure:GPRF:MEAS<i>:POWer:LIST:IREPetition <Index>, <Repetition>
CONFigure:GPRF:MEAS<i>:POWer:LIST:IREPetition? <Index>

Sets/gets the number of repetitions of a list segment.

Parameters:

<Repetition> Repetition of the frequency/level step
Range: 1 to 9981
Increment: The total number of results (segments with repetitions) in the selected list section must not be higher than 10000.
*RST: 1

Parameters for setting and query:

<Index> Segment index

Range: 0 to 3999
*RST: n/a

Example: See Configuring the List Mode

Firmware/Software: V2.0.10
V3.0.12 List size increased from 2000 to 4000

Options: R&S CMW-KM012

Manual operation: See "List > Frequency / Exp. Nom. Pow." on page 126

CONFigure:GPRF:MEAS<i>:POWer:LIST:IREPetition:ALL <Repetition>...

Sets/gets the individual number of repetitions of all list segments.

Parameters:

<Repetition> n comma separated values, one per list segment, where n ≤ 2000. The query returns 2000 results.

Range: 1 to 10000
Increment: The total number of results (segments with repetitions) in the selected list section must not be higher than 10000.
*RST: 1

Example: See Configuring the List Mode

Firmware/Software: V2.0.10

Options: R&S CMW-KM012

Manual operation: See "List > Frequency / Exp. Nom. Pow." on page 126

CONFigure:GPRF:MEAS<i>:POWer:LIST:FREQuency <Index>, <Frequency>
CONFigure:GPRF:MEAS<i>:POWer:LIST:FREQuency? <Index>

Defines or queries the frequency of a selected frequency/level step.

Parameters:

<Frequency> Frequency of the frequency/level step

Range: 70E+6 Hz to 6E+9 Hz
Increment: 0.1 Hz
*RST: Depending on list index (750 MHz to 940 MHz for index 0 to 19)
Default unit: Hz

Parameters for setting and query:

<Index> Number of frequency/level step in the table

Range: 0 to 3999
*RST: n/a

Example: See Configuring the List Mode

Firmware/Software: V1.0.0.4
V3.0.12 List size increased from 2000 to 4000

Options: R&S CMW-KM012

Manual operation: See "List > Frequency / Exp. Nom. Pow." on page 126

CONFigure:GPRF:MEAS<i>:POWer:LIST:FREQuency:ALL <Frequency_1>, ..., <Frequency_n>

Defines the frequencies of all frequency/level steps.

Parameters:

<Frequency_1> ... <Frequency_n>
n frequencies, one per frequency/level step, where n < 2001. The query returns 2000 results.

Range: 70E+6 Hz to 6E+9 Hz
Increment: 0.1 Hz
*RST: value 0 to 19: 750 MHz to 940 MHz, value 20 to 1999: 940 MHz
Default unit: Hz

Example: See Configuring the List Mode

Firmware/Software: V1.0.2.6

Options: R&S CMW-KM012

Manual operation: See "List > Frequency / Exp. Nom. Pow." on page 126

CONFigure:GPRF:MEAS<i>:POWer:LIST:ENPower <Index>, <ExpNomPower>
CONFigure:GPRF:MEAS<i>:POWer:LIST:ENPower? <Index>

Defines or queries the expected nominal power of a selected frequency/level step.

Parameters:

<ExpNomPower>
Expected nominal power of the frequency/level step

Range: -55 dBm to 55 dBm
*RST: Depending on list index (–10 dBm, –10 dBm, –10 dBm, –20 dBm, –20 dBm, –20 dBm, –20 dBm, –30 dBm, ... for the first indices)
Default unit: dBm

Parameters for setting and query:

<Index>
Number of frequency/level step in the table

Range: 0 to 3999
*RST: n/a

Example: See Configuring the List Mode

Firmware/Software: V1.0.0.4
V3.0.12 List size increased from 2000 to 4000

Options: R&S CMW-KM012

Manual operation: See "List > Frequency / Exp. Nom. Pow." on page 126

CONFigure:GPRF:MEAS<i>:POWer:LIST:ENPower:ALL <Power_1>, ..., <Power_n>

Defines the expected nominal power of all frequency/level steps.

Parameters:

<Power_1> ... <Power_n>
n expected powers, one per frequency/level step, where n < 2001.
The query returns 2000 results.

Range: -55 dBm to 55 dBm
Increment: 0.001 dB
*RST: -10 dBm, -10 dBm, -10 dBm, -20 dBm, -20 dBm, -20 dBm, -20 dBm, -30 dBm, ..., -30 dBm
Default unit: dBm

Example: See Configuring the List Mode

Firmware/Software: V1.0.2.6

Options: R&S CMW-KM012

Manual operation: See "List > Frequency / Exp. Nom. Pow." on page 126

CONFigure:GPRF:MEAS<i>:POWer:LIST:RETRigger <Index>, <Retrigger>
CONFigure:GPRF:MEAS<i>:POWer:LIST:RETRigger? <Index>

Enables the retrigger mechanism for a selected list segment. The setting is relevant for trigger mode "Retrigger Preselect" (`TRIGger:GPRF:MEAS<i>:POWer:MODE PRESelect`).

Parameters:

<Retrigger>
OFF | ON

Disable or enable retrigger for segment <Index>

*RST: ON (<Index> = 0), OFF (<Index> > 0)

Parameters for setting and query:

<Index>
List segment index

Range: 0 to 3999
*RST: n/a

Example: See Configuring the List Mode

Firmware/Software: V2.0.10
V3.0.12 List size increased from 2000 to 4000

Options: R&S CMW-KM012

Manual operation: See "List > Retrigger" on page 127

CONFigure:GPRF:MEAS<i>:POWer:LIST:RETRigger:ALL <Retrigger_1>, ..., <Retrigger_n>

Enables the retrigger mechanism after all frequency/level steps. The setting is relevant for trigger mode "Retrigger Preselect" (`TRIGger:GPRF:MEAS<i>:POWer:MODE PRESelect`).

Parameters:

<Retrigger_1> ... <Retrigger_n>
OFF | ON
n comma separated values, one per frequency/level step, where n ≤ 2000. The query returns 2000 results.
*RST: ON (first value), OFF (all other values)

Example: See Configuring the List Mode

Firmware/Software: V2.0.10

Options: R&S CMW-KM012

Manual operation: See "List > Retrigger" on page 127

CONFigure:GPRF:MEAS<i>:POWer:LIST:IQData <Index>, <IQData>
CONFigure:GPRF:MEAS<i>:POWer:LIST:IQData? <Index>

Enables the I/Q data measurement in a selected frequency/level step.

Parameters:

<IQData>
OFF | ON
Disable or enable I/Q data measurement
*RST: OFF (all frequency/level steps)

Parameters for setting and query:

<Index>
Number of frequency/level step in the table
Range: 0 to 3999
*RST: n/a

Example: See Performing an I/Q Data Measurement

Firmware/Software: V2.1.25
V3.0.12 List size increased from 2000 to 4000

Options: R&S CMW-KM012

Manual operation: See "List > IQ Data" on page 128

CONFigure:GPRF:MEAS<i>:POWer:LIST:IQData:ALL <IQData_1>, ..., <IQData_n>

Enables the I/Q data measurement in all frequency/level steps.

Parameters:

<IQData_1> ... <IQData_n>
OFF | ON
n comma separated values, one per frequency/level step, where n ≤ 2000. The query returns 2000 results.
*RST: OFF (all frequency/level steps)

Example: See Performing an I/Q Data Measurement

Firmware/Software: V2.1.25

Options: R&S CMW-KM012

Manual operation: See "List > IQ Data" on page 128

CONFigure:GPRF:MEAS<i>:POWer:LIST:PSET <Index>, <ParameterSet>
CONFigure:GPRF:MEAS<i>:POWer:LIST:PSET? <Index>

Selects the parameter set for a particular frequency/level step <index>. The parameter sets are defined using `...GPRF:MEAS<i>:POWER:PSET...` commands; see chapter 3.5, "Command Reference", on page 185.

Parameters:

<ParameterSet> Parameter set number

Range: 0 to 31
*RST: 0 (all frequency/level steps)

Parameters for setting and query:

<Index> Number of frequency/level step in the table

Range: 0 to 3999
*RST: n/a

Example: See Performing an I/Q Data Measurement

Firmware/Software: V2.1.25
V3.0.12 List size increased from 2000 to 4000

Options: R&S CMW-KM012

Manual operation: See "List > Parameter Set" on page 128

CONFigure:GPRF:MEAS<i>:POWer:LIST:PSET:ALL <ParamSet_1>, ..., <ParamSet_n>

Selects the parameter set for all frequency/level steps. The parameter sets are defined using `...GPRF:MEAS<i>:POWER:PSET...` commands; see chapter 3.5, "Command Reference", on page 185.

Parameters:

<ParamSet_1> ... <ParamSet_n> n comma separated values, one per frequency/level step, where n ≤ 2000. The query returns 2000 results.

Range: 0 to 31
*RST: 0 (all frequency/level steps)

Example: See Performing an I/Q Data Measurement

Firmware/Software: V2.1.25

Options: R&S CMW-KM012

Manual operation: See "List > Parameter Set" on page 128

3.5.3.6 Measurement Results: Single Step Power Evaluation and List Mode

The following commands return the results of the GPRF power measurement for single step "Power" and list mode.

FETCh:GPRF:MEAS<i>:POWer:CURRent?
FETCh:GPRF:MEAS<i>:POWer:MINimum:CURRent?
FETCh:GPRF:MEAS<i>:POWer:MAXimum:CURRent?
FETCh:GPRF:MEAS<i>:POWer:AVERage?
FETCh:GPRF:MEAS<i>:POWer:PEAK:MINimum?
FETCh:GPRF:MEAS<i>:POWer:PEAK:MAXimum?
READ:GPRF:MEAS<i>:POWer:CURRent?
READ:GPRF:MEAS<i>:POWer:MINimum:CURRent?
READ:GPRF:MEAS<i>:POWer:MAXimum:CURRent?
READ:GPRF:MEAS<i>:POWer:AVERage?
READ:GPRF:MEAS<i>:POWer:PEAK:MINimum?
READ:GPRF:MEAS<i>:POWer:PEAK:MAXimum?
CALCulate:GPRF:MEAS<i>:POWer:CURRent?
CALCulate:GPRF:MEAS<i>:POWer:MINimum:CURRent?
CALCulate:GPRF:MEAS<i>:POWer:MAXimum:CURRent?
CALCulate:GPRF:MEAS<i>:POWer:AVERage?
CALCulate:GPRF:MEAS<i>:POWer:PEAK:MINimum?
CALCulate:GPRF:MEAS<i>:POWer:PEAK:MAXimum?

Returns RF power results, see Measurement Results.

The following results can be retrieved:

- Power Current RMS (`...:POWer:CURRent?`)
- Power Current Min. (`...:MINimum:CURRent?`)
- Power Current Max. (`...:MAXimum:CURRent?`)
- Power Average RMS (`...:AVERage?`)
- Power Minimum (`...:PEAK:MINimum?`)
- Power Maximum (`...:PEAK:MAXimum?`)

The values described below are returned by `FETCh` and `READ` commands. `CALCulate` commands return a single-value error code for each result listed below.

See also: "Error Indicators for Single Results" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<Reliability> see Reliability Indicator

<Power_1> ... <Power_n> RF power for each measured power step. If the list mode is switched off, a single value is returned (n = 1). In list mode, the total number n of results is equal to the step count (`CONFigure:GPRF:MEAS<i>:POWer:LIST:COUNt?`).

Range: -100 dBm to 57 dBm
Default unit: dBm

Example: See Single-Shot and Continuous Power Measurements

Usage: Query only

Firmware/Software: V1.0.0.4 (`CALCulate...` commands: V1.0.10.1)

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

FETCh:GPRF:MEAS<i>:POWer:SDEViation?
READ:GPRF:MEAS<i>:POWer:SDEViation?
CALCulate:GPRF:MEAS<i>:POWer:SDEViation?

Returns the standard deviation values, see Measurement Results.

The values described below are returned by `FETCh` and `READ` commands. `CALCulate` commands return a single-value error code for each result listed below.

See also: "Error Indicators for Single Results" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<Reliability> see Reliability Indicator

<PowerStdDev_1> ... <PowerStdDev_n> Standard deviation of RMS power results for each measured power step. If the list mode is switched off, a single value is returned (n = 1). In list mode, the total number n of results is equal to the list count (`CONFigure:GPRF:MEAS<i>:POWer:LIST:COUNt?`).

Range: 0 dB to 78 dB
Default unit: dB

Example: See Single-Shot and Continuous Power Measurements

Usage: Query only

Firmware/Software: V1.0.0.4 (`CALCulate...` commands: V1.0.10.1)

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

3.5.3.7 Measurement Results: Single Step Statistic Evaluation

The following commands return the results of the GPRF power measurement for single step and "Statistic" evaluation mode.

FETCh:GPRF:MEAS<i>:POWer:CCDF?

Returns the trace points of the complementary cumulative distribution function (CCDF).

This result is only available in "Statistic" evaluation mode (see `CONFigure:GPRF:MEAS<i>:POWer:MODE`).

Return values:

<Reliability> see Reliability Indicator

<Results> 4096 results, each representing a 0.047dB interval ("bin"). The position of the average power "bin" can be retrieved via FETCh:GPRF:MEAS<i>:POWer:CCDF:POWer?.

Range: 10E-9 % to 100 %

Usage: Query only

Firmware/Software: V3.0.10

FETCh:GPRF:MEAS<i>:POWer:CCDF:SAMPle?

Returns the sample counters in "Statistic" evaluation mode (see CONFigure:GPRF:MEAS<i>:POWer:MODE).

"Statistic" evaluation mode is only available for single-step measurements (list mode OFF).

Return values:

<Reliability> see Reliability Indicator

<Count> Total sample count

Range: 0 to 281.474976710655E+12

<Time> Total sample time

Range: 0 s to 30.7584E+6 s
Default unit: s

Usage: Query only

Firmware/Software: V3.0.10

FETCh:GPRF:MEAS<i>:POWer:CCDF:POWer?

