R&S®SMW-K544
User-Defined Frequency Response Correction
User Manual

1178532002
Version 13

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 5.30.175.80 and later of the R&S®SMW200A.

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Throughout this document, R&S® is indicated as R&S.

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1 Welcome to the user-defined FRC 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 SMW200A 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 SMW200A 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 SMW200A, 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 5.30.175.80 and later of the R&S®SMW200A.

Compared to the previous version, it provides the new features listed below:

- New design of the instrument and the GUI

- Editorial changes

1.3 Documentation overview

This section provides an overview of the R&S SMW200A user documentation. Unless specified otherwise, you find the documents at:

www.rohde-schwarz.com/manual/smw200a

1.3.1 Getting started manual

Introduces the R&S SMW200A 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 SMW200A is not included.

The contents of the user manuals are available as help in the R&S SMW200A. 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 SMW200A provides interactive examples and demonstrations on operating the instrument in the 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 SMW200A 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 Specifications and product brochures

The specifications document, also known as the data sheet, contains the technical specifications of the R&S SMW200A. It also lists the firmware applications 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 Calibration certificate

The document is available on https://gloris.rohde-schwarz.com/calcert. You need the device ID of your instrument, which you can find on a label on the rear panel.

1.3.9 Release notes and open source acknowledgment

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

The software uses several valuable open source software packages. An open source acknowledgment document provides verbatim license texts of the used open source software.

www.rohde-schwarz.com/firmware/smw200a

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

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

www.rohde-schwarz.com/application/smw200a

For some application sheets, see also:

www.rohde-schwarz.com/manual/smw200a

1.3.11 Videos

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

On the menu bar, search for your product to find related videos.

Figure 1-1: Product search on YouTube

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 SMW200A 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 multicarrier signals distributed over a large bandwidth

Without any additional option, the R&S SMW200A 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.

Components and system flatness

The signal at the RF output and the analog I/Q outputs of the R&S SMW200A 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 SMW200A 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.

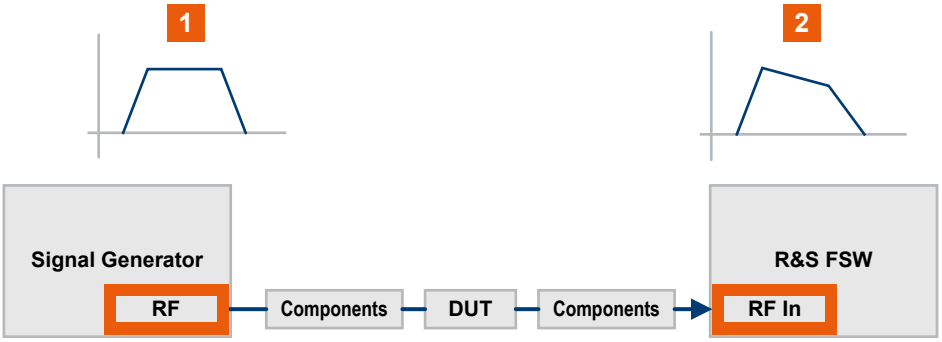


Figure 2-1: Effect of the nonlinear frequency response in the components on the signal flatness

DUT	=	Device under test, whose characteristics are measured
Components	=	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 SMW200A
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 correction

If equipped with the option R&S SMW-K544, you can load scattering parameters (S-parameters) files and frequency response (FR) files to compensate for output signal deviations. These deviations stem from components in the signal chain. see "Components and system flatness" on page 9.

The R&S SMW200A retrieves correction values from these files to pre-process the signal. During pre-processing, the R&S SMW200A compensates signal magnitude variations and signal phase variations for the resulting frequency response.

You can obtain S-parameters files by measuring the components with a vector network analyzer (VNA). If S-parameters files are unavailable, you can also retrieve correction values from FR files. Obtain these files with R&S NRP power sensors or by converting an equalizer file.

