

R&S[®]SMW-K544

User-Defined Frequency Response Correction

User Manual



1178532002
Version 11

ROHDE & SCHWARZ
Make ideas real



This document describes the following software options:

- R&S®SMW-K544 User-Defined Frequency Response Correction (1414.3707.xx)

This manual describes firmware version FW 5.00.044.xx and later of the R&S®SMW200A.

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The following abbreviations are used throughout this manual: R&S®SMW200A is abbreviated as R&S SMW; the license types 02/03/07/11/13/16/12 are abbreviated as xx.

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1 Welcome to the user-defined frequency response correction option

The R&S SMW-K544 is a firmware application that adds functionality for user-defined frequency response corrections.

The R&S SMW-K544 features include:

- Frequency response compensation of internally generated baseband signals by user-defined data
- Cascading of up to 10 scattering parameter files, incl. ports configuration and orientation of the correction chain
- Compensation with up to 5 additional frequency responses correction files
- Absolute level correction at center frequency
- Compensation in real time

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

All functions not discussed in this manual are the same as in the base unit and are described in the R&S SMW user manual. The latest version is available at:

www.rohde-schwarz.com/manual/SMW200A

Installation

You can find detailed installation instructions in the delivery of the option or in the R&S SMW service manual.

1.1 Accessing the frequency response dialog

To open the dialog with user-defined frequency response correction settings

- ▶ In the block diagram of the R&S SMW, select "I/Q Mod > Frequency Response".

A dialog box opens that displays the provided general settings.

Frequency compensation is not performed immediately. Load suitable files first.

1.2 What's new

This manual describes firmware version FW 5.00.044.xx and later of the R&S®SMW200A.

Compared to the previous version there are editorial changes only.

1.3 Documentation overview

This section provides an overview of the R&S SMW user documentation. Unless specified otherwise, you find the documents on the R&S SMW product page at:

www.rohde-schwarz.com/manual/smw200a

1.3.1 Getting started manual

Introduces the R&S SMW and describes how to set up and start working with the product. Includes basic operations, typical measurement examples, and general information, e.g. safety instructions, etc. A printed version is delivered with the instrument.

1.3.2 User manuals and help

Separate manuals for the base unit and the software options are provided for download:

- **Base unit manual**
Contains the description of all instrument modes and functions. It also provides an introduction to remote control, a complete description of the remote control commands with programming examples, and information on maintenance, instrument interfaces and error messages. Includes the contents of the getting started manual.
- **Software option manual**
Contains the description of the specific functions of an option. Basic information on operating the R&S SMW is not included.

The contents of the user manuals are available as help in the R&S SMW. The help offers quick, context-sensitive access to the complete information for the base unit and the software options.

All user manuals are also available for download or for immediate display on the Internet.

1.3.3 Tutorials

The R&S SMW provides interactive examples and demonstrations on operating the instrument in form of tutorials. A set of tutorials is available directly on the instrument.

1.3.4 Service manual

Describes the performance test for checking compliance with rated specifications, firmware update, troubleshooting, adjustments, installing options and maintenance.

The service manual is available for registered users on the global Rohde & Schwarz information system (GLORIS):

<https://gloris.rohde-schwarz.com>

1.3.5 Instrument security procedures

Deals with security issues when working with the R&S SMW in secure areas. It is available for download on the Internet.

1.3.6 Printed safety instructions

Provides safety information in many languages. The printed document is delivered with the product.

1.3.7 Data sheets and brochures

The data sheet contains the technical specifications of the R&S SMW. It also lists the options and their order numbers and optional accessories.

The brochure provides an overview of the instrument and deals with the specific characteristics.

See www.rohde-schwarz.com/brochure-datasheet/smw200a

1.3.8 Release notes and open source acknowledgment (OSA)

The release notes list new features, improvements and known issues of the current firmware version, and describe the firmware installation.

The open-source acknowledgment document provides verbatim license texts of the used open source software.

See www.rohde-schwarz.com/firmware/smw200a

1.3.9 Application notes, application cards, white papers, etc.

These documents deal with special applications or background information on particular topics.

See www.rohde-schwarz.com/application/smw200a and www.rohde-schwarz.com/manual/smw200a

1.4 Scope



Tasks (in manual or remote operation) that are also performed in the base unit in the same way are not described here.

In particular, it includes:

- Managing settings and data lists, like saving and loading settings, creating and accessing data lists, or accessing files in a particular directory.
- Information on regular trigger, marker and clock signals and filter settings, if appropriate.
- General instrument configuration, such as checking the system configuration, configuring networks and remote operation
- Using the common status registers

For a description of such tasks, see the R&S SMW user manual.

1.5 Notes on screenshots

When describing the functions of the product, we use sample screenshots. These screenshots are meant to illustrate as many as possible of the provided functions and possible interdependencies between parameters. The shown values may not represent realistic usage scenarios.

The screenshots usually show a fully equipped product, that is: with all options installed. Thus, some functions shown in the screenshots may not be available in your particular product configuration.

2 About frequency response correction

The I/Q modulation frequency response or the I/Q flatness is an important signal quality parameter for any vector signal generator, in particular when signals with large bandwidth are generated. The I/Q modulation frequency response affects for example:

- Error vector magnitude (EVM) of digitally modulated signals
- Relative carrier power of multi carrier signals distributed over a large bandwidth

Without any additional option, the R&S SMW is equipped with a high-performance I/Q modulator that, if configured to, generates an optimized flat signal. With activated high-quality optimization mode, the instrument uses an internal correction method and digital baseband filters to compensate for frequency response variations and I/Q skew within its signal processing chain. Signal correction is performed in real time.

Component's contribution to the system flatness

The signal at the RF and analog I/Q outputs of the R&S SMW is flat. However, the DUT is rarely connected directly to the outputs of the generator. You are likely to use connecting cables between the R&S SMW and the DUT as it is likely that the test setup includes further measurement equipment, connected at the DUT's outputs. Especially at microwave frequencies and with complex test setups, components like cables, power combiners, switches or mixers can severely affect the I/Q flatness.

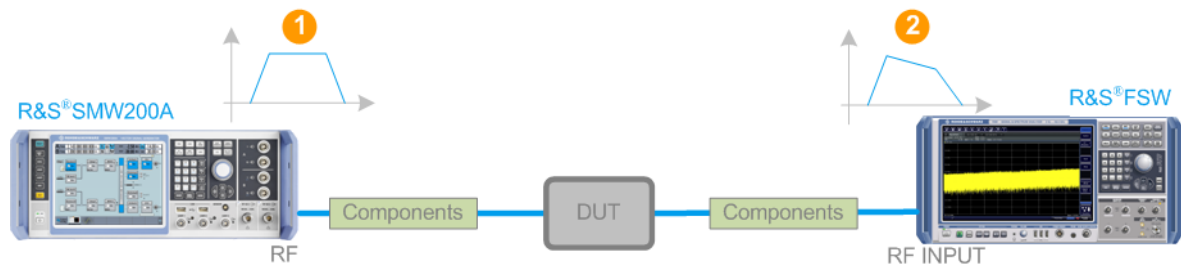


Figure 2-1: Effect of the non-linear frequency response in the components on the signal flatness

- | | |
|-----------------|--|
| DUT | = Device under test, whose characteristics are measured |
| Compo- nents | = Designation of all components between the measurement equipment and the DUT, incl. cables, power combiners, switches or mixers, etc. |
| 1 | = Flat signal at the outputs of the signal generator R&S SMW |
| 2 | = Signal received at the analyzer R&S®FSW is affected by the degraded I/Q flatness caused by the components. Measuring the true DUT characteristics is not feasible. |

Principle of user-defined frequency response compensation

In instruments equipped with the option R&S SMW-K544, you can load scattering parameters (S-parameters) files and frequency response (FR) files to compensate also for the previous mentioned deviations.

The correction values retrieved from these files are used to pre-process the signal so that the resulting frequency response regarding both magnitude and phase is compensated. Suitable transmission scattering parameters files can be obtained by measuring the components with a vector network analyzer (VNA).

In addition to the scattering parameters files or instead of them, if S-parameter files are unavailable, correction values can also be retrieved from FR files. Suitable FR files can be obtained with R&S NRP power sensors or through conversion of an equalizer file.