Returns the power results in "Statistic" evaluation mode (see CONFigure:GPRF:MEAS<i>:POWer:MODE).

"Statistic" evaluation mode is only available for single-step measurements (list mode OFF).

Return values:

<Reliability> see Reliability Indicator

<AVG> Average power

Range: -150 dBm to 50 dBm

<MAX> Maximum power

Range: -150 dBm to 50 dBm

<PAR> Peak to average ratio

Range: 0 dB to 50 dB

<IndexAVGPower> The index of the average power "bin" in the CCDF result (see FETCh:GPRF:MEAS<i>:POWer:CCDF?)
Range: 0 to not used

Usage: Query only

Firmware/Software: V3.0.10

FETCh:GPRF:MEAS<i>:POWer:CCDF:PROBability?

Returns percentiles of the complementary cumulative distribution function (CCDF).

This result is only available in "Statistic" evaluation mode (see CONFigure:GPRF:MEAS<i>:POWer:MODE).

Return values:

<Reliability> see Reliability Indicator

<Probability> 10%, 1%, 0.1%, 0.01%, 0.001% and 0.0001% percentiles of the CCDF (6 values), i.e. the power limits L_p (in dB) such that p=10%, 1%, ... of the samples have a power > Avg. Power + L_p
The average power can be retrieved via FETCh:GPRF:MEAS<i>:POWer:CCDF:POWer?
Range: -80 dB to 50 dB
Default unit: dB

Usage: Query only

Firmware/Software: V3.0.10

FETCh:GPRF:MEAS<i>:POWer:APD?

Returns the trace points of the amplitude probability density (APD).

This result is only available in "Statistic" evaluation mode (see CONFigure:GPRF:MEAS<i>:POWer:MODE).

Return values:

<Reliability> see Reliability Indicator

<Results> 4096 results, each representing a 0.047dB interval ("bin"). The position of the average power "bin" can be retrieved via FETCh:GPRF:MEAS<i>:POWer:CCDF:POWer?.
Range: 10E-9 % to 100 %

Usage: Query only

Firmware/Software: V3.0.10

3.5.3.8 Measurement Results: List Mode

The following commands return the results of the GPRF power measurement for single step and "Statistic" evaluation mode.

FETCh:GPRF:MEAS<i>:POWer:LIST:CURRent? <ListIndex>
FETCh:GPRF:MEAS<i>:POWer:LIST:SDEViation? <ListIndex>
FETCh:GPRF:MEAS<i>:POWer:LIST:MAXimum:CURRent? <ListIndex>
FETCh:GPRF:MEAS<i>:POWer:LIST:MINimum:CURRent? <ListIndex>
FETCh:GPRF:MEAS<i>:POWer:LIST:PEAK:MAXimum? <ListIndex>
FETCh:GPRF:MEAS<i>:POWer:LIST:PEAK:MINimum? <ListIndex>
READ:GPRF:MEAS<i>:POWer:LIST:CURRent? <ListIndex>
READ:GPRF:MEAS<i>:POWer:LIST:AVERage? <ListIndex>
READ:GPRF:MEAS<i>:POWer:LIST:SDEViation? <ListIndex>
READ:GPRF:MEAS<i>:POWer:LIST:MAXimum:CURRent? <ListIndex>
READ:GPRF:MEAS<i>:POWer:LIST:MINimum:CURRent? <ListIndex>
READ:GPRF:MEAS<i>:POWer:LIST:PEAK:MAXimum? <ListIndex>
READ:GPRF:MEAS<i>:POWer:LIST:PEAK:MINimum? <ListIndex>
CALCulate:GPRF:MEAS<i>:POWer:LIST:CURRent? <ListIndex>
CALCulate:GPRF:MEAS<i>:POWer:LIST:AVERage? <ListIndex>
CALCulate:GPRF:MEAS<i>:POWer:LIST:SDEViation? <ListIndex>
CALCulate:GPRF:MEAS<i>:POWer:LIST:MAXimum:CURRent? <ListIndex>
CALCulate:GPRF:MEAS<i>:POWer:LIST:MINimum:CURRent? <ListIndex>
CALCulate:GPRF:MEAS<i>:POWer:LIST:PEAK:MAXimum? <ListIndex>
CALCulate:GPRF:MEAS<i>:POWer:LIST:PEAK:MINimum? <ListIndex>

Returns power results in List Mode, see List Mode: Diagram View.

The following results can be retrieved:

- Power Current RMS (`...:LIST:CURRent?`)
- Power Current Min. (`...:MINimum:CURRent?`)
- Power Current Max. (`...:MAXimum:CURRent?`)
- Power Average RMS (`...:AVERage?`)
- Power Minimum (`...:PEAK:MINimum?`)
- Power Maximum (`...:PEAK:MAXimum?`)

The values described below are returned by `FETCh` and `READ` commands. `CALCulate` commands return a single-value error code for each result listed below.

See also: "Error Indicators for Single Results" in the R&S CMW user manual, chapter "Remote Control"

Query parameters:

<StepIndex> Addresses the power step; must be less or equal than the step count of the active list section (see `CONFigure:GPRF:MEAS<i>:POWer:LIST:COUNt?` on page 211

Return values:

<Reliability> see Reliability Indicator

<Power> Power result
Range: -100 dBm to 57 dBm
Default unit: dBm

Usage: Query only

Firmware/Software: V3.0.10

FETCh:GPRF:MEAS<i>:POWer:IQINfo? <Index>

Returns the number of samples and the sampling rate of the I/Q data measurement in a particular frequency/level step <index>.

Query parameters:
<Index> Range: 0 to 1999

Return values:
<Reliability>

<NumberOfSamples> Range: 0 to 4E+6
*RST: n/a

<SampleRate> Range: 250 Hz to 50 MHz
*RST: n/a
Default unit: dB

Example: See Performing an I/Q Data Measurement

Usage: Query only

Firmware/Software: V2.1.25

FETCh:GPRF:MEAS<i>:POWer:IQData? <Index>
READ:GPRF:MEAS<i>:POWer:IQData? <Index>

Returns the results of the I/Q data measurement in a particular frequency/level step <index> in ASCII format.

Query parameters:
<Index> Range: 0 to 10000
*RST: n/a

Return values:
<Reliablity> see Reliability Indicator

<IQData> I and Q amplitudes in alternating order. The values depend on the selected magnitude unit (`CONFigure:GPRF:MEAS<i>:POWer:LIST:MUNit`.
Range: -160 V to 160 V
Default unit: V

Example: See Performing an I/Q Data Measurement

Usage: Query only

Firmware/Software: V2.1.25
V2.1.25 READ command added

FETCh:GPRF:MEAS<i>:POWer:IQData:BIN? <Index>

Returns the results of the I/Q data measurement in a particular frequency/level step <index> in binary data format.

Query parameters:

<Index> Range: 0 to 1999
*RST: n/a

Return values:

<Reliability> see Reliability Indicator

<IQData> I and Q amplitudes (binary) in alternating order. See Returned <IQData> below. The values depend on the selected magnitude unit (`CONFigure:GPRF:MEAS<i>:POWer:LIST:MUNit`.

Range: -160.0 to +160.0 if magnitude unit is VOLT, -32768.0 to +32767.0 if magnitude unit is RAW

Example: See Performing an I/Q Data Measurement

Usage: Query only

Firmware/Software: V2.1.25

Table 3-6: Returned <IQData>

Parameter	Description
#L	Number of digits of the following counter N
N	Total number of the following data bytes (N=8*n)
<I_1><Q_1> ... <I_n><Q_n>	I and Q amplitudes in alternating order. Each amplitude value consists of four bytes.
EOS	End of string character

See also chapter 3.2.4.3, "ASCII and Binary Data Formats", on page 103.

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

3.5.4 Spectrum Analyzer Commands

The commands for the Spectrum measurement are divided into the groups listed below.

3.5.4.1 Measurement Control and States

The following commands control the measurement and return the current measurement state.

INITiate:GPRF:MEAS<i>:SPECtrum
STOP:GPRF:MEAS<i>:SPECtrum
ABORt:GPRF:MEAS<i>:SPECtrum

Starts, stops, or aborts the measurement:

- `INITiate...` starts or restarts the measurement; the R&S CMW enters the "RUN" state.
- `STOP...` causes a running measurement to stop after the current evaluation period is terminated and valid results are available; the R&S CMW enters the "RDY" state.
- `ABORt...` causes a running measurement to stop immediately; the R&S CMW enters the "OFF" state.

Use `FETCh...STATe?` to query the current measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Example: See Single-Shot and Continuous Measurements

Usage: Event

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Spectrum (Softkey)" on page 132

FETCh:GPRF:MEAS<i>:SPECtrum:STATe?

Queries the main measurement state. Use `FETCh:...:STATe:ALL?` to query the measurement state including the substates. Use `INITiate..., STOP..., ABORt...` to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MeasState> OFF | RUN | RDY | PENDing | ADJusted | QUEued | ACTive | INVValid

OFF: measurement switched off, no resources allocated, no results available (when entered after `ABORt...`)
RDY: measurement has been terminated, valid results may be available
RUN: measurement running (after `INITiate..., READ...`), synchronization pending or adjusted, resources active or queued

*RST: OFF

Example: See Single-Shot and Continuous Measurements

Usage: Query only

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Spectrum (Softkey)" on page 132

FETCh:GPRF:MEAS<i>:SPECtrum:STATe:ALL?

Queries the main measurement state and the measurement substates. Both measurement substates are relevant for running measurements only. Use `FETCh:...:STATe?` to query the main measurement state only. Use `INITiate..., STOP..., ABORt...` to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MainState> OFF | RDY | RUN

OFF: measurement switched off, no resources allocated, no results available (when entered after `STOP...`)
RDY: measurement has been terminated, valid results may be available
RUN: measurement running (after `INITiate..., READ...`), synchronization pending or adjusted, resources active or queued

*RST: OFF

<SyncState> PEND | ADJ | INV

PEND: waiting for resource allocation, adjustment, hardware switching ("pending")
ADJ: all necessary adjustments finished, measurement running ("adjusted")
INV: not applicable because <main_state>: OFF or RDY ("invalid")

<ResourcesState> QUE | ACT | INV

QUE: measurement without resources, no results available ("queued")
ACT: resources allocated, acquisition of results in progress but not complete ("active")
INV: not applicable because <main_state>: OFF or RDY ("invalid")

Example: See Single-Shot and Continuous Measurements

Usage: Query only

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Spectrum (Softkey)" on page 132

3.5.4.2 Statistical Settings

The following commands specify the scope of the measurement.

CONFigure:GPRF:MEAS<i>:SPECtrum:TOUT <TCDTimeOut>

Defines a timeout for the measurement. The timer is started when the measurement is initiated via a `READ` or `INIT` command. It is not started if the measurement is initiated manually (ON/OFF key or RESTART/STOP key).

When the measurement has completed the first measurement cycle (first single shot), the statistical depth is reached and the timer is reset.

If the first measurement cycle has not been completed when the timer expires, the measurement is stopped. The measurement state changes to `RDY` and the reliability indicator is set to 1, indicating that a measurement timeout occurred. Still running `READ`, `FETCh` or `CALCulate` commands are completed, returning the available results. At least for some results there are no values at all or the statistical depth has not been reached.

A timeout of 0 s corresponds to an infinite measurement timeout.

Parameters:
<TCDTimeOut> Default unit: s

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

CONFigure:GPRF:MEAS<i>:SPECtrum:REPetition <Repetition>

Specifies the repetition mode of the measurement. The repetition mode specifies whether the measurement is stopped after a single-shot or repeated continuously. Use `CONFigure:..:MEAS<i>:...:SCOunt` to determine the number of measurement intervals per single shot.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<Repetition> SINGleshot | CONTinuous

SINGleshot: Single-shot measurement
CONTinuous: Continuous measurement

*RST: SING

Example: See Single-Shot and Continuous Measurements

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Repetition" on page 133

CONFigure:GPRF:MEAS<i>:SPECtrum:SCOunt <StatisticCount>

Specifies the statistic count of the measurement. The statistic count is equal to the number of measurement intervals per single shot. Use `CONFigure:...:MEAS<i>:...:REPetition SINGleshot | CONTinuous` to select either single-shot or continuous measurements.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<StatisticCount> Number of measurement intervals. A measurement interval comprises a single frequency sweep.

Range: 1 to 1000
*RST: 1

Example: See Single-Shot and Continuous Measurements

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Statistic Count" on page 134

3.5.4.3 Trigger Settings

The following commands define the trigger system for the "Zero Span" mode of the spectrum analyzer measurement.

TRIGger:GPRF:MEAS<i>:SPECtrum:CATalog:SOURce?

Lists all trigger source values that can be set using `TRIGger:GPRF:MEAS<i>:SPECtrum:SOURce`.

Return values:

<TriggerSources>... Comma separated list of all supported values. Each value is represented as a string.

Example: See Specifying Measurement-Specific Settings

Usage: Query only

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Trigger Source" on page 134

TRIGger:GPRF:MEAS<i>:SPECtrum:SOURce <Source>

Selects the source of the trigger events. Some values are always available in this firmware application. They are listed below. Depending on the installed options additional values may be available. A complete list of all supported values can be displayed using `TRIGger:...:CATalog:SOURce?`.

Parameters:

<Source>

"Free Run": Free Run (untriggered)
"Video": Power trigger at video band
"Base1: External TRIG A": External trigger fed in at TRIG A connector
"Base1: External TRIG B": External trigger fed in at TRIG B connector

*RST: "Free Run"

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Trigger Source" on page 134

TRIGger:GPRF:MEAS<i>:SPECtrum:SLOPe <Slope>

Qualifies whether the trigger event is generated at the rising or at the falling edge of the trigger pulse (valid for external and power trigger sources).

Parameters:

<Slope> REDGe | FEDGe

REDGe: Rising edge
FEDGe: Falling edge

*RST: REDGe

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Trigger Slope" on page 135

TRIGger:GPRF:MEAS<i>:SPECtrum:THReshold <Threshold>

Defines the trigger threshold for power trigger sources.