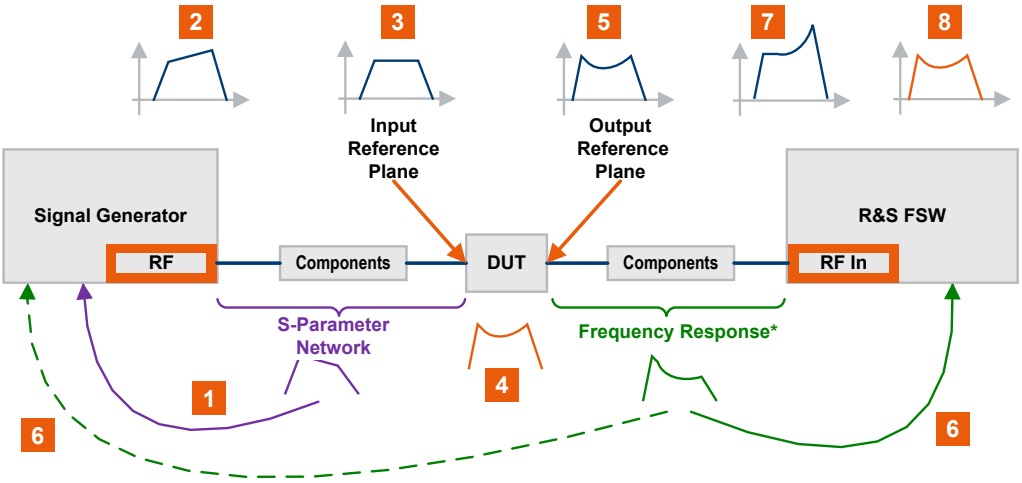


Figure 2-2: Understanding the frequency response correction

DUT	= Device under test
Components	= Devices between the measurement equipment and the DUT, for example cables, power combiners, switches or mixers.
1	= Characterize the transmission chain at the DUT input frequency. Measure all components between the R&S SMW200A and the DUT. In the R&S SMW200A, load and apply the collected S-parameters file.
2	= In the R&S SMW200A, 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 output of the DUT as 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 S-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
*	= FR files or S-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 S-parameters (S-parameters) that characterize the component's frequency response. They compensate the frequency response of the S-parameters network, regarding **magnitude and phase**, while taking reflections into consideration.

FR files with file extension `*.fres` contain magnitude and phase corrections but do not contain reflection corrections. Use user correction files with file extension `*.uco` to compensate the signal magnitude at the center frequency. If you load a frequency response (FR) list that contains several files, these files also compensate the magnitude frequency response over the modulation frequency. User correction files do not contain phase corrections or reflection corrections.

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 with 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 or recall a file that contains the configuration in the dialog	See "Save/Recall" on page 20.

2.2.1 S-parameters (touchstone) files

The R&S SMW200A 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 the touchstone file format in version V1.0.

File extension

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

- `<n>` is an integer value that is equal or higher than 1
- `<n>` is the number of measured ports
- `<n>`^{2} = number of S-parameters that 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.

For the frequency response compensation, the most meaningful S-parameter is *S21*. It characterizes the frequency response of a component. Measure S-parameters with a vector network analyzer, 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**. The top of the file requires this header line that 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 the 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`
  You can replace S_{11} by any S-parameter. The `*.s1p` file format can contain an arbitrary data trace representing an S-parameter. The file lists all values arranged in one line.
- **2-port files (`*.s2p`)**
  `! freq[Hz] re:S11 im:S11 re:S21 im:S21 re:S12 im:S12 re:S22 im:S22`
  The file lists all values arranged in one 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
  ```
  The file lists all 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
  ```
  The file lists all values arranged in m lines, where $m = n^2/4$. The first m-1 data lines contain exactly four value pairs.

The stimulus frequencies are in ascending order. For linear magnitude-phase and magnitude-phase in decibel values (<Data format> = `MA or DB`), the trace data entries are replaced. In particular, the real and imaginary S-parameter values `re:Sij im:Sij` are replaced by `mag:Sij ang:Sij` or `db:Sij ang:Sij`.