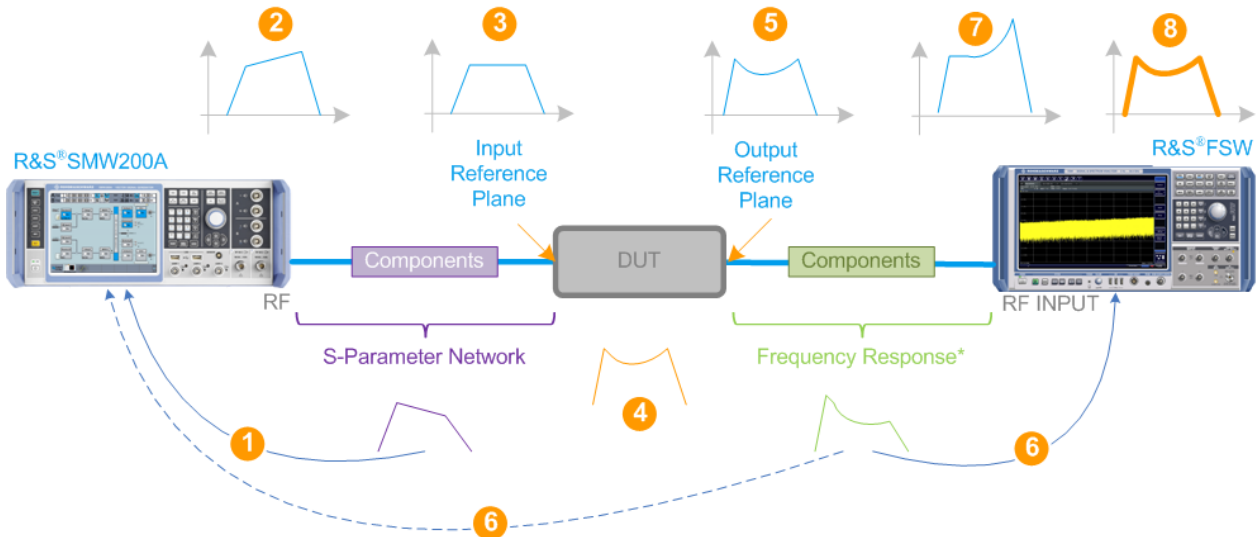


Figure 2-2: Understanding the frequency response correction

- | | |
|------------|--|
| DUT | = Device under test, whose characteristics are to be measured |
| Components | = Designation of all components between the measurement equipment and the DUT, incl. cables, power combiners, switches or mixers, etc. |
| 1 | = Characterize the transmission chain at the DUT input frequency; measure all components between the R&S SMW and the DUT. Load and apply the collected transmission scattering parameters file in the R&S SMW. |
| 2 | = In the R&S SMW, the baseband signal is pre-processed so that the signal at the outputs is the inverted version of the channel response |
| 3 | = Received at the DUT input, the pre-processed signal if flat |
| 4 | = Frequency response of the DUT |
| 5 | = Signal at the DUT's output, as it should be received and measured with the R&S®FSW |
| 6 | = Characterize the transmission chain at the DUT output frequency; measure all components between the DUT and the inputs of the R&S®FSW. Load and apply the collected frequency response (or the transmission scattering parameters) file in one of the measurement instruments. |
| 7 | = If the compensation is performed at the analyzer, the signal at the R&S®FSW input contains the effects caused by the DUT (5) and the transmission channel (6) |
| 8 | = Resembles the DUT characteristic as it is at the DUT' output (4); thus, only the frequency response of the DUT can be analyzed |
| * | = Frequency response or scattering parameters files |

Real-time compensation

The compensation filters are implemented in hardware. Thus, corrections are applied in real time, irrespectively of the baseband signal. If the baseband signal is reconfigured, the compensation is applied on that signal, too. Logically though, if parts of the setup like components or cables are changed, these newly introduced parts have to be measured and their S-parameter files included in the compensation.

Difference between the S-parameters and FR files

The **S-parameters files** contain transmission scattering parameters (S-parameters) that characterize the component's frequency response. They compensate the frequency response of the scattering parameters network, regarding **magnitude and phase**, while taking reflections into consideration.

FR files in ***.fres** format, can contain magnitude and phase corrections but reflections are not included.

User correction or ***.uco** files can be used to compensate the **magnitude at the center frequency**. If loaded as frequency response (FR) list, these files also compensate the magnitude frequency response over the modulation frequency. User correction files, however, do not contain phase or reflection correction values.

2.1 Required options

The equipment layout includes:

- Frequency option (e.g. R&S SMW-B1003)
- Option standard or wideband baseband generator (R&S SMW-B10/-B9) per signal path and
 - Option baseband main module, one/two I/Q paths to RF (R&S SMW-B13/-B13T)
 - Or option wideband baseband main module two I/Q paths to RF (R&S SMW-B13XT)
- Option user-defined frequency response correction (R&S SMW-K544) (per signal path)

2.2 Supported file formats

The following file formats are supported:

| Extension | File type | Description |
|------------|---|--|
| *.s<n>p | Touchstone S-parameters files | See Chapter 2.2.1, "S-parameters (Touchstone) files" , on page 12. |
| *.uco | User correction files | See Chapter 2.2.2, "Frequency response (FR) files" , on page 14. |
| *.fres | Frequency and phase of the transmission path in a touchstone format | See Chapter 2.2.2, "Frequency response (FR) files" , on page 14. |
| *.freqresp | Save/recall file containing configuration in the dialog | See "Save/Recall" on page 20. |

2.2.1 S-parameters (Touchstone) files

The R&S SMW can extract and apply scattering matrix corrections from S-parameters data files. These data files are also known as touchstone files and exist in two format versions, V1.0 and V2.0.

R&S SMW-K544 supports touchstone file format in version V1.0.

File extension

S-parameters files are files with predefined structure and file extension `*.s<n>p`, where `<n>`:

- Is an integer value and $\langle n \rangle \geq 1$
- $\langle n \rangle$ = number of measured ports
- $\langle n \rangle^2$ = number of S-parameters the file contains

An `*.s1p` file, for example, contains a one-port measurement and one S-parameter while the file `*.s3p` contains a three-port measurement and nine S-parameters.

The most meaningful S-parameter for the frequency response compensation is the S21, because it characterizes the frequency response of a component.

S-parameters measurements are typically performed with a vector network analyzer, like, for example, the R&S@ZNB.

File format

Touchstone files contain a **header**, a **comment section**, and the **actual trace data**. The following is an extract of the file content of file created by the R&S@ZNB.

```
# HZ S RI R 50.00
! Rohde & Schwarz Vector Network Analyzer
! Rohde-Schwarz,ZNB8-4Port,1311601044100005,1.93.1.42
! Created: UTC 9/17/2013, 9:13:56 AM
! freq[Hz] re:S11 im:S11
1.000000000000000E5 -4.897128641605377E-1 3.767784312367439E-2
4.259950000000000E7 -5.450598597526550E-1 3.608805686235428E-2
...
```

indicates the beginning of the **header line**. It is required at the top of file and consists of the following data elements:

- **<Frequency unit>**: HZ / KHZ / MHZ / GHZ, Rohde & Schwarz analyzers usually use Hz.
- **<Data file type>**: S for S-parameter files
- **<Data format>**:
 - RI = Re/Im
 - MA = linear magnitude-phase
 - DB = Mag-Phase in decibels
- **<Reference resistance>**: specifies the impedance system underlying the trace data, given as a real, positive resistance (default 50 Ω)

Comment lines start with the exclamation mark (!) and can contain any text used for documentation of the trace data file. Any number of comment lines can be inserted before or after the header line.

The following information is displayed in the comments section:

- VNA identification (comment line 2 in above example)
- Timestamp (comment line 3)
- Port-specific renormalization information (comment lines 4ff, if applied)
- Headings for included data tables (comment lines right above the data tables, starting with ! freq)

The **trace data** section corresponds to a set of single-ended S-parameters. It depends on the number of ports and the data format.

For real and imaginary values (<Data format> = RI) the trace data for each stimulus frequency is arranged as indicated in the lowermost comment lines:

- **1-port files (*.s1p)**
! freq[Hz] re:S11 im:S11
S₁₁ can be replaced by any S-parameter.
Thus, the *.s1p format can contain an arbitrary data trace representing an S-parameter.
- **2-port files (*.s2p)**
! freq[Hz] re:S11 im:S11 re:S21 im:S21 re:S12 im:S12 re:S22 im:S22
(all values arranged in 1 line)
- **n-port files (*.snp), 2 < n ≤ 4**
! freq[Hz] re:S11 im:S11 re:S12 im:S12 ... re:S1n im:S1n
! re:S21 im:S21 re:S22 im:S22 ... re:S2n im:S2n
! ...
! re:Sn1 im:Sn1 re:Sn2 im:Sn2 ... re:Snn im:Snn
(values arranged in n lines)
- **n-port files (*.snp), n > 4**
! freq[Hz] re:S11 im:S11 ... re:S14 im:S14
! re:S15 im:S15 ...
! ...
! ... re:Snn im:Snn
(values arranged in $m = \lceil n^2/4 \rceil$ lines, where the first m-1 data lines contain exactly four value pairs)

The stimulus frequencies are arranged in ascending order. For linear magnitude-phase and magnitude-phase in decibels values (<Data format> = MA or DB), the trace data the real and imaginary S-parameter values re:S_{ij} im:S_{ij} are replaced by mag:S_{ij} ang:S_{ij} or db:S_{ij} ang:S_{ij}, respectively.

Cascading files

If several S-parameter files are loaded, they are cascaded. Each S-parameters file is defined with its origin and destination ports. Thus, you can configure or reverse the orientation of the signal chain.

The first entry in the chain is the R&S SMW itself; it illustrates the chain orientation - form R&S SMW toward the DUT.

2.2.2 Frequency response (FR) files

The R&S SMW can extract and apply frequency response and level corrections from the following file types.

- *.uco files
- *.fres files.

These files types contain transmission parameters, in magnitude and phase. The files order in the file list is not relevant; perfect match is assumed.

Throughout this description, the previously mentioned file formats are referred as frequency response (FR) files.