Parameters:

<Threshold>
Range: -50 dB to 0 dB
*RST: -30 dB
Default unit: dB (full scale, i.e. relative to reference level minus external attenuation)

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Trigger Threshold" on page 135

TRIGger:GPRF:MEAS<i>:SPECtrum:OFFSet <TriggerOffset>

Defines the trigger offset, i.e. the offset of a triggered zero span (time domain) measurement relative to the corresponding trigger event.

Parameters:

<TriggerOffset>
Range: -0.5 s to 0.5 s
Increment: 1E-9 s
*RST: 0 s
Default unit: s

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Trigger Offset" on page 135

TRIGger:GPRF:MEAS<i>:SPECtrum:TOUT <TriggerTimeout>

Selects the maximum time that the R&S CMW will wait for a trigger event before it stops the measurement in remote control mode or indicates a trigger timeout in manual operation mode. This setting has no influence on "Free Run" measurements.

Parameters:

<TriggerTimeout>
Range: 0.01 s to 300 s
Increment: 0.01 s
*RST: 1 s
Default unit: s
Additional values: OFF | ON (disables timeout | enables timeout using the previous/default values)

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

TRIGger:GPRF:MEAS<i>:SPECtrum:MGAP <MinimumGap>

Sets a minimum time during which the IF signal must be below the trigger threshold before the trigger is armed so that an IF power trigger event can be generated.

Parameters:

<MinimumGap>
Range: 0 s to 0.01 s
Increment: 10E-9
*RST: 0 s
Default unit: s

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

3.5.4.4 Frequency Settings

The following commands define the parameters of the analyzer: mode, center, span, RBW, VBW and Sweep Time.

CONFigure:GPRF:MEAS<i>:SPECtrum:FREQuency:CENTer <CenterFrequency>

Sets or gets the center frequency of the spectrum measurement.

In frequency sweep mode (see CONFigure:GPRF:MEAS<i>:SPECtrum:FREQuency:SPAN:MODE on page 232) , setting the center frequency will adjust the start and stop frequency

- keeping the frequency span constant, if neither the start frequency reaches its lower limit (70 MHz) nor the stop frequency reaches its upper limit (6000 MHz)
- reducing the frequency span to the maximum possible value compatible with the supported frequency band (70 MHz to 6000 MHz), if either the start frequency reaches its lower limit (70 MHz) or the stop frequency reaches its upper limit (6000 MHz)

In zero span mode, setting the center frequency will leave the start frequency, stop frequency and span unchanged. These values will be adjusted according to the new center frequency and (appropriately reduced) span as soon as the frequency sweep mode is selected.

Parameters:

<CenterFrequency>
Range: 70E+6 Hz to 6E+9 Hz
Increment: 1 kHz
*RST: 1.685E+9 Hz
Default unit: Hz

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Frequency > Center" on page 137

CONFigure:GPRF:MEAS<i>:SPECtrum:FREQuency:SPAN <FrequencySpan>

Sets or gets the frequency span for frequency sweep mode. Setting this value also determines the center frequency, start frequency and stop frequency.

Increasing the span symmetrically extends the frequency range ("Start Frequency" to "Stop Frequency") around the center frequency, if possible. As soon as the lower/upper frequency limit (70 MHz/6000 MHz) is reached, the range is extended in the direction of higher/lower frequencies only - simultaneously decreasing/increasing the center frequency - until finally the "Full Span" of 5930 MHz is reached.

Parameters:

<FrequencySpan>
Range: 1E+3 Hz to 5.930001E+9 Hz
*RST: 3.23E+9 Hz
Default unit: Hz

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Frequency > Span" on page 137

CONFigure:GPRF:MEAS<i>:SPECtrum:FREQuency:STARt <StartFrequency>

Sets or gets the start frequency of the frequency sweep.

Parameters:

<StartFrequency> Range: 69.99975E+6 Hz to 5.99999975E+9 Hz
*RST: 70E+6 Hz
Default unit: Hz

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Frequency > Start / Stop Frequency" on page 138

CONFigure:GPRF:MEAS<i>:SPECtrum:FREQuency:STOP <StopFrequency>

Sets or gets the stop frequency of the frequency sweep.

Parameters:

<StopFrequency> Range: 70.00025E+6 Hz to 6.00000025E+9 Hz
*RST: 3.3E+9 Hz
Default unit: Hz

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Frequency > Start / Stop Frequency" on page 138

3.5.4.5 Span Settings

The following commands define the span mode and value.

CONFigure:GPRF:MEAS<i>:SPECtrum:FREQuency:SPAN:MODE <SpanMode>

This command gets the current operating mode of the spectrum analyzer.

Parameters:

<SpanMode> FSWeep | ZSPan

FSWeep: Frequency Sweep mode
ZSPan: Zero Span (time sweep) mode

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Span Mode" on page 138

CONFigure:GPRF:MEAS<i>:SPECtrum:FREQuency:LASPan <LastSpan>

Sets the span for frequency sweep measurements to its previous value or queries the span's previous value (see `CONFigure:GPRF:MEAS<i>:SPECtrum:FREQuency:SPAN`).

Parameters:

<LastSpan> Range: 0 Hz to 6E+9 Hz
*RST: 200E+6 Hz
Default unit: Hz

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

3.5.4.6 Frequency Sweep Mode Settings

The following commands define the analyzer parameters that are specific for the frequency sweep mode: resolution bandwidth (RBW), video bandwidth (VBW) and sweep time (SWT).

CONFigure:GPRF:MEAS<i>:SPECtrum:FSWeep:RBW <RBW>

Sets or gets the resolution bandwidth (RBW) for the frequency sweep mode. Setting this value is only possible if the Auto-RBW selection for the sweep mode is switched OFF (see `CONFigure:GPRF:MEAS<i>:SPECtrum:FSWeep:RBW:AUTO`).

Parameters:

<RBW> Range: 100 Hz to 10E+6 Hz
*RST: 10E+6 Hz
Default unit: Hz

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Frequency Sweep > RBW" on page 138

CONFigure:GPRF:MEAS<i>:SPECtrum:FSWeep:RBW:AUTO <RBWAuto>

Sets or gets the state of the Auto-RBW selection for the frequency sweep mode.

Parameters:

<RBWAuto> OFF | ON
*RST: ON

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Frequency Sweep > RBW" on page 138

CONFigure:GPRF:MEAS<i>:SPECtrum:FSWeep:VBW <VBW>

Sets or gets the video bandwidth (VBW) for the frequency sweep mode. Setting this value is only possible if the Auto-VBW selection for the sweep mode is switched OFF (see `CONFigure:GPRF:MEAS<i>:SPECtrum:FSWeep:VBW:AUTO`).

Parameters:

<VBW>
Range: 10 Hz to 10E+6 Hz
*RST: 1E+6 Hz
Default unit: Hz

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Frequency Sweep > VBW" on page 138

CONFigure:GPRF:MEAS<i>:SPECtrum:FSWeep:VBW:AUTO <VBWAuto>

Sets or gets the state of the Auto-VBW selection for the frequency sweep mode.

Parameters:

<VBWAuto>
OFF | ON
*RST: On

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Frequency Sweep > VBW" on page 138

CONFigure:GPRF:MEAS<i>:SPECtrum:FSWeep:SWT <SweepTime>

Sets or gets the sweep time (SWT) for the frequency sweep mode. Setting this value is only possible if the Auto-SWT selection for the sweep mode is switched OFF (see `CONFigure:GPRF:MEAS<i>:SPECtrum:FSWeep:SWT:AUTO`).

Parameters:

<SweepTime>
Range: 0 s to 2000 s
*RST: 0.0646 s
Default unit: s

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Frequency Sweep > Sweep Time" on page 139

CONFigure:GPRF:MEAS<i>:SPECtrum:FSWeep:SWT:AUTO <SweepTimeAuto>

Sets or gets the state of the Auto-SWT selection for the frequency sweep mode.

Parameters:
<SweepTimeAuto> OFF | ON
*RST: On

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Frequency Sweep > Sweep Time" on page 139

3.5.4.7 Zero Span Settings

The following commands define the analyzer parameters that are specific for the zero span mode: the IF filter's type and bandwidth (radio bandwidth, RBW), the video bandwidth (VBW) and sweep time (SWT).

CONFigure:GPRF:MEAS<i>:SPECtrum:ZSPan:RBW:TYPE <RBWType>

Sets/gets the type of the resolution filter to be used in zero span mode.

Parameters:
<RBWType> GAUSs | BANDpass
*RST: GAUS

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Zero Span > RBW > Filter Type" on page 139

CONFigure:GPRF:MEAS<i>:SPECtrum:ZSPan:RBW:GAUSs <RBW>

Sets/gets the bandwidth of the gaussian resolution filter (see `CONFigure:GPRF:MEAS<i>:SPECtrum:ZSPan:RBW:TYPE`)

Parameters:
<RBW> Range: 100 Hz to 10E+6 Hz
*RST: 10E+6 Hz
Default unit: Hz

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Zero Span > RBW > Bandwidth" on page 139

CONFigure:GPRF:MEAS<i>:SPECtrum:ZSPan:RBW:BANDpass <RBWBandpass>

Sets/gets the bandwidth of the bandpass resolution filter (see `CONFigure:GPRF:MEAS<i>:SPECtrum:ZSPan:RBW:TYPE`).

Note that currently only a filter bandwidth of 40 MHz is supported.

Parameters:

<RBWBandpass>
Range: 40E+6 Hz to 40E+6 Hz
*RST: 40E+6 Hz
Default unit: Hz

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Zero Span > RBW > Bandwidth" on page 139

CONFigure:GPRF:MEAS<i>:SPECtrum:ZSPan:VBW <VBW>

Sets or gets the video bandwidth (VBW) for the zero span mode. Setting this value is only possible if the Auto-VBW selection for the zero span mode is switched OFF (see `CONFigure:GPRF:MEAS<i>:SPECtrum:ZSPan:VBW:AUTO`).

Parameters:

<VBW>
Range: 10 Hz to 10E+6 Hz
*RST: 1E+6 Hz
Default unit: Hz

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Zero Span > VBW" on page 139

CONFigure:GPRF:MEAS<i>:SPECtrum:ZSPan:VBW:AUTO <VBWAuto>

Sets or gets the state of the Auto-VBW selection for the zero span mode.

Parameters:

<VBWAuto>
OFF | ON
*RST: OFF

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Zero Span > VBW" on page 139

CONFigure:GPRF:MEAS<i>:SPECtrum:ZSPan:SWT <SweepTime>

Sets or gets the sweep time (SWT) for the zero span mode.

Parameters:

<SweepTime> Range: 0 s to 2000 s
*RST: 0.01 s
Default unit: s

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

3.5.4.8 Averaging mode

The following command configures the averaging mode for the result trace calculations.

CONFigure:GPRF:MEAS<i>:SPECtrum:AMODe <Averaging Mode>

Defines how the R&S CMW calculates the AVERage traces from the current results.

Parameters:

<Averaging Mode> LINear | LOGarithmic
*RST: Logarithmic

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

Manual operation: See "Averaging Mode" on page 141

3.5.4.9 Measurement Results

The following commands return the results of the "Spectrum Analyzer" for the supported detectors. All detectors are running in parallel.

FETCh:GPRF:MEAS<i>:SPECtrum:AVERage:AVERage?
FETCh:GPRF:MEAS<i>:SPECtrum:AVERage:CURRent?
FETCh:GPRF:MEAS<i>:SPECtrum:AVERage:MAXimum?
FETCh:GPRF:MEAS<i>:SPECtrum:AVERage:MINimum?
READ:GPRF:MEAS<i>:SPECtrum:AVERage:AVERage?
READ:GPRF:MEAS<i>:SPECtrum:AVERage:CURRent?
READ:GPRF:MEAS<i>:SPECtrum:AVERage:MAXimum?
READ:GPRF:MEAS<i>:SPECtrum:AVERage:MINimum?

Returns the traces calculated with the average detector. Current, average, maximum and minimum traces can be retrieved.

The averaging mode is defined via `CONFigure:GPRF:MEAS<i>:SPECtrum:AMODe`

Return values:

<Reliability> see Reliability Indicator

<Power> 1001 values
Range: -150 dBm to 50 dBm
Default unit: dBm

Usage: Query only

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

FETCh:GPRF:MEAS<i>:SPECtrum:RMS:AVERage?
FETCh:GPRF:MEAS<i>:SPECtrum:RMS:CURRent?
FETCh:GPRF:MEAS<i>:SPECtrum:RMS:MAXimum?
FETCh:GPRF:MEAS<i>:SPECtrum:RMS:MINimum?
READ:GPRF:MEAS<i>:SPECtrum:RMS:AVERage?

READ:GPRF:MEAS<i>:SPECtrum:RMS:CURRent?
READ:GPRF:MEAS<i>:SPECtrum:RMS:MAXimum?
READ:GPRF:MEAS<i>:SPECtrum:RMS:MINimum?

Returns the traces calculated with the RMS detector. Current, average, maximum and minimum traces can be retrieved.

Return values:
<Reliability>

<Power> 1001 values
Range: -150 dBm to 50 dBm
Default unit: dBm

Usage: Query only

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

FETCh:GPRF:MEAS<i>:SPECtrum:SAMPle:AVERage?
FETCh:GPRF:MEAS<i>:SPECtrum:SAMPle:CURRent?
FETCh:GPRF:MEAS<i>:SPECtrum:SAMPle:MAXimum?
FETCh:GPRF:MEAS<i>:SPECtrum:SAMPle:MINimum?
READ:GPRF:MEAS<i>:SPECtrum:SAMPle:AVERage?
READ:GPRF:MEAS<i>:SPECtrum:SAMPle:CURRent?
READ:GPRF:MEAS<i>:SPECtrum:SAMPle:MAXimum?
READ:GPRF:MEAS<i>:SPECtrum:SAMPle:MINimum?

Returns the traces calculated with the sample detector. Current, average, maximum and minimum traces can be retrieved.

Return values:
<Reliability>

<Power> 1001 values
Range: -150 dBm to 50 dBm
Default unit: dBm

Usage: Query only

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

FETCh:GPRF:MEAS<i>:SPECtrum:MINimum:AVERage?
FETCh:GPRF:MEAS<i>:SPECtrum:MINimum:CURRent?
FETCh:GPRF:MEAS<i>:SPECtrum:MINimum:MAXimum?
FETCh:GPRF:MEAS<i>:SPECtrum:MINimum:MINimum?
READ:GPRF:MEAS<i>:SPECtrum:MINimum:AVERage?
READ:GPRF:MEAS<i>:SPECtrum:MINimum:CURRent?