Cascading files

If you load several S-parameter files, the R&S SMW200A processes these files in a cascading manner. Each S-parameters file defines the S-parameter origin and the des-

tination ports. You can configure or reverse the orientation of the signal chain. The first entry in the signal chain is the R&S SMW200A, the last entry is the DUT.

2.2.2 Frequency response (FR) files

This description provides information on frequency response (FR) files.

FR file extensions

The R&S SMW200A can extract and apply frequency response and level corrections from the following FR file types:

- `*.uco` files
- `*.fres` files.

These files types contain transmission parameters, in magnitude and phase. The order of the files in the file list is not relevant but the file processing assumes a perfect matching of the single 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 S-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 in spectrum analyzers like, for example, the R&S®FSW. The analyzer uses these filters to compensate for the frequency response of the received signal. You can query the equalizer characteristics or filter tabs with 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 the following:

- Section "User correction" in the R&S SMW200A user manual

3 User-defined FRC configuration and settings

Access:

► In the block diagram of the R&S SMW200A, select "I/Q Mod" > "Frequency Response".

The dialog provides settings to configure the frequency responses.

The remote commands to define these settings are described in Chapter 5, "Remote control commands", on page 30.

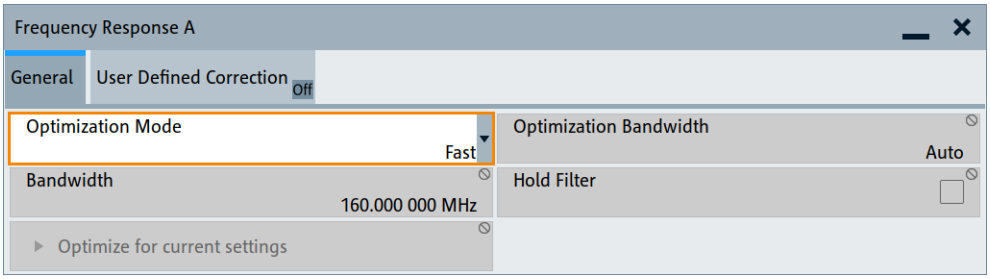
For step-by-step instructions, see Chapter 4, "Applying user-defined FRC", on page 26.

- General settings 16
- User-defined correction settings 18

3.1 General settings

Access:

► Select "I/Q Mod" > "Frequency Response" > "General".



The tab provides general FRC settings.

Settings:

Optimization Mode 16
Optimization Bandwidth 17
Bandwidth 17
Hold Filter 18
Optimize for current setting 18

Optimization Mode
Selects the optimization mode for I/Q modulation.

The selected optimization mode applies for the I/Q modulation performance and for the user-defined frequency response corrections. See also the following:

- Chapter 4, "Applying user-defined FRC", on page 26
- Chapter "Optimizing I/Q modulation performance" in the R&S SMW200A user manual.

For more information, refer to the specifications document.

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

"High Quality" Optimizes I/Q modulation by compensating for I/Q skew and frequency response correction. This mode generates a flat signal over a large bandwidth but requires a longer setting time and leads to signal interruption.

Note:
Do not enable both the I/Q optimization mode "High Quality" and the RF signal level optimization mode "Uninterrupted" or "Strictly Monotone". The high-quality I/Q optimization mode leads to an RF signal interruption which blocks the RF signal level optimization.

"High Quality Table"
Improves the frequency response while maintaining setting time, there is no signal interruption.

Select this mode if your setup requires repeatable settings together with high-quality optimization or if you have wideband baseband input signals. The mode is useful in the following cases:

- To optimize I/Q modulation in setups to generate phase coherent signals.
- To optimize I/Q modulation if you generate upconverted I/Q signals, for example with a connected R&S SZU.

Remote command:
`[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:MODE`
on page 32

Optimization Bandwidth
Requires "Optimization Mode" > "High Quality"/"High Quality Table".