*.fres files

These files contain user-defined transmission frequency response values and are created manually, in one of the following ways:

- From existing user data describing the transmission characteristics of the channel or the device, like, for example, the S21 scattering parameter set. The *.fres file format is the same as the file format of the one port S-parameter files; merely changed is the file extension.
See [Chapter 2.2.1, "S-parameters \(Touchstone\) files"](#), on page 12.
- Obtained through conversion of an equalizer file.
Equalizers are special filters that are built-in in spectrum analyzers like, for example, the R&S®FSW and used to compensate the frequency response of the received signal. You can query the equalizer characteristics (i.e. filter tabs) by using remote-control commands.
For more information, see R&S®FSW user manual.

*.uco files

User correction files can be created manually or obtained by a power sensor for example R&S NRP.

These types of files can also be used with the user correction functionality in the RF block. Corrections affect one or a sequence of discrete frequencies. For narrowband signals, this approach can achieve sufficient results but it is not effective for wideband signals.

The user-defined frequency response corrections are applied digitally and on the current baseband signal, thus compensating the magnitude of the signal in the modulation frequency range.

For information on the user correction function, file format and on how to acquire the frequency response characteristics of the transmission channel by R&S NRP power sensor, see:

- R&S SMW User Manual, section "User Correction"

- R&S SMW User Manual, section "How to Calibrate the Power Level with an R&S NRP Power Sensor"

3 Frequency response configuration and settings

Access:

- ▶ In the block diagram of the R&S SMW, select "I/Q Mod > Frequency Response".

This section describes the related settings.

The remote commands required to define these settings are described in [Chapter 5, "Remote-control commands"](#), on page 30.

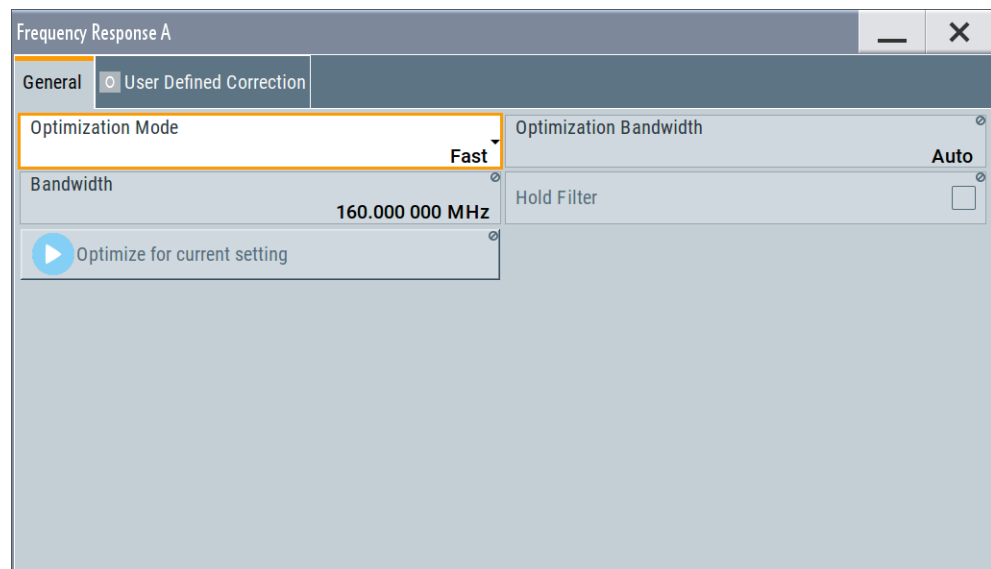
For step-by-step instructions, see [Chapter 4, "How to apply user-defined frequency response corrections"](#), on page 26.

- [General settings](#)..... 16
- [User-defined correction](#)..... 18

3.1 General settings

Access:

- ▶ Select "I/Q Mod > Frequency Response > General".



Settings:

| | |
|------------------------------------|----|
| Optimization Mode..... | 17 |
| Optimization Bandwidth..... | 18 |
| Bandwidth..... | 18 |
| Hold Filter..... | 18 |
| Optimize for Current Settings..... | 18 |

Optimization Mode

Selects the optimization mode.

For information on the I/Q modulation performance in any of the modes, see the data sheet.

The value selected here is used also as optimization mode for the user-defined frequency response corrections, and vice versa.

See user manual R&S SMW-K544 User-Defined Frequency Response Correction.

"Fast" Fast optimization by compensation for I/Q skew.
This mode is suitable in time sensitive environments and narrowband signal.

"High Quality Table"
This mode provides improved optimization while maintaining setting time.

Select this mode if repeatable settings together with high quality optimization also of wideband signals are required. The "High Quality Table" mode is useful in the following cases:

- If R&S SZU is connected to the R&S SMW and the connection is active
- In setup for the generation of phase-coherent signals
- In DPD setups

See user manual R&S SMW-K540, R&S SMW-K541 Envelope Tracking and AM/AM, AM/PM Predistortion.

"High Quality"
With "Source > Internal Baseband", enables an optimization by compensation for I/Q skew and frequency response correction.
This mode generates flat signal over large bandwidth but requires longer setting time and leads to signal interruption.

Note:

Do not use the mode "I/Q Modulator > Optimization Mode > High Quality" in combination with the modes "RF Level > Setting Characteristics > Uninterrupted/Strictly Monotone".

The high quality I/Q optimization leads to RF signal interruption. The requirements of the RF level modes "Uninterrupted" and "Strictly Monotone" can not be fulfilled.

Remote command:

`[:SOURce<hw>] :CORRection:FRESponse:RF:OPTimization:MODE`

on page 33

Optimization Bandwidth

For "Optimization Mode > High Quality/High Quality Table", defines how the signal bandwidth on that frequency response is compensated is selected.

"Auto" Signal bandwidth is determined automatically, based on the sample rate of the baseband signal.

"Manual" Signal bandwidth is set with the parameter [Bandwidth](#).

Remote command:

`[:SOURce<hw>] :CORRection:FRESponse:RF:OPTimization:BANDwidth:MODE` on page 34

Bandwidth

In "Optimization Bandwidth > Manual", sets the signal bandwidth on that frequency response is compensated.

Remote command:

`[:SOURce<hw>] :CORRection:FRESponse:RF:OPTimization:BANDwidth[:VALue]` on page 34

Hold Filter

For "Optimization Mode > High Quality/High Table", retains the last calculated correction values as long as one of the following is performed:

- "Optimize for Current Settings" is triggered
- "Hold Filter > Off" is selected

Remote command:

`[:SOURce<hw>] :CORRection:FRESponse:RF:OPTimization:HOLD[:STATe]` on page 34

Optimize for Current Settings

For "Optimization Mode > High Quality", set that the correction data is calculated for the currently selected frequency and bandwidth.

Use this function to trigger recalculation of the compensation values, if "Hold Filter > On" is used.

Remote command:

`[:SOURce<hw>] :CORRection:FRESponse:RF:OPTimization:LOCal` on page 35

3.2 User-defined correction

Access:

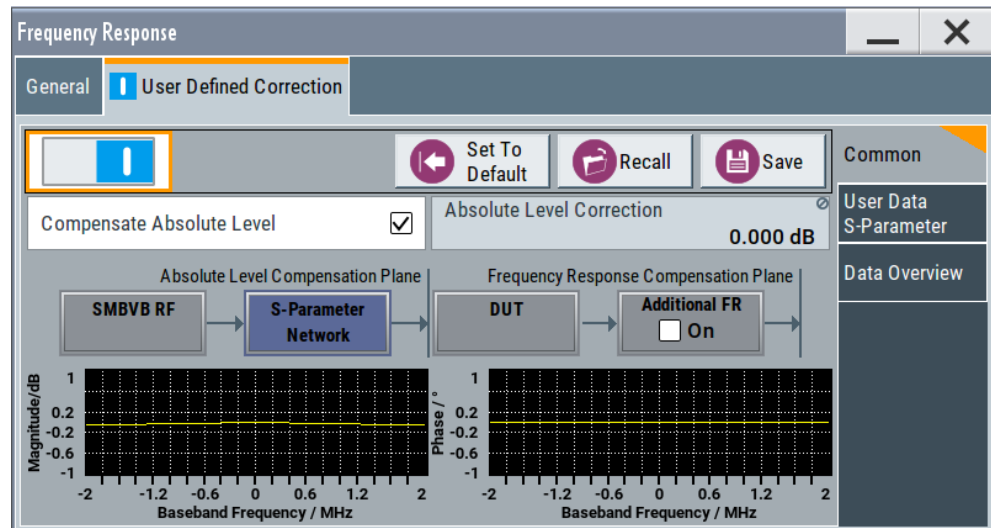
► Select "I/Q Mod > Frequency Response > User Defined Correction".

- [Common settings](#)..... 19
- [User data S-parameter settings](#)..... 21
- [User data additional FR settings](#)..... 22
- [Data overview](#)..... 24

3.2.1 Common settings

Access:

- ▶ Select "I/Q Mod > Frequency Response > User Defined Correction > Common".



This dialog provides access to the default and the "Save/Recall" settings, and for settings that are common for the particular setup.