READ:GPRF:MEAS<i>:SPECtrum:MINimum:MAXimum?
READ:GPRF:MEAS<i>:SPECtrum:MINimum:MINimum?

Returns the traces calculated with the minimum peak detector. Current, average, maximum and minimum traces can be retrieved.

Return values:
<Reliability>

<Power> 1001 values
Range: -150 dBm to 50 dBm
Default unit: dBm

Usage: Query only

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

FETCh:GPRF:MEAS<i>:SPECtrum:MAXimum:AVERage?
FETCh:GPRF:MEAS<i>:SPECtrum:MAXimum:CURRent?
FETCh:GPRF:MEAS<i>:SPECtrum:MAXimum:MAXimum?
FETCh:GPRF:MEAS<i>:SPECtrum:MAXimum:MINimum?
READ:GPRF:MEAS<i>:SPECtrum:MAXimum:AVERage?
READ:GPRF:MEAS<i>:SPECtrum:MAXimum:CURRent?
READ:GPRF:MEAS<i>:SPECtrum:MAXimum:MAXimum?
READ:GPRF:MEAS<i>:SPECtrum:MAXimum:MINimum?

Returns the traces calculated with the maximum peak detector. Current, average, maximum and minimum traces can be retrieved.

Return values:
<Reliability>

<Power> 1001 values
Range: -150 dBm to 50 dBm
Default unit: dBm

Usage: Query only

Firmware/Software: V3.0.10

Options: R&S CMW-KM010

3.5.5 FFT Spectrum Analyzer Commands

The commands for the "FFT Spectrum Analyzer" are divided into the groups listed below.

3.5.5.1 Measurement Control and States

The following commands control the measurement and return the current measurement state.

INITiate:GPRF:MEAS<i>:FFTSanalyzer
STOP:GPRF:MEAS<i>:FFTSanalyzer
ABORt:GPRF:MEAS<i>:FFTSanalyzer

Starts, stops, or aborts the measurement:

- `INITiate...` starts or restarts the measurement; the R&S CMW enters the "RUN" state.
- `STOP...` causes a running measurement to stop after the current evaluation period is terminated and valid results are available; the R&S CMW enters the "RDY" state.
- `ABORt...` causes a running measurement to stop immediately; the R&S CMW enters the "OFF" state.

Use `FETCh...STATe?` to query the current measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Example: See Single-Shot and Continuous Measurements

Usage: Event

Firmware/Software: V1.0.5.3
V3.0.10 Option R&S CMW-KM010 no longer required

FETCh:GPRF:MEAS<i>:FFTSanalyzer:STATe?

Queries the main measurement state. Use `FETCh:...:STATe:ALL?` to query the measurement state including the substates. Use `INITiate..., STOP..., ABORt...` to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MeasState> OFF | RDY | RUN

OFF: measurement switched off, no resources allocated, no results available (when entered after `ABORt...`)
RDY: measurement has been terminated, valid results may be available
RUN: measurement running (after `INITiate..., READ...`), synchronization pending or adjusted, resources active or queued

*RST: OFF

Example: See Single-Shot and Continuous Measurements

Usage: Query only

Firmware/Software: V1.0.5.3
V3.0.10 Option R&S CMW-KM010 no longer required

Manual operation: See "FFT (Softkey)" on page 143

FETCh:GPRF:MEAS<i>:FFTSanalyzer:STATe:ALL?

Queries the main measurement state and the measurement substates. Both measurement substates are relevant for running measurements only. Use `FETCh:...:STATe?` to query the main measurement state only. Use `INITiate..., STOP..., ABORt...` to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MainState> OFF | RDY | RUN

OFF: measurement switched off, no resources allocated, no results available (when entered after `STOP...`)
RDY: measurement has been terminated, valid results may be available
RUN: measurement running (after `INITiate..., READ...`), synchronization pending or adjusted, resources active or queued

*RST: OFF

<SyncState> PEND | ADJ | INV

PEND: waiting for resource allocation, adjustment, hardware switching ("pending")
ADJ: all necessary adjustments finished, measurement running ("adjusted")
INV: not applicable because <main_state>: OFF or RDY ("invalid")

<ResourcesState> QUE | ACT | INV

QUE: measurement without resources, no results available ("queued")
ACT: resources allocated, acquisition of results in progress but not complete ("active")
INV: not applicable because <main_state>: OFF or RDY ("invalid")

Example: See Single-Shot and Continuous Measurements

Usage: Query only

Firmware/Software: V1.0.5.3
V3.0.10 Option R&S CMW-KM010 no longer required

Manual operation: See "FFT (Softkey)" on page 143

3.5.5.2 Statistical Settings

The following commands specify the scope of the measurement.

CONFigure:GPRF:MEAS<i>:FFTSanalyzer:TOUT <TCDTimeOut>

Defines a timeout for the measurement. The timer is started when the measurement is initiated via a `READ` or `INIT` command. It is not started if the measurement is initiated manually (ON/OFF key or RESTART/STOP key).

When the measurement has completed the first measurement cycle (first single shot), the statistical depth is reached and the timer is reset.

If the first measurement cycle has not been completed when the timer expires, the measurement is stopped. The measurement state changes to `RDY` and the reliability indicator is set to 1, indicating that a measurement timeout occurred. Still running `READ`, `FETCh` or `CALCulate` commands are completed, returning the available results. At least for some results there are no values at all or the statistical depth has not been reached.

A timeout of 0 s corresponds to an infinite measurement timeout.

Parameters:
<TCDTimeOut> *RST: 1 s
Default unit: s

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V2.0.10
V3.0.10 Option R&S CMW-KM010 no longer required

CONFigure:GPRF:MEAS<i>:FFTSanalyzer:REPetition <Repetition>

Specifies the repetition mode of the measurement. The repetition mode specifies whether the measurement is stopped after a single-shot or repeated continuously. Use `CONFigure:...:MEAS<i>:...:SCOunt` to determine the number of measurement intervals per single shot.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<Repetition> SINGleshot | CONTinuous

SINGleshot: Single-shot measurement
CONTinuous: Continuous measurement

*RST: SING

Example: See Single-Shot and Continuous Measurements

Firmware/Software: V1.0.5.3
V3.0.10 Option R&S CMW-KM010 no longer required

Manual operation: See "Repetition" on page 144

CONFigure:GPRF:MEAS<i>:FFTSanalyzer:SCOunt <StatisticCount>

Specifies the statistic count of the measurement. The statistic count is equal to the number of measurement intervals per single shot. Use `CONFigure:...:MEAS<i>:...:REPetition SINGleshot | CONTinuous` to select either single-shot or continuous measurements.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<StatisticCount> Number of measurement intervals. A measurement interval comprises a single power/frequency step (list mode switched off) or a sweep (list mode switched on).

Range: 1 to 1000
*RST: 10

Example: See Single-Shot and Continuous Measurements

Firmware/Software: V1.0.5.3
V3.0.10 Option R&S CMW-KM010 no longer required

Manual operation: See "Statistic Count" on page 144

CONFigure:GPRF:MEAS<i>:FFTSanalyzer:MOEXception <MeasOnException>

Specifies whether measurement results that the R&S CMW identifies as faulty or inaccurate are rejected.

Parameters:

<MeasOnException> OFF | ON

OFF: Faulty results are rejected
ON: Results are never rejected.

*RST: OFF

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.5.3
V3.0.10 Option R&S CMW-KM010 no longer required

Manual operation: See "Measure on Exception" on page 144

3.5.5.3 Measurement Control Parameters

The following commands define the measurement interval. See also Search Functions.

CONFigure:GPRF:MEAS<i>:FFTSanalyzer:FSPan <FrequencySpan>

Selects the calculated and displayed frequency range (span) of the FFT spectrum analyzer.

Parameters:

<FrequencySpan> Range: 1.25 MHz | 2.5 MHz | 5 MHz | 10 MHz | 20 MHz | 40 MHz
*RST: 10 MHz
Default unit: Hz

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.5.3
V3.0.10 Option R&S CMW-KM010 no longer required

Manual operation: See "Frequency Span" on page 144

CONFigure:GPRF:MEAS<i>:FFTSanalyzer:FFTLength <Length>

Selects the number of samples (FFT Length) that the R&S CMW uses for the FFT analysis.

Parameters:

<Length> Range: 1024 | 2048 | 4096 | 8192 | 16384 (other values are rounded to the closest possible FFT length)
*RST: 2048

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.5.3
V3.0.10 Option R&S CMW-KM010 no longer required

Manual operation: See "FFT Length" on page 145

CONFigure:GPRF:MEAS<i>:FFTSanalyzer:DETector <Detector>

Selects the detector for the display of the FFT trace.

Parameters:

<Detector> PEAK | RMS

PEAK: Trace points are calculated from peak values of a set of adjacent raw calculated data
RMS: Trace points are calculated from RMS values

*RST: PEAK

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.5.3
V3.0.10 Option R&S CMW-KM010 no longer required

Manual operation: See "Detector" on page 145

CONFigure:GPRF:MEAS<i>:FFTSanalyzer:AMODe <AveragingMode>

Selects the averaging mode for the average FFT trace (see `READ:GPRF:MEAS<i>:FFTSanalyzer:POWer:AVERage?`).

Parameters:

<AveragingMode> LINear | LOGarithmic

LINear: Averaging of linear power value
LOGarithmic: Averaging of the logarithmic (displayed) power values

*RST: LOG

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.10.1
V3.0.10 Option R&S CMW-KM010 no longer required

Manual operation: See "Averaging Mode" on page 145

3.5.5.4 Trigger Settings

The following commands define the trigger parameters.

TRIGger:GPRF:MEAS<i>:FFTSanalyzer:CATalog:SOURce?

Lists all trigger source values that can be set using `TRIGger:GPRF:MEAS<i>:FFTSanalyzer:SOURce`.

Return values:

'<Source_1>' ... '<Source_n>' Comma separated list of all supported values. Each value is represented as a string.

Example: See Specifying Measurement-Specific Settings

Usage: Query only

Firmware/Software: V1.0.5.3
V3.0.10 Option R&S CMW-KM010 no longer required

Manual operation: See "Trigger Source" on page 146

TRIGger:GPRF:MEAS<i>:FFTSanalyzer:SOURce '<Source>'

Selects the source of the trigger events. Some values are always available in this firmware application. They are listed below. Depending on the installed options additional values may be available. A complete list of all supported values can be displayed using `TRIGger:...:CATalog:SOURce?`.

Parameters:

'<Source>'

'IF Power': IF Power trigger
'Free Run': Free Run (untriggered)
'Base1: External TRIG A': External trigger fed in at TRIG A connector
'Base1: External TRIG B': External trigger fed in at TRIG B connector

*RST: 'Free Run'

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.5.3
V3.0.10 Option R&S CMW-KM010 no longer required

Manual operation: See "Trigger Source" on page 146

TRIGger:GPRF:MEAS<i>:FFTSanalyzer:SLOPe <Event>

Qualifies whether the trigger event is generated at the rising or at the falling edge of the trigger pulse (valid for external and power trigger sources).

Parameters:

<Event> REDGe | FEDGe

REDGe: Rising edge
FEDGe: Falling edge

*RST: REDGe

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.5.3
V3.0.10 Option R&S CMW-KM010 no longer required

Manual operation: See "Trigger Slope" on page 146

TRIGger:GPRF:MEAS<i>:FFTSanalyzer:THReshold <Threshold>

Defines the trigger threshold for power trigger sources.

Parameters:

<Threshold> Range: -50 dB to 0 dB
*RST: -30 dB
Default unit: dB (full scale, i.e. relative to reference level minus external attenuation)

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.5.3
V3.0.10 Option R&S CMW-KM010 no longer required

Manual operation: See "Trigger Threshold" on page 147

TRIGger:GPRF:MEAS<i>:FFTSanalyzer:OMODe <OffsetMode>

Selects a fixed or a variable trigger offset. In the "FFT Spectrum Analyzer" measurement, the trigger offset defines the center of the FFT window.

Parameters:

<OffsetMode> VARiable | FIXed

VARiable: Variable trigger offset, see `TRIGger:GPRF:MEAS<i>:FFTSanalyzer:OSSTop`
FIXed: Fixed trigger offset, defined via `TRIGger:GPRF:MEAS<i>:FFTSanalyzer:OFFSet`

*RST: FIX

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.10.1
V3.0.10 Option R&S CMW-KM010 no longer required

Manual operation: See "Trigger Offset" on page 147

TRIGger:GPRF:MEAS<i>:FFTSanalyzer:OFFSet <Offset>

Defines the fixed trigger offset; see `TRIGger:GPRF:MEAS<i>:FFTSanalyzer:OMODe`.

Parameters:

<Offset> Range: -0.15 s to 0.15 s
*RST: 0 s
Default unit: s

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.5.3
V3.0.10 Option R&S CMW-KM010 no longer required

Manual operation: See "Trigger Offset" on page 147

TRIGger:GPRF:MEAS<i>:FFTSanalyzer:OSSTop <OffsetStart>, <OffsetStop>

Defines the start and stop time for the variable trigger offset; see `TRIGger:GPRF:MEAS<i>:FFTSanalyzer:OMODe`.

Parameters:

<OffsetStart> must be smaller than the stop value

Range: -0.15 s to 0.15 s
*RST: 0 s
Default unit: s

<OffsetStop> must be larger than the start value

Range: -0.15 s to 0.15 s
*RST: 1E-3 s
Default unit: s

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.10.1
V3.0.10 Option R&S CMW-KM010 no longer required

Manual operation: See "Trigger Offset" on page 147

TRIGger:GPRF:MEAS<i>:FFTSanalyzer:TOUT <Timeout>

Selects the maximum time that the R&S CMW will wait for a trigger event before it stops the measurement in remote control mode or indicates a trigger timeout in manual operation mode. This setting has no influence on "Free Run" measurements.