Sets the method to determine the signal bandwidth. The instrument uses this signal bandwidth to compensate for the frequency response.

"Auto" Automatic signal bandwidth setting that is based on the sample rate of the baseband signal.

"Manual" Manual signal bandwidth setting via "Bandwidth". See "Bandwidth" on page 17.

Remote command:
`[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:BANDwidth:MODE` on page 33

Bandwidth
Displays or sets the signal bandwidth to compensate for the frequency response.

Setting requires "Optimization Mode" > "High Quality"/"High Quality Table" and "Optimization Bandwidth" > "Manual".

For "Optimization Bandwidth" > "Auto", displays the automatically derived signal bandwidth.

See "Optimization Bandwidth" on page 17.

Remote command:
`[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:BANDwidth[:VALue]` on page 33

Hold Filter
Requires "Optimization Mode" > "High Quality"/"High Quality Table".

Retains the last calculated correction values as long as one of the following holds:
- Select "Optimize for current setting".
- Select "Hold Filter" > "Off".

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

Optimize for current setting
Requires "Optimization Mode" > "High Quality"/"High Quality Table".

Optimizes correction for the current frequency and bandwidth. Use this function to trigger recalculation of the compensation values for the enabled hold filter ("Hold Filter" > "On").

Remote command:
`[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:LOCal` on page 34

3.2 User-defined correction settings

Access:

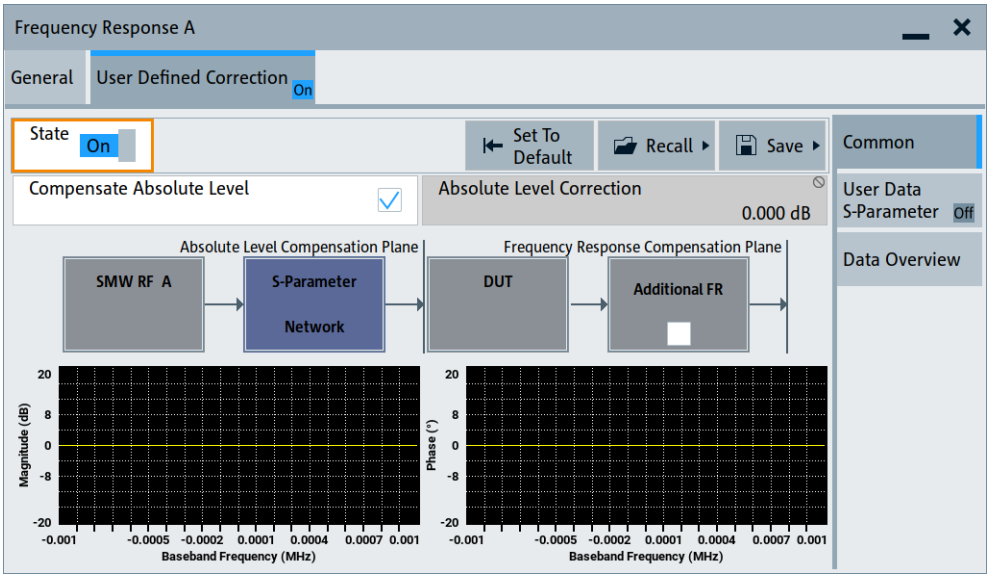
► Select "I/Q Mod" > "Frequency Response" > "User Defined Correction".

- Common settings 19
- User data S-parameter settings 21
- User data additional FR settings 23
- Data overview 24

3.2.1 Common settings

Access:

► Select "User Defined Correction" > "Common".



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

Settings:

State....19
Set To Default....19
Save/Recall....20
Compensate Absolute Level....20
Absolute Level Correction....20
Additional FR....20

State
Enables the user-defined frequency response correction. Enabling requires "Optimization Mode" > "High Quality".

See "Optimization Mode" on page 16.