Settings:

| | |
|---|----|
| State..... | 19 |
| Set to Default..... | 19 |
| Save/Recall..... | 20 |
| Compensate Absolute Level..... | 20 |
| Absolute Level Correction..... | 20 |
| Additional Frequency Response (FR)..... | 20 |

State

If "I/Q Mod > Frequency Response > General" > "Optimization Mode = High Quality", activates the user-defined frequency response correction.

Remote command:

`[:SOURce<hw>] :CORRection:FRESponse:RF:USER[:STATe]` on page 35

Set to Default

Calls the default settings. The values of the main parameters are listed in the following table.

| Parameter | Value |
|------------------------------------|-------|
| State | Off |
| Compensate absolute level | Off |
| Additional frequency response (FR) | Off |

Remote command:

`[:SOURce<hw>] :CORRection:FRESponse:RF:USER:PRESet` on page 36

Save/Recall

Accesses the "Save/Recall" dialog, that is the standard instrument function for saving and recalling the complete dialog-related settings in a file. The provided navigation possibilities in the dialog are self-explanatory.

The settings are saved in a file with predefined extension. You can define the filename and the directory, in that you want to save the file.

See also, chapter "File and Data Management" in the R&S SMW user manual.

Remote command:

`[:SOURce<hw>] :CORRection:FRESponse:RF:USER:STORe` on page 35

`[:SOURce<hw>] :CORRection:FRESponse:RF:USER:LOAD` on page 36

Compensate Absolute Level

If S-parameters files are loaded, absolute level compensation at the current center frequency can also be enabled. Current correction value is indicated.

If activated, absolute level is compensated for the signal until the DUT inputs. Level compensation in the transmission channel, i.e. if FR files are used, is not supported. You recognize active absolute level correction by the "Lev Fcor" icon in the status bar.

To apply corrections from S-parameters files, select [User Data S-Parameter](#), load suitable files, activate them and select "Apply".

Note: Absolute level compensation and user correction cannot be activated simultaneously. These functions exclude each other; only one of them can be used at a time. See also R&S SMW User Manual, section "User Correction".

Remote command:

`[:SOURce<hw>] :CORRection:FRESponse:RF:USER:ALEVel [:STATe]`
on page 36

Absolute Level Correction

Indicates the current level correction value, if absolute level correction is enabled.

Remote command:

`[:SOURce<hw>] :CORRection:FRESponse:RF:USER:ALEVel:VALue?`
on page 37

Additional Frequency Response (FR)

Enables that user-defined corrections in form of FR files are used to compensate for the channel response of the transmission channel. To apply such corrections, select [User Data Additional FR](#), load RF files, activate them and select "Apply".

Observe the shift of the compensation plane in the illustration in the dialog.

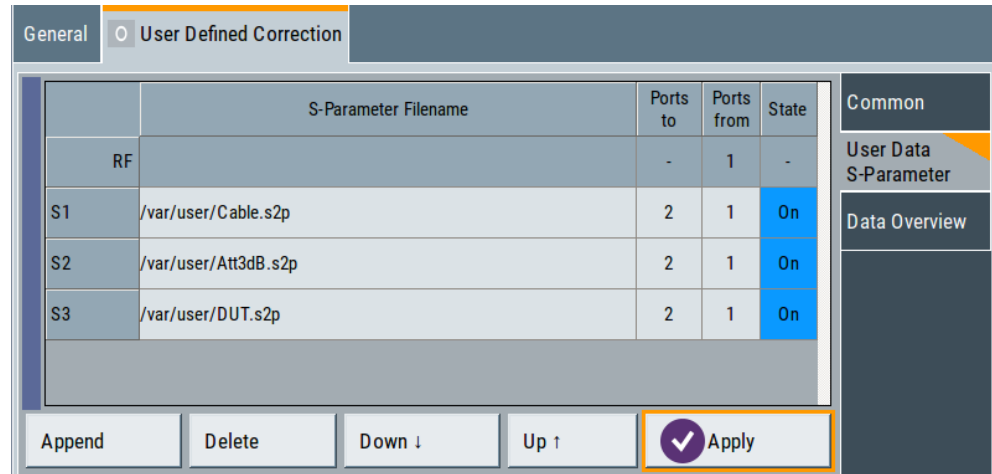
Remote command:

`[:SOURce<hw>] :CORRection:FRESponse:RF:USER:FLISt [:STATe]`
on page 37

3.2.2 User data S-parameter settings

Access:

- ▶ Select "I/Q Mod > Frequency Response > User Defined Correction > User Data S-Parameter".



In this dialog, you can load S-parameters files. If activated, the transmission scattering parameter values are extracted from the file and used to pre-process the generated signal. At the DUT, the signal is as if the DUT is directly connected to the output of the R&S SMW. The frequency response of the related components is compensated.

Additionally to or instead of S-parameters files if the latter are for example unavailable for particular components, you can also load frequency response RF files, see [Chapter 3.2.3, "User data additional FR settings"](#), on page 22.

To activate loaded files, enable them ("State > On") and select "Apply". A warning icon appears, if you change any setting in the dialog but "Apply" is not executed.

Settings:

| | |
|------------------------------|----|
| S1 to S10..... | 21 |
| S-Parameter Filename..... | 22 |
| Ports to/from..... | 22 |
| State..... | 22 |
| Append, Delete, Up/Down..... | 22 |
| Apply..... | 22 |

S1 to S10

Subsequent number indicating the loaded files.

Rows can be omitted.

Remote command:

n.a.

(files are indicated by the SLIST<ch> suffix in the corresponding command)

S-Parameter Filename

Access the standard "File Select" dialog for loading S-parameters (Touchstone) files. S-parameters files are files with predefined extension (*.s<n>p) and file format.

See [Chapter 2.2.1, "S-parameters \(Touchstone\) files"](#), on page 12.

Use the standard "File Manager" function to transfer external data lists to the instrument.

Remote command:

```
[ :SOURce<hw> ] :CORRection:FRESponse:RF:USER:SLISt<ch>:SELeCt
```

on page 38

Ports to/from

Sets the origin and destination ports, i.e. the port number from that the signal is coming and the port to that it is going. Use this parameter to change the orientation of the signal chain.

Remote command:

```
[ :SOURce<hw> ] :CORRection:FRESponse:RF:USER:SLISt<ch>:PORTs:FROM
```

on page 38

```
[ :SOURce<hw> ] :CORRection:FRESponse:RF:USER:SLISt<ch>:PORTs:TO
```

on page 38

State

If activated, the file is used for frequency response compensation. Thus, you can load files that are excluded from the current frequency response compensation scenario, exchange files or temporarily deactivate files.

Note: However, files are of the S-parameter used until you execute "**Apply**".

Observe the indication in the side tab. A warning icon appears, if you change any setting in the "Use Data S-Parameter" dialog but "Apply" is not executed.

Remote command:

```
[ :SOURce<hw> ] :CORRection:FRESponse:RF:USER:SLISt<ch> [ :STATe ]
```

on page 38

Append, Delete, Up/Down

Standard functions for handling the table rows.

Apply

Retrieves the values from the active S-parameters files and uses them to pre-process the signal.

Remote command:

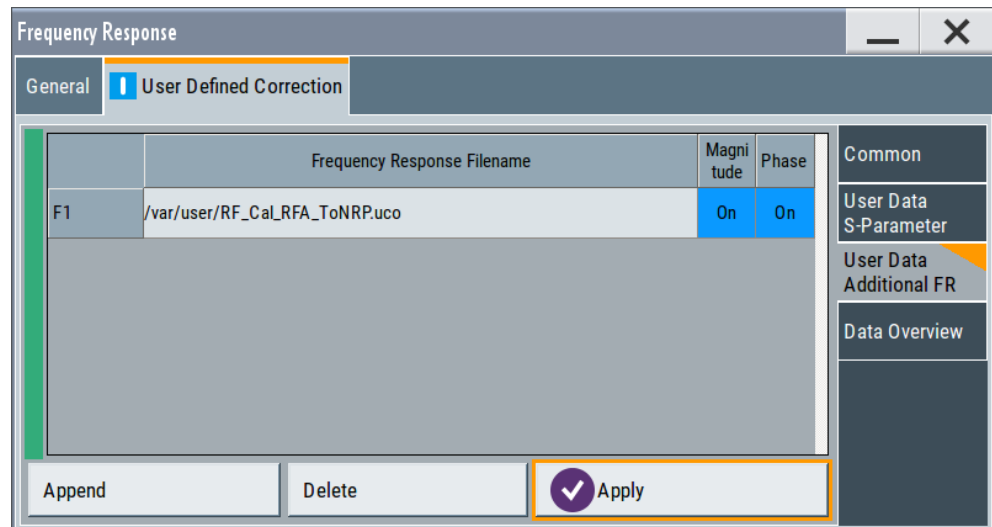
```
[ :SOURce<hw> ] :CORRection:FRESponse:RF:USER:APPLy on page 37
```

3.2.3 User data additional FR settings

Access:

1. Select "I/Q Mod > Frequency Response > User Defined Correction > Common".

2. Select "Additional Frequency Response (FR) > On".
3. Select "User Data Additional FR".



In this dialog, you can load user-defined frequency response (FR) files. If activated, the frequency response values are extracted from the file and used to pre-process the generated signal.

FR files can be used additionally to or instead of the S-parameters file, if the latter are, for example, unavailable.