Parameters:

<Timeout>

Range: 0.01 s to 300 s
*RST: 1 s
Default unit: s
Additional values: OFF | ON (disables timeout | enables timeout using the previous/default values)

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.5.3
V3.0.10 Option R&S CMW-KM010 no longer required

Manual operation: See "Trigger Timeout" on page 148

TRIGger:GPRF:MEAS<i>:FFTSanalyzer:MGAP <MinimumGap>

Sets a minimum time during which the IF signal must be below the trigger threshold before the trigger is armed so that an IF power trigger event can be generated.

Parameters:

<MinimumGap> Range: 0 s to 0.01 s
*RST: 0 s
Default unit: s

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.5.3
V3.0.10 Option R&S CMW-KM010 no longer required

Manual operation: See "Minimum Trigger Gap" on page 148

3.5.5.5 Search Functions

The following commands configure the peak search using markers.

CONFigure:GPRF:MEAS<i>:FFTSanalyzer:PSEarch:NOAMarkers
<NoActiveMarkers>

Defines the number of active markers for the peak search (see `CONFigure:GPRF:MEAS<i>:FFTSanalyzer:PSEarch`).

Parameters:

<NoActiveMarkers> Range: 0 to 5
*RST: 1

Example: See Single-Shot and Continuous Measurements

Firmware/Software: V1.0.10.1
V3.0.10 Option R&S CMW-KM010 no longer required

Manual operation: See "Marker - Peak Search Ranges" on page 149

CONFigure:GPRF:MEAS<i>:FFTSanalyzer:PSEarch <FullSearch0>, <From0>, <To0>, ..., <FullSearch4>, <From4>, <To4>

Defines the peak search ranges. The search ranges are automatically adjusted if the frequency span f_s is reduced (see `CONFigure:GPRF:MEAS<i>:FFTSanalyzer:FSPan`). Range settings beyond the number of active markers (see `CONFigure:GPRF:MEAS<i>:FFTSanalyzer:PSEarch:NOAMarkers`) are ignored.

Parameters:

<FullSearch0> ... <FullSearch4> OFF | ON
OFF: Limit search to the range [<From ...>, <To ...>]
ON: Enable search in full frequency span
*RST: ON

<From0> ... <From4> Range: $-f_s$ / 2 to $+f_s$ / 2, where f_s is the frequency span
*RST: -5E+6 Hz
Default unit: Hz

<To0> ... <To4> Range: $-f_s$ / 2 to $+f_s$ / 2, where f_s is the frequency span
*RST: 5E+6 Hz
Default unit: Hz

Example: See Single-Shot and Continuous Measurements

Firmware/Software: V1.0.5.3
V3.0.10 Option R&S CMW-KM010 no longer required

Manual operation: See "Marker - Peak Search Ranges" on page 149

3.5.5.6 Measurement Results

The following commands return the results of the "FFT Spectrum Analyzer".

FETCh:GPRF:MEAS<i>:FFTSanalyzer:POWer:CURRent?
FETCh:GPRF:MEAS<i>:FFTSanalyzer:POWer:MINimum?
FETCh:GPRF:MEAS<i>:FFTSanalyzer:POWer:MAXimum?
FETCh:GPRF:MEAS<i>:FFTSanalyzer:POWer:AVERage?
READ:GPRF:MEAS<i>:FFTSanalyzer:POWer:CURRent?
READ:GPRF:MEAS<i>:FFTSanalyzer:POWer:MINimum?
READ:GPRF:MEAS<i>:FFTSanalyzer:POWer:MAXimum?
READ:GPRF:MEAS<i>:FFTSanalyzer:POWer:AVERage?

Returns the "FFT Spectrum Analyzer" traces across the selected frequency span (see `CONFigure:GPRF:MEAS<i>:FFTSanalyzer:FSPan`). The results of the current, average, minimum and maximum traces can be retrieved.

Return values:
<Reliability> see Reliability Indicator

<Power1> ... <Power801>
Frequency-dependent power values. Each of the traces contains 801 values, irrespective of the frequency span.
Range: –100.0 dBm to 57.0 dBm
Default unit: dBm

Example: See Single-Shot and Continuous Measurements

Usage: Query only

Firmware/Software: V1.0.5.3
V3.0.10 Option R&S CMW-KM010 no longer required

FETCh:GPRF:MEAS<i>:FFTSanalyzer:PEAKs:CURRent?
FETCh:GPRF:MEAS<i>:FFTSanalyzer:PEAKs:AVERage?
READ:GPRF:MEAS<i>:FFTSanalyzer:PEAKs:CURRent?
READ:GPRF:MEAS<i>:FFTSanalyzer:PEAKs:AVERage?

Returns the results of the peak search. Separate commands retrieve current and average values.

Return values:

<Reliability>
see Reliability Indicator

<Frequency0> <Power0> ... <Frequency4> <Power4>
5 pairs of frequency / power values, one pair per search range (no. 0 to 4).
<Frequency...>:
Range: depends on search range settings (see `CONFigure:GPRF:MEAS<i>:FFTSanalyzer:PSEarch`)
Def. unit: Hz
<Power...>:
Range: –100.0 dBm to +57.0 dBm
Def. unit: dBm

Example: See Single-Shot and Continuous Measurements

Usage: Query only

Firmware/Software: V1.0.5.3
V3.0.10 Option R&S CMW-KM010 no longer required

FETCh:GPRF:MEAS<i>:FFTSanalyzer:I?
FETCh:GPRF:MEAS<i>:FFTSanalyzer:Q?
READ:GPRF:MEAS<i>:FFTSanalyzer:I?
READ:GPRF:MEAS<i>:FFTSanalyzer:Q?

Returns the measured normalized I and Q amplitudes in time domain.

Return values:

<Reliability>
see Reliability Indicator

<Amplitude_1> ... <Amplitude_n>	n normalized I or Q amplitudes, where n is given by the FFT length (see `CONFigure:GPRF:MEAS<i>:FFTSanalyzer:FFTLength`) Range: -2 to 2
Example:	See Single-Shot and Continuous Measurements
Usage:	Query only
Firmware/Software:	V1.0.5.3 V3.0.10 Option R&S CMW-KM010 no longer required

3.5.6 I/Q Recorder Measurement Commands

The commands for the "I/Q Recorder" measurement are divided into the groups listed below.

3.5.6.1 Measurement Control and States

The following commands control the measurement and return the current measurement state.

INITiate:GPRF:MEAS<i>:IQRecorder [<SaveToIQFile>]
STOP:GPRF:MEAS<i>:IQRecorder
ABORt:GPRF:MEAS<i>:IQRecorder

Starts, stops, or aborts the measurement:

- `INITiate...` starts or restarts the measurement; the R&S CMW enters the "RUN" state.
- `STOP...` causes a running measurement to stop after the current evaluation period is terminated and valid results are available; the R&S CMW enters the "RDY" state.
- `ABORt...` causes a running measurement to stop immediately; the R&S CMW enters the "OFF" state.

Use `FETCh...STATe?` to query the current measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<SaveToIQFile> ON | OFF

Optional parameter, enables or disables writing of a text file where the "I/Q Recorder" results are stored in binary format; see `CONFigure:GPRF:MEAS<i>:IQRecorder:IQFile`

Example: See Performing a Single-Shot Measurement

Usage: Event

Firmware/Software: V1.0.4.11

FETCh:GPRF:MEAS<i>:IQRecorder:STATe?

Queries the main measurement state. Use `FETCh:...:STATe:ALL?` to query the measurement state including the substates. Use `INITiate..., STOP..., ABORt...` to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MeasState> OFF | RDY | RUN

OFF: measurement switched off, no resources allocated, no results available (when entered after `ABORt...`)
RDY: measurement has been terminated, valid results may be available
RUN: measurement running (after `INITiate..., READ...`), synchronization pending or adjusted, resources active or queued

*RST: OFF

Example: See Performing a Single-Shot Measurement

Usage: Query only

Firmware/Software: V1.0.4.11

Manual operation: See "IQ Recorder (Softkey)" on page 151

FETCh:GPRF:MEAS<i>:IQRecorder:STATe:ALL?

Queries the main measurement state and the measurement substates. Both measurement substates are relevant for running measurements only. Use `FETCh:...:STATe?` to query the main measurement state only. Use `INITiate..., STOP..., ABORt...` to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MainState> OFF | RDY | RUN

OFF: measurement switched off, no resources allocated, no results available (when entered after `STOP...`)
RDY: measurement has been terminated, valid results may be available
RUN: measurement running (after `INITiate..., READ...`), synchronization pending or adjusted, resources active or queued

*RST: OFF

<SyncState> PEND | ADJ | INV

PEND: waiting for resource allocation, adjustment, hardware switching ("pending")
ADJ: all necessary adjustments finished, measurement running ("adjusted")
INV: not applicable because <main_state>: OFF or RDY ("invalid")

<ResourcesState> QUE | ACT | INV

QUE: measurement without resources, no results available ("queued")
ACT: resources allocated, acquisition of results in progress but not complete ("active")
INV: not applicable because <main_state>: OFF or RDY ("invalid")

Example: See Performing a Single-Shot Measurement

Usage: Query only

Firmware/Software: V1.0.4.11

Manual operation: See "IQ Recorder (Softkey)" on page 151

3.5.6.2 Measurement Control Parameters

The following commands define the measurement interval. See also Filter Settings.

CONFigure:GPRF:MEAS<i>:IQRecorder:TOUT <TCDTimeOut>

Defines a timeout for the measurement. The timer is started when the measurement is initiated via a `READ` or `INIT` command. It is not started if the measurement is initiated manually (ON/OFF key or RESTART/STOP key).

When the measurement has completed the first measurement cycle (first single shot), the statistical depth is reached and the timer is reset.

If the first measurement cycle has not been completed when the timer expires, the measurement is stopped. The measurement state changes to `RDY` and the reliability indicator is set to 1, indicating that a measurement timeout occurred. Still running `READ`, `FETCh` or `CALCulate` commands are completed, returning the available results. At least for some results there are no values at all or the statistical depth has not been reached.

A timeout of 0 s corresponds to an infinite measurement timeout.

Parameters:

<TCDTimeOut> *RST: 1 s
Default unit: s

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V2.0.10

CONFigure:GPRF:MEAS<i>:IQRecorder:CAPTure <CaptSampBefTrig>, <CaptSampAftTrig>

Selects the total number of samples and their position relative to the trigger event. The total number of samples corresponds to the sum of <CaptSampBefTrig> + <CaptSampAftTrig>.

The R&S CMW can acquire up to 4 MSamples (4194304 samples) of data. <CaptSampBefTrig> + <CaptSampAftTrig> must not exceed this value. For free run measurements only the sum <CaptSampBefTrig> + <CaptSampAftTrig> is relevant.

Parameters:

<CaptSampBefTrig> Samples before trigger
Range: 1 to 4194304
*RST: 512

<CaptSampAftTrig> Samples after trigger
Range: 1 to 4194304
*RST: 512

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Pre Trigger, Post Trigger" on page 152

CONFigure:GPRF:MEAS<i>:IQRecorder:IQFile <IQSaveFile>

Selects the name and path of a file that is used to store the I/Q Recorder results in binary format. To write the file, the I/Q-Recorder measurement must be started using `INITiate:GPRF:MEAS<i>:IQRecorder ON`.

Parameters:

<IQSaveFile> String parameter to specify the name and path of the I/Q file. The extension "*.iqw" is appended automatically.
*RST: D:\Rohde-Schwarz\CMW\Data\iqrecorder\IQSaveFile.iqw

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Select File, File Name" on page 152

CONFigure:GPRF:MEAS<i>:IQRecorder:FORMat <Format>

Selects the coordinates that are used to represent the I/Q Recorder results.

Parameters:

<Format> IQ | RPHI

IQ: cartesian coordinates (I and Q axis)
RPHI: polar coordinates (radius R and angle PHI).

*RST: IQ

Firmware/Software: V3.0.10

Manual operation: See "Format" on page 152

CONFigure:GPRF:MEAS<i>:IQRecorder:MUNit <MagnitudeUnit>

Selets the magnitude unit for the measurement results.

Parameters:

<MagnitudeUnit> VOLT | RAW

Voltage units or raw I/Q data relative to full scale

*RST: VOLT

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V2.1.25

Manual operation: See "Magnitude Unit" on page 153

3.5.6.3 Filter Settings

The following commands select the measurement filter (IF filter) for the measurement.

CONFigure:GPRF:MEAS<i>:IQRecorder:FILTer:TYPE <FilterType>

Selects the IF filter type. Gauss filters have shorter settling times and therefore larger sampling rates; bandpass filters have a flat passband and steeper edges; see Filter Settings and Samples.

Parameters:

<FilterType> BANDpass | GAUSs

BANDpass: Bandpass filter with variable bandwidth (`CONFigure:GPRF:MEAS<i>:IQRecorder:FILTer:BANDpass:BWIDth`)

GAUSs: Filter of Gaussian shape with variable bandwidth (`CONFigure:GPRF:MEAS<i>:IQRecorder:FILTer:GAUSs:BWIDth`)

*RST: GAUS

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Filter" on page 152

CONFigure:GPRF:MEAS<i>:IQRecorder:FILTer:GAUSs:BWIDth <GaussBW>

Selects the bandwidth for a filter of Gaussian shape.

Parameters:

<GaussBW> Range: 1 kHz | 10 kHz | 100 kHz | 1 MHz | 10 MHz (values in-between are rounded)

*RST: 100 kHz

Default unit: Hz

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Filter" on page 152

CONFigure:GPRF:MEAS<i>:IQRecorder:FILTer:BANDpass:BWIDth <BandPassBW>

Selects the bandwidth for a bandpass filter.

Parameters:

<BandPassBW> Range: 1 kHz | 10 kHz | 100 kHz | 1 MHz | 10 MHz | 40 MHz (values in-between are rounded)

*RST: 1 kHz

Default unit: Hz

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Filter" on page 152

CONFigure:GPRF:MEAS<i>:IQRecorder:RATio <Ratio>

Reduces the sampling rate (as defined by the filter settings) by a factor ≤1 and thus extends the total measurement time.

Parameters:

<Ratio> Range: 0.1 to 1
*RST: 1

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.10.1

Manual operation: See "Sample Ratio" on page 153

3.5.6.4 Trigger Settings

The following commands define the trigger parameters.

TRIGger:GPRF:MEAS<i>:IQRecorder:CATalog:SOURce?

Lists all trigger source values that can be set using `TRIGger:GPRF:MEAS<i>:IQRecorder:SOURce`.

Return values:

'<Source_1>' ... '<Source_n>' Comma separated list of all supported values. Each value is represented as a string.

Example: See Specifying Measurement-Specific Settings

Usage: Query only

Firmware/Software: V1.0.4.11

Manual operation: See "Trigger Source" on page 154

TRIGger:GPRF:MEAS<i>:IQRecorder:SOURce '<Source>'

Selects the source of the trigger events. Some values are always available in this firmware application. They are listed below. Depending on the installed options additional values may be available. A complete list of all supported values can be displayed using `TRIGger:...:CATalog:SOURce?`.

Parameters:

'<Source>' **'IF Power':** IF Power trigger
'Free Run': Free Run (untriggered)
'Base1: External TRIG A': External trigger fed in at TRIG A connector
'Base1: External TRIG B': External trigger fed in at TRIG B connector
*RST: 'Free Run'

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Trigger Source" on page 154

TRIGger:GPRF:MEAS<i>:IQRecorder:SLOPe <Event>

Qualifies whether the trigger event is generated at the rising or at the falling edge of the trigger pulse (valid for external and power trigger sources).

Parameters:

<Event> REDGe | FEDGe
REDGe: Rising edge
FEDGe: Falling edge
*RST: REDG

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Trigger Slope" on page 154

TRIGger:GPRF:MEAS<i>:IQRecorder:THReshold <Threshold>

Defines the trigger threshold for power trigger sources.

Parameters:

<Threshold> Range: -50 dB to 0 dB
*RST: -30 dB
Default unit: dB (full scale, i.e. relative to reference level minus external attenuation)

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Trigger Threshold" on page 155

TRIGger:GPRF:MEAS<i>:IQRecorder:OFFSet <TriggerOffset>

Defines a delay time for triggered measurements. The trigger offset delays the start of the measurement relative to the trigger event.

Parameters:

<TriggerOffset> Range: 0 to 64E+6
*RST: 0
Default unit: samples

Firmware/Software: V3.0.10

Manual operation: See "Trigger Offset" on page 154

TRIGger:GPRF:MEAS<i>:IQRecorder:TOUT <Timeout>

Selects the maximum time that the R&S CMW will wait for a trigger event before it stops the measurement in remote control mode or indicates a trigger timeout in manual operation mode. This setting has no influence on "Free Run" measurements.

Parameters:

<Timeout> Range: 0.01 s to 300 s
*RST: 0.5 s
Default unit: s
Additional values: OFF | ON (disables timeout | enables timeout using the previous/default values)

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Trigger Timeout" on page 155

TRIGger:GPRF:MEAS<i>:IQRecorder:MGAP <MinimumGap>

Sets a minimum time during which the IF signal must be below the trigger threshold before the trigger is armed so that an IF power trigger event can be generated.

The I/Q Recorder measurement is always performed in single-shot mode, therefore it is controlled by a single trigger event. As a consequence the minimum trigger gap condition is valid between the start of the measurement and the first trigger event only.

For continuous or re-triggered measurements (e.g. Power), the gap condition can be applied repeatedly.

Parameters:

<MinimumGap> Range: 0 s to 0.01 s
*RST: 0 s
Default unit: s

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Manual operation: See "Minimum Trigger Gap" on page 155

3.5.6.5 List Configuration

The following commands enable and configure the List Mode for the "I/Q Recorder" measurement.

CONFigure:GPRF:MEAS<i>:IQRecorder:LIST <EnableListMode>

Enables or disables the list mode for the "I/Q Recorder" measurement.

Parameters:

<EnableListMode> OFF | ON

OFF: List mode off (single power step)
ON: List mode on

*RST: OFF

Example: See Performing a Single-Shot Measurement

Firmware/Software: V1.0.10.1

Options: R&S CMW-KM012

Manual operation: See "List Mode Enable" on page 153

CONFigure:GPRF:MEAS<i>:IQRecorder:LIST:SLENgth <StepLength>

Selects the time between the beginning of two consecutive measurement steps.

Parameters:

<StepLength> Range: 100E-6 s to 0.1 s
*RST: 200E-6 s
Default unit: s

Example: See Performing a Single-Shot Measurement

Firmware/Software: V1.0.10.1

Options: R&S CMW-KM012

CONFigure:GPRF:MEAS<i>:IQRecorder:LIST:COUNt?

Queries the total number of results, given by <StopIndex> – <StartIndex> + 1 (see commands `CONFigure:GPRF:MEAS<i>:IQRecorder:LIST:STARt` and `CONFigure:GPRF:MEAS<i>:IQRecorder:LIST:STOP`).

Return values:
<ResultCount> Range: 1 to 2000

Example: See Performing a Single-Shot Measurement

Usage: Query only

Firmware/Software: V1.0.10.1

Options: R&S CMW-KM012

CONFigure:GPRF:MEAS<i>:IQRecorder:LIST:STARt <StartIndex>

Start index, defines the first frequency/level step in the frequency/level list that is measured.

The value must not exceed the stop index defined by `CONFigure:GPRF:MEAS<i>:IQRecorder:LIST:STOP`.

Parameters:
<StartIndex> Range: 0 to 1999
*RST: 0

Example: See Performing a Single-Shot Measurement

Firmware/Software: V1.0.10.1

Options: R&S CMW-KM012

CONFigure:GPRF:MEAS<i>:IQRecorder:LIST:STOP <StopIndex>

Stop index, defines the last frequency/level step in the frequency/level list that is measured

The value must not be smaller than the start index defined by `CONFigure:GPRF:MEAS<i>:IQRecorder:LIST:STARt`.

Parameters:
<StopIndex> Range: 0 to 1999
*RST: 19

Example: See Performing a Single-Shot Measurement

Firmware/Software: V1.0.10.1

Options: R&S CMW-KM012

CONFigure:GPRF:MEAS<i>:IQRecorder:LIST:SSTop <StartIndex>, <StopIndex>

Start index and stop index, defines the first and last frequency/level step in the frequency/level list that is measured.

The start index must not exceed the stop index.

Parameters:

<StartIndex> Range: 0 to 1999
*RST: 0

<StopIndex> Range: 0 to 1999
*RST: 19

Firmware/Software: V3.0.10

Options: R&S CMW-KM012

CONFigure:GPRF:MEAS<i>:IQRecorder:LIST:FREQuency <Index>, <Frequency>
CONFigure:GPRF:MEAS<i>:IQRecorder:LIST:FREQuency? <Index>

Defines or queries the frequency of a selected frequency/level step.

Parameters:

<Frequency> Frequency of the frequency/level step

Range: 70E+6 Hz to 6E+9 Hz
Increment: 0.1 Hz
*RST: Depending on list index (750 MHz to 960 MHz for index 0 to 21)
Default unit: Hz

Parameters for setting and query:

<Index> Number of frequency/level step in the table

Range: 0 to 1999
*RST: n/a

Example: See Performing a Single-Shot Measurement

Firmware/Software: V1.0.10.1

Options: R&S CMW-KM012

CONFigure:GPRF:MEAS<i>:IQRecorder:LIST:FREQuency:ALL <Frequency_1>, ..., <Frequency_n>

Defines the frequencies of all frequency/level steps.

Parameters:

<Frequency_1> ... <Frequency_n>
n frequencies, one per frequency/level step, where n < 2001. The query returns 2000 results.

Range: 70E+6 Hz to 6E+9 Hz
Increment: 0.1 Hz
*RST: value 0 to 21: 750 MHz to 960 MHz, value 22 to 1999: 960 MHz
Default unit: Hz

Example: See Performing a Single-Shot Measurement

Firmware/Software: V1.0.10.1

Options: R&S CMW-KM012

CONFigure:GPRF:MEAS<i>:IQRecorder:LIST:ENPower <Index>, <ExpNomPower>
CONFigure:GPRF:MEAS<i>:IQRecorder:LIST:ENPower? <Index>

Defines or queries the expected nominal power of a selected frequency/level step.

Parameters:

<ExpNomPower>
Expected nominal power of the frequency/level step

Range: -55 dBm to 55 dBm
*RST: Depending on list index (–10 dBm, –10 dBm, –10 dBm, –20 dBm, –20 dBm, –20 dBm, –20 dBm, –30 dBm, –30 dBm ... for the first indices)
Default unit: dBm

Parameters for setting and query:

<Index>
Number of frequency/level step in the table

Range: 0 to 1999
*RST: n/a

Example: See Performing a Single-Shot Measurement

Firmware/Software: V1.0.10.1

Options: R&S CMW-KM012

CONFigure:GPRF:MEAS<i>:IQRecorder:LIST:ENPower:ALL <Power_1>, ..., <Power_n>

Defines the expected nominal power of all frequency/level steps.

Parameters:

<Power_1> ... <Power_n>
n expected powers, one per frequency/level step, where n < 2001. The query returns 2000 results.

Range: -55 dBm to 55 dBm
Increment: 0.1 dB
*RST: -10 dBm, -10 dBm, -10 dBm, -20 dBm, -20 dBm, -20 dBm, -20 dBm, -30 dBm, ..., -30 dBm
Default unit: dBm

Example: See Performing a Single-Shot Measurement

Firmware/Software: V1.0.10.1

Options: R&S CMW-KM012

3.5.6.6 Measurement Results

The following commands return the "I/Q Recorder" measurement results.

FETCh:GPRF:MEAS<i>:IQRecorder?
READ:GPRF:MEAS<i>:IQRecorder?

Returns the I and Q amplitudes in the format specified by `FORMat:BASE:DATA`. For a detailed description of the data formats see ASCII and Binary Data Formats.

For the number n of values see `CONFigure:GPRF:MEAS<i>:IQRecorder:CAPTure`.

Return values:

<Reliability> see Reliability Indicator
The following values are returned only if the reliability indicator indicates valid results.

<I_1> <Q_1> ... <I_n> <Q_n> **Returned for ASCII format only**
I and Q amplitudes in alternating order.
Range: -160 V to 160 V
Default unit: V

<Data> <dblock>
Returned for REAL format only
Binary block data consisting of the parts listed in the table below. There are no commas within this parameter.

Example: See Performing a Single-Shot Measurement

Usage: Query only

Firmware/Software: V1.0.4.11

Table 3-7: Components of parameter <Data>

Parameter	Description
#L	Number of digits of the following counter N
N	Total number of the following data bytes (N=8*n)

Parameter	Description
<I_1><Q_1> ... <I_n><Q_n>	I and Q amplitudes in alternating order. Each amplitude value consists of four bytes.
EOS	End of string character

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

FETCh:GPRF:MEAS<i>:IQRecorder:BIN?
READ:GPRF:MEAS<i>:IQRecorder:BIN?

Retrieve IQ recorder results in binary format.

The number n of sample values is set via `CONFigure:GPRF:MEAS<i>:IQRecorder:CAPTure`.

Return values:

<IQSamples>... <dblock>

Binary block data. For a detailed description see ASCII and Binary Data Formats

Usage: Query only

Firmware/Software: V3.0.10

FETCh:GPRF:MEAS<i>:IQRecorder:SRATe?

Returns the sampling rate of the I/Q Recorder measurement, depending on the filter settings; see Filter Settings and Samples.

Return values:

<SampleRate> Range: > 0 Hz to 100E+6 Hz
Default unit: Hz

Example: See Performing a Single-Shot Measurement

Usage: Query only

Firmware/Software: V1.0.4.11

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

CONFigure:GPRF:MEAS<i>:IQRecorder:IQSettings:SRATe <SampleRate>

Sets/gets the sampling rate to a value less or equal to the maximum sampling rate implied by the filter settings (Filter Settings and Samples).

Parameters:

<SampleRate> Range: 1.92E+6 to 100E+6
*RST: 100E+6

Firmware/Software: V3.0.10

Manual operation: See "Sample Ratio" on page 153

FETCh:GPRF:MEAS<i>:IQRecorder:RELiability?

Queries the reliability indicator for the I/Q Recorder measurement; see chapter 3.5.1.4, "Reliability Indicator", on page 186.

Return values:
<ReliabilityFlag> Two equal values, separated by a comma (e.g. `0,0` for "OK")

Example: See Performing a Single-Shot Measurement

Usage: Query only

Firmware/Software: V1.0.15.20

3.5.7 I/Q vs. Slot Measurement Commands

The commands for the "I/Q vs. Slot" measurement are divided into the groups listed below.

3.5.7.1 Measurement Control and States

The following commands control the measurement and return the current measurement state.

INITiate:GPRF:MEAS<i>:IQVSlot
STOP:GPRF:MEAS<i>:IQVSlot
ABORt:GPRF:MEAS<i>:IQVSlot

Starts, stops, or aborts the measurement:

- `INITiate...` starts or restarts the measurement; the R&S CMW enters the "RUN" state.
- `STOP...` causes a running measurement to stop after the current evaluation period is terminated and valid results are available; the R&S CMW enters the "RDY" state.

- `ABORt...` causes a running measurement to stop immediately; the R&S CMW enters the "OFF" state.

Use `FETCh...STATe?` to query the current measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Example: See Single-Shot and Continuous Measurements

Usage: Event

Firmware/Software: V1.0.3.6

Options: R&S CMW-KM011

FETCh:GPRF:MEAS<i>:IQVSlot:STATe?

Queries the main measurement state. Use `FETCh:...:STATe:ALL?` to query the measurement state including the substates. Use `INITiate..., STOP..., ABORt...` to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MeasState> OFF | RDY | RUN

OFF: measurement switched off, no resources allocated, no results available (when entered after `ABORt...`)
RDY: measurement has been terminated, valid results may be available
RUN: measurement running (after `INITiate..., READ...`), synchronization pending or adjusted, resources active or queued

*RST: OFF

Example: See Single-Shot and Continuous Measurements

Usage: Query only

Firmware/Software: V1.0.3.6

Options: R&S CMW-KM011

Manual operation: See "I/Q vs. Slot (Softkey)" on page 156

FETCh:GPRF:MEAS<i>:IQVSlot:STATe:ALL?