To activate loaded files, enable them and select "Apply". A warning icon appears if you change any setting in the dialog but "Apply" is not executed.

Settings:

| | |
|----------------------------------|----|
| F1 to F5..... | 23 |
| Frequency Response Filename..... | 23 |
| Magnitude, Phase..... | 24 |
| Append, Delete, Up/Down..... | 24 |
| Apply..... | 24 |

F1 to F5

Subsequent number indicating the loaded files.

Rows can be omitted.

Remote command:

n.a.

(files are indicated by the `FLIST<ch>` suffix in the corresponding command)

Frequency Response Filename

Access the standard "File Select" dialog for loading FR files. FR files are files with pre-defined extension (`*.uco` or `*.fres`) and file format.

See [Chapter 2.2.2, "Frequency response \(FR\) files"](#), on page 14.

Use the standard "File Manager" function to transfer external data lists to the instrument.

Remote command:

`[:SOURce<hw>] :CORRection:FRESponse:RF:USER:FLISt<ch>:SELection`
on page 40

`[:SOURce<hw>] :CORRection:FRESponse:RF:USER:FLISt:CATalog?`
on page 41

Magnitude, Phase

Enables using the phase and magnitude information from the loaded FR file.

Note: However, files are of the FR used until you execute "Apply".

Observe the indication in the side tab. A warning icon appears, if you change any setting in the "Use Data Additional RF" dialog but "Apply" is not executed.

Remote command:

`[:SOURce<hw>] :CORRection:FRESponse:RF:USER:FLISt<ch>:MAGNitude[:STATe]` on page 40

`[:SOURce<hw>] :CORRection:FRESponse:RF:USER:FLISt<ch>:PHASE[:STATe]` on page 40

Append, Delete, Up/Down

Standard functions for handling the table rows.

Apply

Retrieves the values from the active FR files and pre-processes the signal with them.

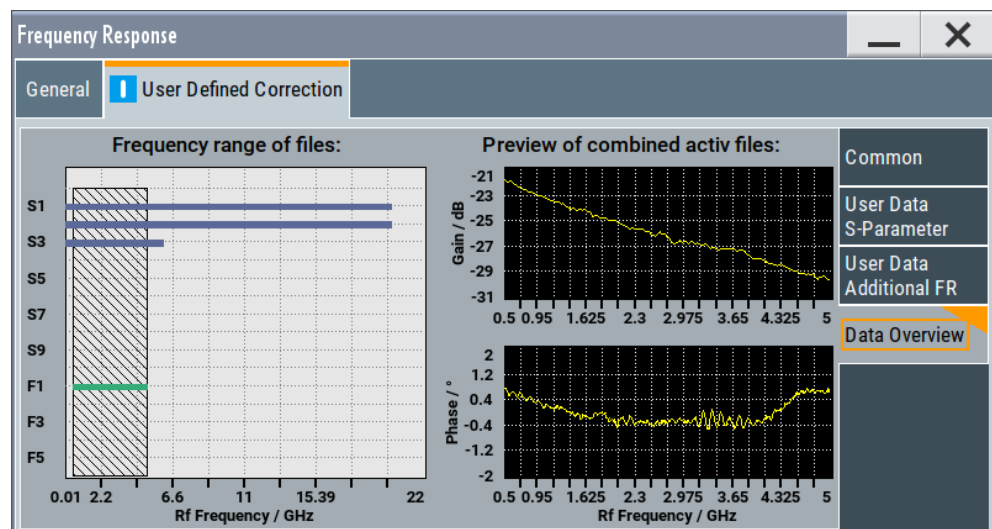
Remote command:

`[:SOURce<hw>] :CORRection:FRESponse:RF:USER:APPLY` on page 37

3.2.4 Data overview

Access:

- ▶ Select "I/Q Mod > Frequency Response > User Defined Correction > Data Overview".



This dialog provides a graphical overview of the combined user-defined frequency response corrections.

The first graph represents the frequency range covered by each of the files and highlights the common frequency region. The graphs on the right indicate the aggregated frequency response corrections for both the magnitude and phase corrections over the common frequency range.

In both cases, considered are the active ("State > On") rather than all loaded files.

4 How to apply user-defined frequency response corrections

This section shows you how to use the R&S SMW-K544 functionality and load scattering parameters files for compensating for the frequency response of a test setup.

We assume that you have characterized the components (cable, combiners, DUT), for example with vector network analyzer, and have created the required scattering parameters files. We also assume that the frequency response files are created.

Configure the baseband signal and enable signal generation

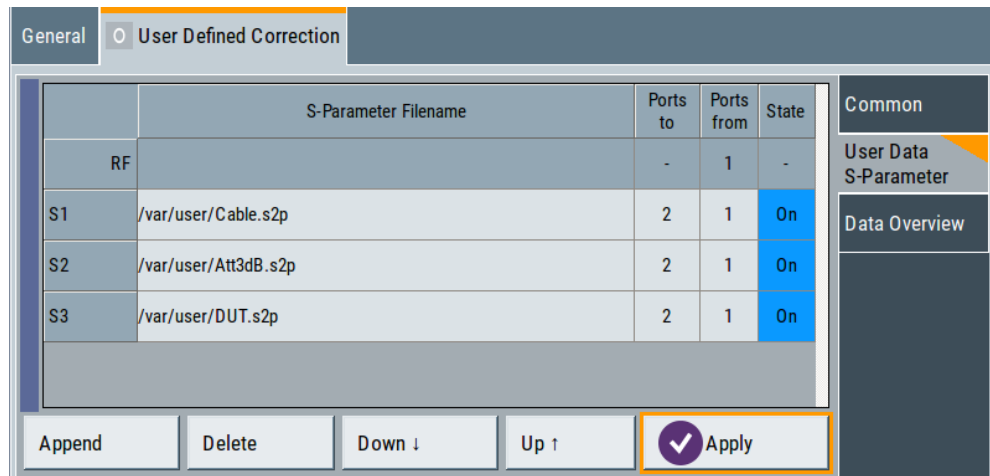
Configure the baseband signal and enable signal generation, for example as follows:

1. Select "Baseband > MCCW > State > On".
2. In the status bar, set the frequency and level, for example, "Frequency = 5 GHz" and "Level = -15 dB".
3. In the block diagram, select "RF > On".

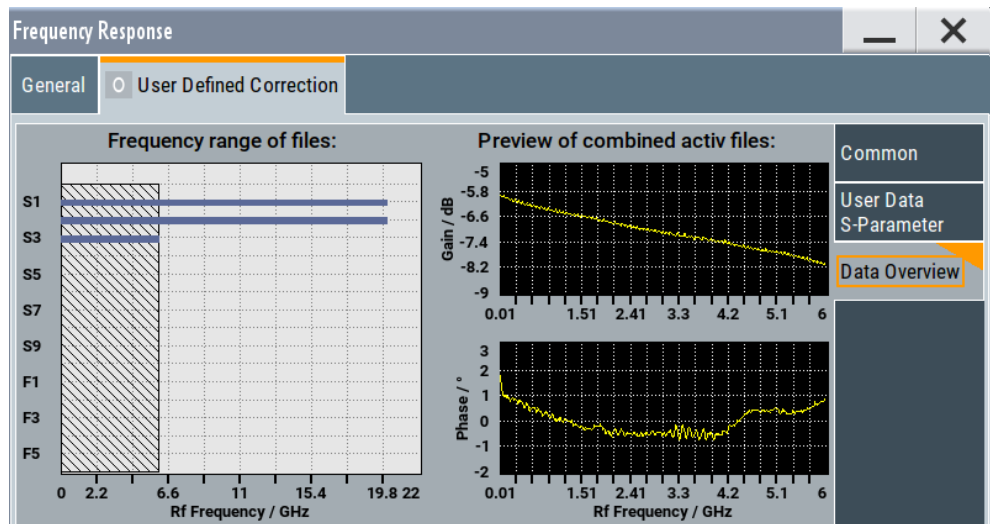
Load the scattering parameters files and enable frequency response correction

We assume that you have characterized the components (cable, combiners, DUT), for example with vector network analyzer, and have created the required scattering parameters files. We also assume that the frequency response files are created.

1. Use any of the file transfer methods to save the S-parameters files in the /var/user/ directory of the R&S SMW.
2. Select "I/Q Mod > Frequency Response".
3. Select "General > Optimization Mode > High Quality".
4. Select "Use Defined Correction > User Data S-parameter".
In the S-parameter table, select "S1 > S-Parameter Filename" and navigate to the S-parameter file.
5. If several files are used, select "Append".
Load the files in the same manner.
6. For each of the files, select "State > On".
7. Select "Apply".