Queries the main measurement state and the measurement substates. Both measurement substates are relevant for running measurements only. Use `FETCh:...:STATe?` to query the main measurement state only. Use `INITiate..., STOP..., ABORt...` to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MainState> OFF | RDY | RUN

OFF: measurement switched off, no resources allocated, no results available (when entered after `STOP...`)
RDY: measurement has been terminated, valid results may be available
RUN: measurement running (after `INITiate..., READ...`), synchronization pending or adjusted, resources active or queued

*RST: OFF

<SyncState> PEND | ADJ | INV

PEND: waiting for resource allocation, adjustment, hardware switching ("pending")
ADJ: all necessary adjustments finished, measurement running ("adjusted")
INV: not applicable because <main_state>: OFF or RDY ("invalid")

<ResourcesState> QUE | ACT | INV

QUE: measurement without resources, no results available ("queued")
ACT: resources allocated, acquisition of results in progress but not complete ("active")
INV: not applicable because <main_state>: OFF or RDY ("invalid")

Example: See Single-Shot and Continuous Measurements

Usage: Query only

Firmware/Software: V1.0.3.6

Options: R&S CMW-KM011

Manual operation: See "I/Q vs. Slot (Softkey)" on page 156

3.5.7.2 Measurement Control Parameters

The following commands define the measurement interval. See also Filter Settings.

CONFigure:GPRF:MEAS<i>:IQVSlot:TOUT <TCDTimeOut>

Defines a timeout for the measurement. The timer is started when the measurement is initiated via a `READ` or `INIT` command. It is not started if the measurement is initiated manually (ON/OFF key or RESTART/STOP key).

When the measurement has completed the first measurement cycle (first single shot), the statistical depth is reached and the timer is reset.

If the first measurement cycle has not been completed when the timer expires, the measurement is stopped. The measurement state changes to `RDY` and the reliability indicator is set to 1, indicating that a measurement timeout occurred. Still running `READ`, `FETCh` or `CALCulate` commands are completed, returning the available results. At least for some results there are no values at all or the statistical depth has not been reached.

A timeout of 0 s corresponds to an infinite measurement timeout.

Parameters:

<TCDTimeOut> *RST: 1 s
Default unit: s

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V2.0.10

Options: R&S CMW-KM011

CONFigure:GPRF:MEAS<i>:IQVSlot:SLENgth <StepLength>

Selects the time between the beginning of two consecutive measurement steps.

Parameters:

<StepLength> Range: 50E-6 s to 5E-3 s
*RST: 1E-3 s
Default unit: s

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.3.6

Options: R&S CMW-KM011

Manual operation: See "Step Length" on page 157

CONFigure:GPRF:MEAS<i>:IQVSlot:MLENgth <MeasLength>

Selects the length of the averaging intervals that the R&S CMW uses to calculate the "I/Q vs. Slot" results for each measurement step.

Parameters:

<MeasLength> Range: 10E-6 s to 1 ms
*RST: 800E-6 s
Default unit: s

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.3.6

Options: R&S CMW-KM011

Manual operation: See "Measurement Length" on page 158

CONFigure:GPRF:MEAS<i>:IQVSlot:FELimit <Limit>

Defines a minimum average signal level relative to the "Expected Nominal Power" for all measurement steps to be considered for the calculation of the average frequency per subsweep and the "Overall Frequency Error".

Parameters:

<Limit> Range: -100 dB to -30 dB
*RST: -100 dB
Default unit: dB

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.3.6

Options: R&S CMW-KM011

Manual operation: See "Frequency Estimation Limit" on page 158

3.5.7.3 Statistical Settings

The following commands specify the scope of the measurement.

CONFigure:GPRF:MEAS<i>:IQVSlot:REPetition <Repetition>

Specifies the repetition mode of the measurement. The repetition mode specifies whether the measurement is stopped after a single-shot or repeated continuously. Use `CONFigure:..:MEAS<i>:...:SCOunt` to determine the number of measurement intervals per single shot.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<Repetition> SINGleshot | CONTinuous

SINGleshot: Single-shot measurement
CONTinuous: Continuous measurement

*RST: SING

Example: See Single-Shot and Continuous Measurements

Firmware/Software: V1.0.3.6

Options: R&S CMW-KM011

Manual operation: See "Repetition" on page 157

CONFigure:GPRF:MEAS<i>:IQVSlot:SCOunt <StepCount>

Defines the number of measurement steps per subsweep. The total number of steps, i.e. the step count times the number of subsweeps, must not exceed 3000 (see `CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:COUNt?`).

Parameters:
<StepCount> Range: 1 to 3000
*RST: 20

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.3.6

Options: R&S CMW-KM011

Manual operation: See "Step Count" on page 157

3.5.7.4 Filter Settings

The following commands select the measurement filter (IF filter) for the measurement.

CONFigure:GPRF:MEAS<i>:IQVSlot:FTYPe <FilterType>

Selects the IF filter type.

Parameters:
<FilterType> GAUSs | BANDpass
GAUSs: Filter of Gaussian shape, 100 kHz bandwidth
BANDpass: Nyquist filter, 100 kHz bandwidth
*RST: GAUS

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.3.6

Options: R&S CMW-KM011

Manual operation: See "Filter Type" on page 158

3.5.7.5 Trigger Settings

The following commands define the trigger parameters.

TRIGger:GPRF:MEAS<i>:IQVSlot:CATalog:SOURce?

Lists all trigger source values that can be set using `TRIGger:GPRF:MEAS<i>:IQVSlot:SOURce`.

Return values:
'<Source_1>' ... '<Source_n>' Comma separated list of all supported values. Each value is represented as a string.

Example: See Specifying Measurement-Specific Settings

Usage: Query only

Firmware/Software: V1.0.4.11

Options: R&S CMW-KM011

Manual operation: See "Trigger Source" on page 159

TRIGger:GPRF:MEAS<i>:IQVSlot:SOURce '<Source>'

Selects the source of the trigger events. Some values are always available in this firmware application. They are listed below. Depending on the installed options additional values may be available. A complete list of all supported values can be displayed using `TRIGger:...:CATalog:SOURce?`.

Parameters:
'<Source>'
'IF Power': IF Power trigger
'Free Run': Free Run (untriggered)
'Base1: External TRIG A': External trigger fed in at TRIG A connector
'Base1: External TRIG B': External trigger fed in at TRIG B connector
*RST: 'Free Run'

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Options: R&S CMW-KM011

Manual operation: See "Trigger Source" on page 159

TRIGger:GPRF:MEAS<i>:IQVSlot:SLOPe <Event>

Qualifies whether the trigger event is generated at the rising or at the falling edge of the trigger pulse (valid for external and power trigger sources).

Parameters:
<Event> REDGe | FEDGe
REDGe: Rising edge
FEDGe: Falling edge
*RST: REDG

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Options: R&S CMW-KM011

Manual operation: See "Trigger Slope" on page 160

TRIGger:GPRF:MEAS<i>:IQVSlot:THReshold <Threshold>

Defines the trigger threshold for power trigger sources.

Parameters:

<Threshold>
Range: -50 dB to 0 dB
*RST: -30 dB
Default unit: dB (full scale, i.e. relative to reference level minus external attenuation)

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Options: R&S CMW-KM011

Manual operation: See "Trigger Threshold" on page 160

TRIGger:GPRF:MEAS<i>:IQVSlot:OFFSet <Offset>

Defines a delay time for triggered measurements. The trigger offset delays the start of the measurement relative to the trigger event.

Parameters:

<Offset>
Range: 0 s to 1 s
*RST: 100E-6 s
Default unit: s

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.0.4

Options: R&S CMW-KM011

Manual operation: See "Trigger Offset" on page 160

TRIGger:GPRF:MEAS<i>:IQVSlot:TOUT <Timeout>

Selects the maximum time that the R&S CMW will wait for a trigger event before it stops the measurement in remote control mode or indicates a trigger timeout in manual operation mode. This setting has no influence on "Free Run" measurements.

Parameters:

<Timeout>
Range: 0.01 s to 300 s
*RST: 0.5 s
Default unit: s
Additional values: OFF | ON (disables timeout | enables timeout using the previous/default values)

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Options: R&S CMW-KM011

Manual operation: See "Trigger Timeout" on page 160

TRIGger:GPRF:MEAS<i>:IQVSlot:MGAP <MinimumGap>

Sets a minimum time during which the IF signal must be below the trigger threshold before the trigger is armed so that an IF power trigger event can be generated.

Parameters:

<MinimumGap> Range: 0 s to 0.01 s
*RST: 0 s
Default unit: s

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V1.0.4.11

Options: R&S CMW-KM011

Manual operation: See "Minimum Trigger Gap" on page 160

TRIGger:GPRF:MEAS<i>:IQVSlot:MODE <Mode>

Selects the measurement sequence that is triggered by each single trigger event. This setting is not valid for "Free Run" measurements.

Parameters:

<Mode> ONCE | PRESelect

ONCE: Trigger Once
PRESelect: Retrigger Preselect(ed) steps, see `CONFigure:GPRF:MEAS<i>:POWer:LIST:RETRigger`

*RST: ONCE

Example: See Specifying Measurement-Specific Settings

Firmware/Software: V2.0.10

Options: R&S CMW-KM011

Manual operation: See "Trigger Mode" on page 161

3.5.7.6 List Configuration

The following commands enable and configure the list mode for the "I/Q vs. Slot" measurement.

CONFigure:GPRF:MEAS<i>:IQVSlot:LIST <ListMode>

Enables or disables the list mode for the "I/Q vs. Slot" measurement.

Parameters:

<ListMode> OFF | ON

OFF: List mode off (single power step)
ON: List mode on

*RST: OFF

Example: See Configuring the List Mode

Firmware/Software: V1.0.3.6

Options: R&S CMW-KM011
R&S CMW-KM012

Manual operation: See "List Mode" on page 162

CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:COUNt?

Queries the number of subsweeps (<Stop Index> – <Start Index> + 1). The total number of steps, i.e. the number of subsweeps times the "Step Count", must not exceed 3000 (see `CONFigure:GPRF:MEAS<i>:IQVSlot:SCOunt`).

Return values:

<SweepCount> Range: 1 to 150
*RST: 1

Example: See Configuring the List Mode

Usage: Query only

Firmware/Software: V1.0.3.6

Options: R&S CMW-KM011
R&S CMW-KM012

Manual operation: See "List Section" on page 162

CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:STARt <StartIndex>

Start index, defines the first frequency/level step in the frequency/level list that is measured.

Parameters:

<StartIndex> Range: 0 to 149
*RST: 0

Example: See Configuring the List Mode

Firmware/Software: V1.0.3.6

Options: R&S CMW-KM011
R&S CMW-KM012

Manual operation: See "List Section" on page 162

CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:STOP <StopIndex>

Stop index, defines the last frequency/level step in the frequency/level list that is measured.

Parameters:

<StopIndex>
Range: 0 to 149
*RST: 0

Example: See Configuring the List Mode

Firmware/Software: V1.0.3.6

Options: R&S CMW-KM011
R&S CMW-KM012

Manual operation: See "List Section" on page 162

CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:SSTop <StartIndex>, <StopIndex>

Start and stop index, defines the first and last frequency/level step in the frequency/level list that is measured.

Parameters:

<StartIndex>
Range: 0 to 149
*RST: 0

<StopIndex>
Range: 0 to 149
*RST: 0

Firmware/Software: V3.0.10

Options: R&S CMW-KM011
R&S CMW-KM012

Manual operation: See "List Section" on page 162

CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:FREQuency <Index>, <Frequency>
CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:FREQuency? <Index>

Defines or queries the frequency of a selected frequency/level step.

Parameters:

<Frequency>
Frequency of the frequency/level step
Range: 70E+6 Hz to 6E+9 Hz
Increment: 0.1 Hz
*RST: Depending on list index (750 MHz to 960 MHz for index 0 to 21)
Default unit: Hz

Parameters for setting and query:

<Index> Number of frequency/level step in the table

Range: 0 to 199
*RST: n/a

Example: See Configuring the List Mode

Firmware/Software: V1.0.3.6

Options: R&S CMW-KM011
R&S CMW-KM012

Manual operation: See "List" on page 162

CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:FREQuency:ALL <Frequency_1>, ..., <Frequency_n>

Defines the frequencies of all frequency/level steps.

Parameters:

<Frequency_1> ... <Frequency_n> n frequencies, one per frequency/level step, where n < 201. The query returns 200 results.

Range: 70E+6 Hz to 6E+9 Hz
Increment: 0.1 Hz
*RST: value 0 to 21: 750 MHz to 960 MHz, value 22 to 199: 960 MHz
Default unit: Hz

Example: See Configuring the List Mode

Firmware/Software: V1.0.3.6

Options: R&S CMW-KM011
R&S CMW-KM012

Manual operation: See "List" on page 162

CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:ENPower <Index>, <ExpNomPower>
CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:ENPower? <Index>

Defines or queries the expected nominal power of a selected frequency/level step.

Parameters:

<ExpNomPower> Range: -55 dBm to 55 dBm
Increment: 0.1 dB
*RST: Depending on list index (–10 dBm, –10 dBm, –10 dBm, –20 dBm, –20 dBm, –20 dBm, –20 dBm, –30 dBm, ... for the first indices)
Default unit: dBm

Parameters for setting and query:

<Index> Number of frequency/level step in the table

Range: 0 to 199
*RST: n/a

Example: See Configuring the List Mode

Firmware/Software: V1.0.3.6

Options: R&S CMW-KM011
R&S CMW-KM012

Manual operation: See "List" on page 162

CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:ENPower:ALL <Power_1>, ..., <Power_n>

Defines the expected nominal power of all frequency/level steps.

Parameters:

<Power_1> ... <Power_n>
n expected powers, one per frequency/level step, where n < 201.
The query returns 200 results.

Range: -55 dBm to 55 dBm
Increment: 0.1 dB
*RST: -10 dBm, -10 dBm, -10 dBm, -20 dBm, -20 dBm, -20 dBm, -20 dBm, -30 dBm, ..., -30 dBm
Default unit: dBm

Example: See Configuring the List Mode

Firmware/Software: V1.0.3.6

Options: R&S CMW-KM011
R&S CMW-KM012

Manual operation: See "List" on page 162

CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:RETRigger <Index>, <Retrigger>
CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:RETRigger? <Index>

Enables the retrigger mechanism after a selected frequency/level step. The setting is relevant for trigger mode "Retrigger Preselect" (`TRIGger:GPRF:MEAS<i>:IQVSlot:MODE PRESelect`).