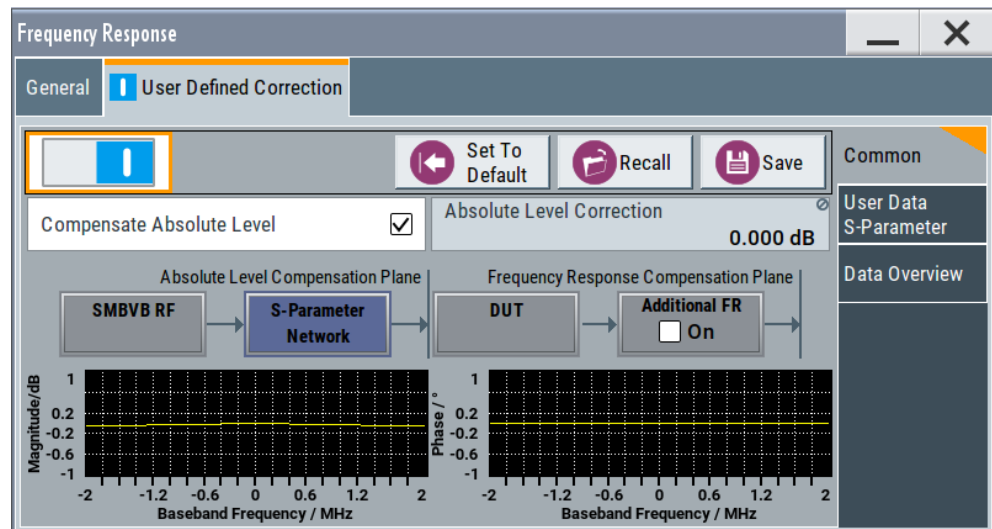


8. Select "Use Defined Correction > Data Overview" to observe the frequency range covered by the loaded files.



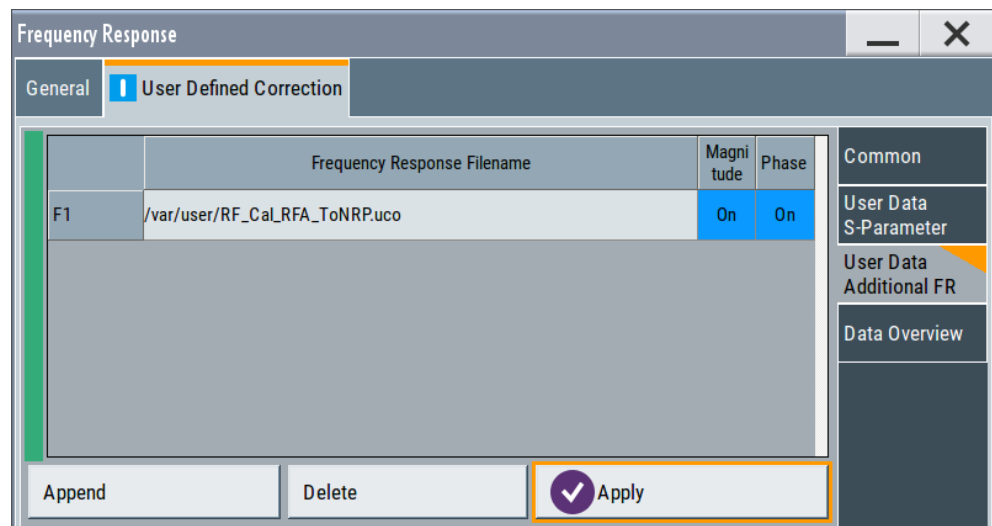
The dialog also shows an overview of the aggregated correction data of all active files.

9. Select "Use Defined Correction > Common > State > On".
10. Optionally, select "Compensate Absolute Level > On".

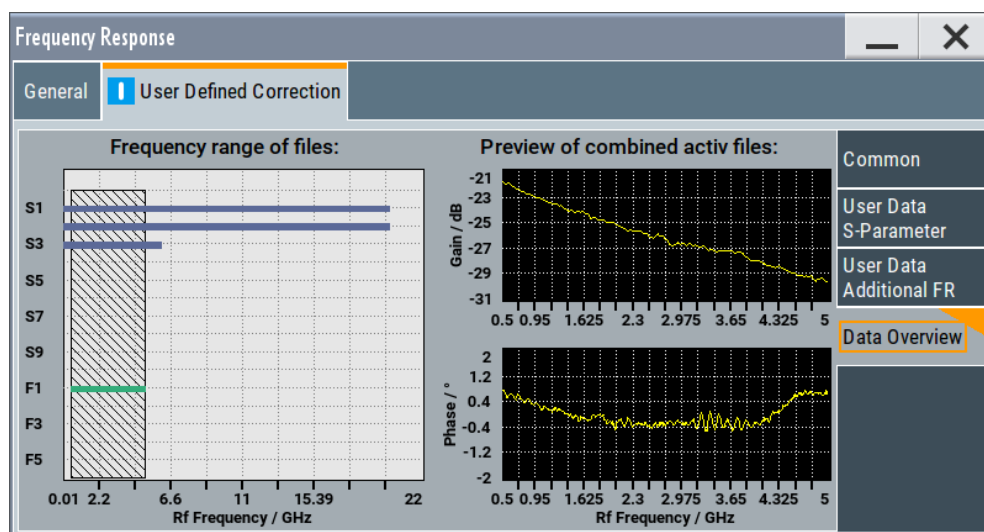


Load and enable additional frequency correction data

1. Select "Use Defined Correction > Common > Additional FR > On".
2. Select "Use Defined Correction > User Data Additional FR".
In the frequency response table, select "F1 > Frequency Response Filename" and navigate to the *.uco file.
3. If several files are used, select "Append".
Load the files in the same manner.
4. For each of the files, select "Magnitude/Phase > On".
5. Select "Apply".



6. Select "Use Defined Correction > Data Overview" to observe the frequency range covered by all loaded files.



The dialog also shows an overview of the aggregated correction data of all active files.

5 Remote-control commands

The following commands are required to perform signal generation with the option R&S SMW-K544 in a remote environment. We assume that the R&S SMW has already been set up for remote operation in a network as described in the R&S SMW documentation. A knowledge about the remote control operation and the SCPI command syntax is assumed.



Conventions used in SCPI command descriptions

For a description of the conventions used in the remote command descriptions, see section "Remote Control Commands" in the R&S SMW user manual.

Common Suffixes

The following common suffixes are used in the remote commands:

| Suffix | Value range | Description |
|------------------------|-------------------|--|
| SOURce<hw> | [1] to 4 | Available baseband signals Only SOURce1 possible, if the keyword ENTity is used |
| SLISt<hw> FLISt<hw> | 1 to 10 1 to 5 | Subsequent number indicating the user correction file as loaded in the GUI |

Programming examples

This description provides simple programming examples. The purpose of the examples is to present **all** commands for a given task. In real applications, one would rather reduce the examples to an appropriate subset of commands.

The programming examples have been tested with a software tool which provides an environment for the development and execution of remote tests. To keep the example as simple as possible, only the "clean" SCPI syntax elements are reported. Non-executable command lines (e.g. comments) start with two // characters.

At the beginning of the most remote control program, an instrument (p)reset is recommended to set the instrument to a definite state. The commands *RST and SYSTem:PRESet are equivalent for this purpose. *CLS also resets the status registers and clears the output buffer.

The following commands specific to the R&S SMW-K544 option are described here:

- [Programming examples](#)..... 31
- [General commands](#)..... 33
- [Common commands](#)..... 35
- [S-parameter commands](#)..... 37
- [Frequency response \(FR\) list commands](#)..... 40

5.1 Programming examples

Example: Configuring baseband test signal

```
// create test signal, e.g. unsymmetrical multi carrier signal
SOURCEl:BB:MCCW:CARRier:COUNT 200
SOURCEl:BB:MCCW:CARRier:SPACing 500000
SOURCEl:BB:MCCW:EDIT:CARRier:START 100
SOURCEl:BB:MCCW:EDIT:CARRier:STOP 199
SOURCEl:BB:MCCW:EDIT:CARRier:STATe 0
SOURCEl:BB:MCCW:EDIT:CARRier:EXECute
SOURCEl:BB:MCCW:STATe 1
OUTPut1:STATe 1

SOURCEl:FREQuency:CW 2143000000
SOURCEl:POWer:POWer -20
```

Example: Enabling high-quality optimization

```
SOURCEl:CORRection:FRESponse:RF:OPTimization:MODE QHIG
SOURCEl:CORRection:FRESponse:RF:OPTimization:BANDwidth:MODE AUTO
SOURCEl:CORRection:FRESponse:RF:OPTimization:BANDwidth:VALue?
// 160000000
SOURCEl:CORRection:FRESponse:RF:OPTimization:LOCAl
SOURCEl:CORRection:FRESponse:RF:OPTimization:HOLD:STATe 1
```

Example: Activating user-defined frequency response correction

```

// Enable frequency response correction with S-parameter files
// measure the frequency response of the components to be compensated
// save and load one file per component
// or if available load one file for the complete transmission channel
// in the following, we assume that the files cable.s1p and combiner.s3p exist
// and that they are saved in the used directory on the instrument
SOURcel:CORRection:FRESponse:RF:USER:ALEvel:STATe 1
SOURcel:CORRection:FRESponse:RF:USER:SLIST:CATalog?
// "None,None,None,None,None,None,None,None,None"
// S-parameter list is empty
// cable.s1p, converter.s2p
SOURcel:CORRection:FRESponse:RF:USER:SLIST1:SElect "/var/user/cable.s1p"
// *.s1p files contain single-port measurement
SOURcel:CORRection:FRESponse:RF:USER:SLIST1:PORTs:FROM 1
SOURcel:CORRection:FRESponse:RF:USER:SLIST1:PORTs:TO 1
SOURcel:CORRection:FRESponse:RF:USER:SLIST1:STATe 1
// rows can be skipped
SOURcel:CORRection:FRESponse:RF:USER:SLIST3:SElect "/var/user/combiner.s3p"
SOURcel:CORRection:FRESponse:RF:USER:SLIST3:STATe 1
SOURcel:CORRection:FRESponse:RF:USER:SLIST4:SElect "/var/user/converter.s2p"
SOURcel:CORRection:FRESponse:RF:USER:SLIST4:STATe 1
SOURcel:CORRection:FRESponse:RF:USER:SLIST:CATalog?
// "None,None,None,None,None,None,None,None,None"
// S-parameter list is empty; apply the changes first
SOURcel:CORRection:FRESponse:RF:USER:APPLy
SOURcel:CORRection:FRESponse:RF:USER:SLIST:SIZE?
// 3
SOURcel:CORRection:FRESponse:RF:USER:SLIST:CATalog?
// "/var/user/cable.s1p,None,/var/user/combiner.s3p,/var/user/converter.s2p,None,..."

// to exclude files from the configuration
// deactivate them or unload them; apply the changes
SOURcel:CORRection:FRESponse:RF:USER:SLIST4:STATe 0
// or
SOURcel:CORRection:FRESponse:RF:USER:SLIST4:SElect "none"
SOURcel:CORRection:FRESponse:RF:USER:APPLy
SOURcel:CORRection:FRESponse:RF:USER:SLIST:CATalog?
// "/var/user/cable.s1p,None,/var/user/combiner.s3p,none,None,None,None,None,None,None"

// to reset (empty) the S-parameter list at once
// SOURcel:CORRection:FRESponse:RF:USER:SLIST:CLEar

// enable frequency response correction with RF list files
// measure the channel response, save and load the required files
// in the following, we assume that the file tr_channel.fres exists
// and that it is saved in the used directory on the instrument
SOURcel:CORRection:FRESponse:RF:USER:FLIST:STATe 1
SOURcel:CORRection:FRESponse:RF:USER:FLIST1:SElect "/var/user/tr_channel.fres"
SOURcel:CORRection:FRESponse:RF:USER:FLIST1:MAGNitude:STATe 1

```



```

SOURcel:CORRection:FRESponse:RF:USER:FLISt1:PHASe:STATe 1
SOURcel:CORRection:FRESponse:RF:USER:FLISt2:SElect "/var/user/ucor.uco"
SOURcel:CORRection:FRESponse:RF:USER:FLISt:APPLY
SOURcel:CORRection:FRESponse:RF:USER:FLISt:CATalog?
// "tr_channel.fres, ucor.uco"

SOURcel:CORRection:FRESponse:RF:USER:STATe 1
SOURcel:CORRection:FRESponse:RF:USER:ALEvel:VALUe?
// 0.78

SOURcel:CORRection:FRESponse:RF:USER:STORe "/var/user/frc"
SOURcel:CORRection:FRESponse:RF:USER:PRESet
SOURcel:CORRection:FRESponse:RF:USER:LOAD "/var/user/frc"

```

5.2 General commands

| | |
|--|----|
| <code>[SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:MODE</code> | 33 |
| <code>[SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:BANDwidth:MODE</code> | 34 |
| <code>[SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:BANDwidth[:VALUe]</code> | 34 |
| <code>[SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:HOLD[:STATe]</code> | 34 |
| <code>[SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:LOCal</code> | 35 |

`[SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:MODE` <FreqRespOptMode>

Sets the optimization mode.

The value selected here is used also as optimization mode in the I/Q modulator, and vice versa.

For details, see R&S SMW User Manual.

Parameters:

<FreqRespOptMode> FAST | QHIGh | QHTable

FAST

Optimization by compensation for I/Q skew.

QHTable

Enabled if R&S SZU is connected to the R&S SMW and the connection is active.

Improved optimization by maintained speed.

QHIGh

Optimization by compensation for I/Q skew and frequency response correction.

This mode interrupts the RF signal. Do not use it in combination with the uninterrupted level settings and strictly monotone modes RF level modes. These RF level modes can be set with the following command:

```
[SOURce<hw>]:POWER:LBEHaviour
```

*RST: FAST

*RST: QHIGH / QHTable (if R&S SZU connected to R&S SMW and the connection is active)

Example: See [Example "Enabling high-quality optimization"](#) on page 31.

Manual operation: See ["Optimization Mode"](#) on page 17

[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:BANDwidth:MODE
 <FreqRespOptBwMo>

For [:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:MODE QHIGH|QHT, sets how the signal bandwidth is estimated: automatically or manually with the command [:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:BANDwidth[:VALue].

Parameters:

<FreqRespOptBwMo>AUTO | MANual

*RST: AUTO

Example: See [Example "Enabling high-quality optimization"](#) on page 31.

Manual operation: See ["Optimization Bandwidth"](#) on page 18

[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:BANDwidth[:VALue]
 <FreqRespOptBwVa>

Sets the signal compensation bandwidth for [:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:BANDwidth:MODE MAN.

Parameters:

<FreqRespOptBwVa> integer

Range: depends on installed baseband extension option

*RST: = max. bandwidth (depending on installed options)

* e.g. 8E6 to 120E6 (R&S SMW-B10); min value also depends on the system configuration (R&S SMW-B9)

For more information, see data sheet.

Example: See [Example "Enabling high-quality optimization"](#) on page 31.

Manual operation: See ["Bandwidth"](#) on page 18

[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:HOLD[:STATe]
 <FreqRespHoldSta>

For [:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:MODE QHIGH|QHT, retains the last calculated correction values as long as one of the following is performed:

- SOURce1:CORRection:FRESponse:RF:OPTimization:HOLD:STATe 0
- [:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:LOCal

Parameters:

<FreqRespHoldSta> 1 | ON | 0 | OFF
 *RST: 0

Example: See [Example "Enabling high-quality optimization"](#) on page 31.

Manual operation: See ["Hold Filter"](#) on page 18

[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:LOCal

For [:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:MODEQHIG, triggers optimization for the current settings.

Example: See [Example "Enabling high-quality optimization"](#) on page 31.

Usage: Event

Manual operation: See ["Optimize for Current Settings"](#) on page 18

5.3 Common commands

| | |
|--|----|
| [:SOURce<hw>]:CORRection:FRESponse:RF:USER[:STATe]..... | 35 |
| [:SOURce<hw>]:CORRection:FRESponse:RF:USER:STORE..... | 35 |
| [:SOURce<hw>]:CORRection:FRESponse:RF:USER:PRESet..... | 36 |
| [:SOURce<hw>]:CORRection:FRESponse:RF:USER:LOAD..... | 36 |
| [:SOURce<hw>]:CORRection:FRESponse:RF:USER:ALEVel[:STATe]..... | 36 |
| [:SOURce<hw>]:CORRection:FRESponse:RF:USER:ALEVel:VALue?..... | 37 |
| [:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt[:STATe]..... | 37 |
| [:SOURce<hw>]:CORRection:FRESponse:RF:USER:APPLY..... | 37 |

[:SOURce<hw>]:CORRection:FRESponse:RF:USER[:STATe] <FreqRespState>

Enables/disables the frequency response correction.

Parameters:

<FreqRespState> 1 | ON | 0 | OFF
 *RST: 0

Example: See [Example "Activating user-defined frequency response correction"](#) on page 32.

Manual operation: See ["State"](#) on page 19

[:SOURce<hw>]:CORRection:FRESponse:RF:USER:STORE <FreqRespRfSave>

Saves the current settings into the selected file; the file extension (*.freqresp) is assigned automatically.

Parameters:

<FreqRespRfSave> "<filename>"
 Filename or complete file path

Example: See [Example "Activating user-defined frequency response correction"](#) on page 32.

Manual operation: See ["Save/Recall"](#) on page 20

[:SOURce<hw>]:CORRection:FRESponse:RF:USER:PRESet

Sets the option's parameters to their default values (*RST values specified for the commands).

Not affected is the state set with the command [\[:SOURce<hw>\]:CORRection:FRESponse:RF:USER\[:STATe\]](#) on page 35.

Example: See [Example "Activating user-defined frequency response correction"](#) on page 32.

Usage: Event

Manual operation: See ["Set to Default"](#) on page 19

[:SOURce<hw>]:CORRection:FRESponse:RF:USER:LOAD <FreqRespRfRcl>

Loads the selected file from the default or the specified directory. Loaded are files with extension *.freqresp.

Parameters:

<FreqRespRfRcl> "<filename>"
Filename or complete file path; file extension can be omitted

Example: See [Example "Activating user-defined frequency response correction"](#) on page 32.

Manual operation: See ["Save/Recall"](#) on page 20

[:SOURce<hw>]:CORRection:FRESponse:RF:USER:ALEVel[:STATe] <FreqCorrRfAISta>

Activates absolute level compensation at the current center frequency.

Query the level correction value with the command [\[:SOURce<hw>\]:CORRection:FRESponse:RF:USER:ALEVel:VALue?](#) on page 37.

Parameters:

<FreqCorrRfAISta> 1 | ON | 0 | OFF
Absolute level compensation and user correction cannot be activated simultaneously. These functions exclude each other; only one of them can be used at a time.
See also R&S SMWUser Manual, section "User Correction".