Parameters:

<Retrigger>
OFF | ON

Disable or enable retrigger after the frequency/level step

*RST: ON (all steps)

Parameters for setting and query:

<Index>
Number of frequency/level step in the table

Range: 0 to 199
*RST: n/a

Example: See Configuring the List Mode

Firmware/Software: V2.0.10

Options: R&S CMW-KM011

R&S CMW-KM012

Manual operation: See "List" on page 162

CONFigure:GPRF:MEAS<i>:IQVSlot:LIST:RETRigger:ALL <Retrigger>...

Enables the retrigger mechanism after all frequency/level steps. The setting is relevant for trigger mode "Retrigger Preselect" (`TRIGger:GPRF:MEAS<i>:IQVSlot:MODE PRESelect`).

Parameters:

<Retrigger> OFF | ON

n comma separated values, one per frequency/level step, where n ≤ 200. The query returns 200 results.

*RST: ON (all steps)

Example: See Configuring the List Mode

Firmware/Software: V2.0.10

Options: R&S CMW-KM011
R&S CMW-KM012

Manual operation: See "List" on page 162

3.5.7.7 Measurement Results

The following commands return the RF power results of the measurement.

FETCh:GPRF:MEAS<i>:IQVSlot:I?
FETCh:GPRF:MEAS<i>:IQVSlot:Q?
READ:GPRF:MEAS<i>:IQVSlot:I?
READ:GPRF:MEAS<i>:IQVSlot:Q?

Returns the averaged I and Q amplitudes, see Measurement Results.

Return values:

<Reliability> see Reliability Indicator

<Amplitude_1> ... <Amplitude_n> — Average I or Q amplitude for each measurement step. The total number n of results is equal to the total number of steps (see CONFigure:GPRF:MEAS<i>:IQVSlot:SCOunt).

Range: -150 V to 150 V
Default unit: V

Example: See Single-Shot and Continuous Measurements

Usage: Query only

Firmware/Software: V1.0.3.6

Options: R&S CMW-KM011

FETCh:GPRF:MEAS<i>:IQVSlot:LEVel?
READ:GPRF:MEAS<i>:IQVSlot:LEVel?

Returns the averaged signal levels, see Measurement Results.

Return values:

<Reliability> — see Reliability Indicator

<Level_1> ... <Level_n> — Average level for each measurement step. The total number n of results is equal to the total number of steps (see CONFigure:GPRF:MEAS<i>:IQVSlot:SCOunt).

Range: -150 dBm to 60 dBm
Default unit: dBm

Example: See Single-Shot and Continuous Measurements

Usage: Query only

Firmware/Software: V1.0.3.6

Options: R&S CMW-KM011

FETCh:GPRF:MEAS<i>:IQVSlot:PHASe?
READ:GPRF:MEAS<i>:IQVSlot:PHASe?

Returns the averaged phase values, see Measurement Results.

Return values:

<Reliability> — see Reliability Indicator

<Phase_1> ... <Phase_n> — Average phase for each measurement step. The total number n of results is equal to the total number of steps (see CONFigure:GPRF:MEAS<i>:IQVSlot:SCOunt).

Range: -180 deg to 180 deg
Default unit: deg

Example: See Single-Shot and Continuous Measurements

Usage: Query only

Firmware/Software: V1.0.3.6

Options: R&S CMW-KM011

FETCh:GPRF:MEAS<i>:IQVSlot:FERRor?
READ:GPRF:MEAS<i>:IQVSlot:FERRor?

Returns the frequency errors, see Measurement Results.

Return values:

<Reliability> see Reliability Indicator

<FreqError_1> ... <FreqError_n> Frequency error for each measurement step. The total number n of results is equal to the total number of steps (see `CONFigure:GPRF:MEAS<i>:IQVSlot:SCOunt`).

Range: -50E+3 Hz to 50E+3 Hz
Default unit: Hz

Example: See Single-Shot and Continuous Measurements

Usage: Query only

Firmware/Software: V1.0.3.6

Options: R&S CMW-KM011

FETCh:GPRF:MEAS<i>:IQVSlot:OFERror?
READ:GPRF:MEAS<i>:IQVSlot:OFERror?
CALCulate:GPRF:MEAS<i>:IQVSlot:OFERror?

Returns the frequency errors, see Measurement Results.

The values described below are returned by `FETCh` and `READ` commands. `CALCulate` commands return a single-value error code for each result listed below.

See also: "Error Indicators for Single Results" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<Reliability> see Reliability Indicator

<FrequencyError> Overall frequency error, the arithmetic mean value of the frequency errors for each measurement step (see `READ:GPRF:MEAS<i>:IQVSlot:FERRor?`).

Range: -50E+3 Hz to 50E+3 Hz
Default unit: Hz

Example: See Single-Shot and Continuous Measurements

Usage: Query only

Firmware/Software: Software version V1.0.3.6 (`CALCulate...` commands: V1.0.10.1)

Options: R&S CMW-KM011

3.5.8 External Power Sensor Measurement Commands

The commands valid for the External Power Sensor measurement are divided into the groups listed below.

3.5.8.1 Measurement Control and States

The following commands control the measurement and return the current measurement state.

INITiate:GPRF:MEAS<i>:EPSensor
STOP:GPRF:MEAS<i>:EPSensor
ABORt:GPRF:MEAS<i>:EPSensor

Starts, stops, or aborts the measurement:

- `INITiate...` starts or restarts the measurement; the R&S CMW enters the "RUN" state.
- `STOP...` causes a running measurement to stop after the current evaluation period is terminated and valid results are available; the R&S CMW enters the "RDY" state.
- `ABORt...` causes a running measurement to stop immediately; the R&S CMW enters the "OFF" state.

Use `FETCh...STATe?` to query the current measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Example: See Performing a Single-Shot Measurement

Usage: Event

Firmware/Software: V1.0.0.4

FETCh:GPRF:MEAS<i>:EPSensor:STATe?

Queries the main measurement state. Use `FETCh:...:STATe:ALL?` to query the measurement state including the substates. Use `INITiate..., STOP..., ABORt...` to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MeasState> OFF | RDY | RUN

OFF: measurement switched off, no resources allocated, no results available (when entered after `ABORt...`)
RDY: measurement has been terminated, valid results may be available
RUN: measurement running (after `INITiate..., READ...`), synchronization pending or adjusted, resources active or queued

*RST: OFF

Example: See Performing a Single-Shot Measurement

Usage: Query only

Firmware/Software: V1.0.0.4

Manual operation: See "EPS (Softkey)" on page 164

FETCh:GPRF:MEAS<i>:EPSensor:STATe:ALL?

Queries the main measurement state and the measurement substates. Both measurement substates are relevant for running measurements only. Use `FETCh:...:STATe?` to query the main measurement state only. Use `INITiate..., STOP..., ABORt...` to change the measurement state.

See also: "Measurement Control" in the R&S CMW user manual, chapter "Remote Control"

Return values:

<MainState> OFF | RDY | RUN

OFF: measurement switched off, no resources allocated, no results available (when entered after `STOP...`)
RDY: measurement has been terminated, valid results may be available
RUN: measurement running (after `INITiate..., READ...`), synchronization pending or adjusted, resources active or queued

*RST: OFF

<SyncState> PEND | ADJ | INV

PEND: waiting for resource allocation, adjustment, hardware switching ("pending")
ADJ: all necessary adjustments finished, measurement running ("adjusted")
INV: not applicable because <main_state>: OFF or RDY ("invalid")

<ResourcesState> QUE | ACT | INV

QUE: measurement without resources, no results available ("queued")
ACT: resources allocated, acquisition of results in progress but not complete ("active")
INV: not applicable because <main_state>: OFF or RDY ("invalid")

Example: See Performing a Single-Shot Measurement

Usage: Query only

Firmware/Software: V1.0.0.4

Manual operation: See "EPS (Softkey)" on page 164

FETCh:GPRF:MEAS<i>:EPSensor:IDN?

Returns the identification string of the connected external sensor.

Return values:
<Idn> String parameter

Example: See Performing a Single-Shot Measurement

Usage: Query only

Firmware/Software: V1.0.4.0

Manual operation: See "EPS (Softkey)" on page 164

3.5.8.2 Zeroing

The following commands initiate zeroing of the power sensor or read the zeroing state.

CALibration:GPRF:MEAS<i>:EPSensor:ZERO

Initiates zeroing of the power sensor or reads the zeroing state. A running external power sensor measurement is interrupted and re-started after the zeroing procedure has been completed.

Zeroing takes a few seconds (3 to 10).

Return values:
<Reliability>

<ZeroingState> PASSed | FAILed

'PASSed': the previous zeroing was successful
'FAILed': the previous zeroing resulted in an error, e.g. because the signal power was not switched off

*RST: not used

Example: See Zeroing the External Sensor

Firmware/Software: V1.0.0.4

Manual operation: See "Start Zeroing" on page 164

3.5.8.3 Statistical Settings

The following commands specify the scope of the measurement.

CONFigure:GPRF:MEAS<i>:EPSensor:TOUT <TCDTimeOut>

Defines a timeout for the measurement. The timer is started when the measurement is initiated via a `READ` or `INIT` command. It is not started if the measurement is initiated manually (ON/OFF key or RESTART/STOP key).

When the measurement has completed the first measurement cycle (first single shot), the statistical depth is reached and the timer is reset.

If the first measurement cycle has not been completed when the timer expires, the measurement is stopped. The measurement state changes to `RDY` and the reliability indicator is set to 1, indicating that a measurement timeout occurred. Still running `READ`, `FETCh` or `CALCulate` commands are completed, returning the available results. At least for some results there are no values at all or the statistical depth has not been reached.

A timeout of 0 s corresponds to an infinite measurement timeout.

Parameters:

<TCDTimeOut>
*RST: 1 s
Default unit: s

Example: See Performing a Single-Shot Measurement

Firmware/Software: V2.0.10

Manual operation: See "Measurement Timeout" on page 165

CONFigure:GPRF:MEAS<i>:EPSensor:REPetition <Repetition>

Specifies the repetition mode of the measurement. The repetition mode specifies whether the measurement is stopped after a single-shot or repeated continuously. Use `CONFigure:..:MEAS<i>:...:SCOunt` to determine the number of measurement intervals per single shot.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<Repetition>
SINGleshot | CONTinuous

SINGleshot: Single-shot measurement
CONTinuous: Continuous measurement

*RST: SING

Example: See Performing a Single-Shot Measurement

Firmware/Software: V1.0.0.4

Manual operation: See "Repetition" on page 165

CONFigure:GPRF:MEAS<i>:EPSensor:SCOunt <StatisticCount>

Specifies the statistic count of the measurement. The statistic count is equal to the number of measurement intervals per single shot. Use `CONFigure:...:MEAS<i>:...:REPetition SINGleshot | CONTinuous` to select either single-shot or continuous measurements.

See also: "Statistical Settings" in the R&S CMW user manual, chapter "Remote Control"

Parameters:

<StatisticCount> Number of measurement intervals, i.e. the number of measured power values from the external sensor.

Range: 1 to 1000
*RST: 10

Example: See Performing a Single-Shot Measurement

Firmware/Software: V1.0.0.4

Manual operation: See "Statistic Count" on page 165

CONFigure:GPRF:MEAS<i>:EPSensor:RESolution <Resolution>

Defines the number of digits of the power results in the measurement dialog. This command does not affect the remote control results.

Parameters:

<Resolution> PD0 | PD1 | PD2 | PD3

PD0: 1 (results rounded to 1 dB)
PD1: 0.1
PD2: 0.01
PD3: 0.001

*RST: PD2

Example: See Performing a Single-Shot Measurement

Firmware/Software: V1.0.0.4

Manual operation: See "Resolution" on page 166

3.5.8.4 Sensor Configuration

The following commands specify external sensor settings.

CONFigure:GPRF:MEAS<i>:EPSensor:FREQuency <CorrectionFreq>

Specifies the input frequency at the power sensor.

Parameters:

<CorrectionFreq>
Range: Depending on sensor model used
*RST: 800E+6 Hz
Default unit: Hz

Example: See Performing a Single-Shot Measurement

Firmware/Software: V1.0.0.4

Manual operation: See "Frequency" on page 165

CONFigure:GPRF:MEAS<i>:EPSensor:ATTenuation:STATe <AttenuatState>

Enables or disables an external input attenuation at the sensor.

Parameters:

<AttenuatState>
OFF | ON
Enable (**ON**) or disable (**OFF**) external attenuation
*RST: OFF

Example: See Performing a Single-Shot Measurement

Firmware/Software: V1.0.0.4

Manual operation: See "Attenuation State" on page 166

CONFigure:GPRF:MEAS<i>:EPSensor:ATTenuation <Attenuation>

Specifies the external input attenuation factor to correct the power reading at the sensor.

Parameters:

<Attenuation>
Range: -50 dB to 50 dB
*RST: 0 dB
Default unit: dB

Example: See Performing a Single-Shot Measurement

Firmware/Software: V1.0.0.4

Manual operation: See "Attenuation Value" on page 166

3.5.8.5 Measurement Results

The following commands return the results of the measurement.

FETCh:GPRF:MEAS<i>:EPSensor?
READ:GPRF:MEAS<i>:EPSensor?

Returns statistical evaluation values of the sensor power results, see Measurement Results.

Return values:

<Reliability> see Reliability Indicator

<CurrentPower>
<AveragePower>
<MinimumPower>
<MaximumPower> RF power (single values)
Range: depending on power sensor model
Def. unit: dBm

<ElapsedStat> Range: 1 to "statistic count" setting (see `CONFigure:GPRF:MEAS<i>:EPSensor:SCOunt`)

Example: See Performing a Single-Shot Measurement

Usage: Query only

Firmware/Software: V1.0.0.4

For additional information concerning syntax elements and returned values refer to Conventions and General Information.

3.6 List of Commands

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