*RST: 0

Example: See [Example "Activating user-defined frequency response correction"](#) on page 32.

Manual operation: See ["Compensate Absolute Level"](#) on page 20

[:SOURce<hw>]:CORRection:FRESponse:RF:USER:ALEVel:VALue?

If [:SOURce<hw>]:CORRection:FRESponse:RF:USER:ALEVel[:STATe]1, queries the absolute level correction value.

Return values:

<FreqCorRfAbsLVa> float
 Range: -100 to 100
 Increment: 0.001
 *RST: 0
 Default unit: dB

Example: See [Example "Activating user-defined frequency response correction"](#) on page 32.

Usage: Query only

Manual operation: See "[Absolute Level Correction](#)" on page 20

**[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt[:STATe]
<FreqCorrRfFLSta>**

Enables that user-defined corrections in form of FR lists are used.

To use corrections of this kind, load the FR lists, activated them and apply the configuration with the corresponding commands, see [Chapter 5.5, "Frequency response \(FR\) list commands"](#), on page 40.

Parameters:

<FreqCorrRfFLSta> 1 | ON | 0 | OFF
 *RST: 0

Example: See [Example "Activating user-defined frequency response correction"](#) on page 32.

Manual operation: See "[Additional Frequency Response \(FR\)](#)" on page 20

[:SOURce<hw>]:CORRection:FRESponse:RF:USER:APPLY

Retrieves the values from **all active** S-parameters correction files.

Example: See [Example "Activating user-defined frequency response correction"](#) on page 32.

Usage: Event

Manual operation: See "[Apply](#)" on page 22
 See "[Apply](#)" on page 24

5.4 S-parameter commands

[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt<ch>:SElect..... 38

| | |
|---|----|
| <code>[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt<ch>:PORTs:FROM</code> | 38 |
| <code>[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt<ch>:PORTs:TO</code> | 38 |
| <code>[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt<ch>[:STATe]</code> | 38 |
| <code>[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt:CATalog?</code> | 39 |
| <code>[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt:SIZE?</code> | 39 |
| <code>[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt:CLEar</code> | 39 |
| <code>[:SOURce<hw>]:CORRection:FRESponse:RF:USER:APPLy</code> | 39 |

**`[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt<ch>:SELEct`
<FreqRespRfSlSel>**

Selects an existing S-parameter file (*.s<n>p) from the default directory or from the specific directory.

Parameters:

<FreqRespRfSlSel> string
 Filename incl. file extension or complete file path
 Use "none" to unload a file.

Example: See [Example "Activating user-defined frequency response correction"](#) on page 32.

Manual operation: See ["S-Parameter Filename"](#) on page 22

**`[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt<ch>:PORTs:FROM`
<FreqRespSListFr>**

**`[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt<ch>:PORTs:TO`
<FreqRespSListFr>**

Sets the port number from that the signal is coming and the port to that it is going.

Available ports depend on the file content and file extension, see [Chapter 2.2.1, "S-parameters \(Touchstone\) files"](#), on page 12.

Parameters:

<FreqRespSListFr> integer
 Range: 1 to 8 (dynamic)
 *RST: 2

Example: See [Example "Activating user-defined frequency response correction"](#) on page 32.

Manual operation: See ["Ports to/from"](#) on page 22

**`[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt<ch>[:STATe]`
<FreqRespSLiStat>**

Enables that the selected file is used for frequency response compensation.

To trigger calculation of the correction values, send the command `[:SOURce<hw>]:CORRection:FRESponse:RF:USER:APPLy`. Otherwise changes are not considered.

Parameters:

<FreqRespSLiStat> 1 | ON | 0 | OFF
 *RST: 0

Example: See [Example "Activating user-defined frequency response correction"](#) on page 32.

Manual operation: See ["State"](#) on page 22

[[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLIST:CATalog?

Queries the S-parameter files included in the current S-paramters list.

Return values:

<Catalog> <filename1>,<filename2>,...<filename10>
 Returns a string of filenames separated by commas.

Example: See [Example "Activating user-defined frequency response correction"](#) on page 32.

Usage: Query only

[[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLIST:SIZE?

Queries the number of files in the list.

Return values:

<FreqRespRfsLiSi> integer
 Range: 0 to 10
 *RST: 0

Example: See [Example "Activating user-defined frequency response correction"](#) on page 32.

Usage: Query only

[[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLIST:CLEar

Deletes all entries in the lists.

Example: See [Example "Activating user-defined frequency response correction"](#) on page 32.

Usage: Event

[[:SOURce<hw>]:CORRection:FRESponse:RF:USER:APPLY

Retrieves the values from **all active** S-parameters correction files.

Example: See [Example "Activating user-defined frequency response correction"](#) on page 32.

Usage: Event

Manual operation: See "Apply" on page 22
See "Apply" on page 24

5.5 Frequency response (FR) list commands

| | |
|---|----|
| <code>[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt<ch>:SElect</code> | 40 |
| <code>[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt<ch>:PHASe[:STATe]</code> | 40 |
| <code>[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt<ch>:MAGNitude[:STATe]</code> | 40 |
| <code>[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt:CATalog?</code> | 41 |
| <code>[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt:SIZE?</code> | 41 |
| <code>[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt:CLEar</code> | 41 |

`[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt<ch>:SElect`
<FreqCorrRfFISel>

Selects an existing frequency response list file (*.uco or *.fres) from the default directory or from the specific directory.

Parameters:

<FreqCorrRfFISel> string
Filename incl. file extension or complete file path
Use "none" to unload a file.

Example: See [Example "Activating user-defined frequency response correction"](#) on page 32.

Manual operation: See ["Frequency Response Filename"](#) on page 23

`[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt<ch>:PHASe[:STATe]`
<FreqCorrRfPhSta>

`[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt<ch>:MAGNitude[:`
STATe] <FreqCorrRfMagSt>

Enables that the magnitude and/or phase values from the selected file are used for frequency response compensation.

To trigger calculation of the correction values, send the command `[:SOURce<hw>]:CORRection:FRESponse:RF:USER:APPLY`. Otherwise changes are not considered.

Parameters:

<FreqCorrRfMagSt> 1 | ON | 0 | OFF
*RST: 0

Example: See [Example "Activating user-defined frequency response correction"](#) on page 32.

Manual operation: See ["Magnitude, Phase"](#) on page 24

[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt:CATalog?

Queries the frequency response FR list files included in the current FR list.

Return values:

<Catalog> <filename1>,<filename2>,...<filename5>
Returns a string of filenames separated by commas.

Example: See [Example "Activating user-defined frequency response correction"](#) on page 32.

Usage: Query only

Manual operation: See ["Frequency Response Filename"](#) on page 23

[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt:SIZE?

Queries the number of files in the list.

Return values:

<FreqRespRfFLiSi> integer
Range: 0 to 5
*RST: 0

Example: See [Example "Activating user-defined frequency response correction"](#) on page 32.

Usage: Query only

[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt:CLEar

Deletes all entries in the lists.

Example: See [Example "Activating user-defined frequency response correction"](#) on page 32.

Usage: Event

List of commands

| | |
|---|----|
| [:SOURCE<hw>]:CORRection:FRESponse:RF:OPTimization:BANDwidth:MODE..... | 34 |
| [:SOURCE<hw>]:CORRection:FRESponse:RF:OPTimization:BANDwidth[:VALue]..... | 34 |
| [:SOURCE<hw>]:CORRection:FRESponse:RF:OPTimization:HOLD[:STATe]..... | 34 |
| [:SOURCE<hw>]:CORRection:FRESponse:RF:OPTimization:LOCAl..... | 35 |
| [:SOURCE<hw>]:CORRection:FRESponse:RF:OPTimization:MODE..... | 33 |
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| [:SOURCE<hw>]:CORRection:FRESponse:RF:USER:FLISt[:STATe]..... | 37 |
| [:SOURCE<hw>]:CORRection:FRESponse:RF:USER:FLISt<ch>:MAGNitude[:STATe]..... | 40 |
| [:SOURCE<hw>]:CORRection:FRESponse:RF:USER:FLISt<ch>:PHASe[:STATe]..... | 40 |
| [:SOURCE<hw>]:CORRection:FRESponse:RF:USER:FLISt<ch>:SELEct..... | 40 |
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| [:SOURCE<hw>]:CORRection:FRESponse:RF:USER:PRESet..... | 36 |
| [:SOURCE<hw>]:CORRection:FRESponse:RF:USER:SLISt:CATAlog?..... | 39 |
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| [:SOURCE<hw>]:CORRection:FRESponse:RF:USER:SLISt<ch>:PORTs:FROM..... | 38 |
| [:SOURCE<hw>]:CORRection:FRESponse:RF:USER:SLISt<ch>:PORTs:TO..... | 38 |
| [:SOURCE<hw>]:CORRection:FRESponse:RF:USER:SLISt<ch>:SELEct..... | 38 |
| [:SOURCE<hw>]:CORRection:FRESponse:RF:USER:SLISt<ch>[:STATe]..... | 38 |
| [:SOURCE<hw>]:CORRection:FRESponse:RF:USER:STORe..... | 35 |
| [:SOURCE<hw>]:CORRection:FRESponse:RF:USER[:STATe]..... | 35 |

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