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 FR	Off

Remote command:
`[:SOURce<hw>]:CORRection:FRESponse:RF:USER:PRESet` on page 35

Save/Recall
Opens 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 a predefined extension. You can define the filename and the directory, in that you want to save the file.

See also section "Saving and recalling settings" in the R&S SMW200A 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 enabled, the 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".

You cannot enable absolute level compensation and user correction simultaneously. These functions exclude each other.

See also section "About user correction" in the R&S SMW200A user manual.

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 36

Additional FR
Enables user-defined corrections. The instrument uses FR files to apply these corrections to compensate for the channel response of the transmission channel.

To apply such corrections, select the "User Data Additional FR" tab, load RF files, enable them and select "Apply". See Chapter 3.2.3, "User data additional FR settings", on page 23.

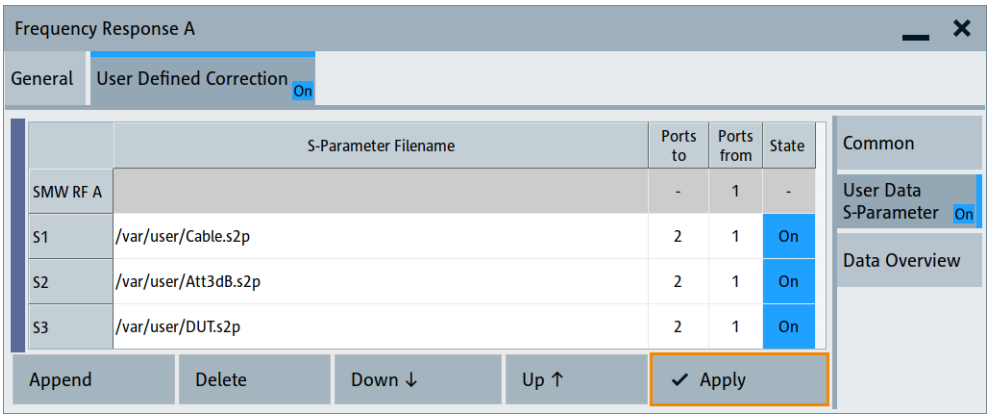
Observe the shift of the compensation plane in the illustration in the dialog.

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 S-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 SMW200A. The frequency response of the related components is compensated.
Also 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 23.

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 22
S-Parameter Filename 22
Ports to/Ports from 22
State 22
Append / Delete/Up/Down 22
Apply 22

S1 to S10
S-parameter file number indicating the loaded files. You can load up to 10 files.

Remote command:
Via `SLISt<ch>` suffix

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 37

Ports to/Ports 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.

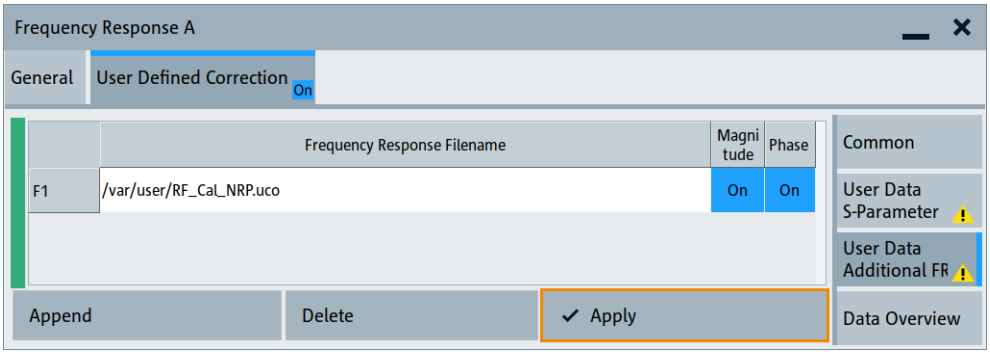
Apply
Applies the values from the active S-parameters files and uses them to pre-process the signal.

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".
2. Select "User Defined Correction" > "Common".
3. Select "Additional FR" > "On".
4. 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.
You can use FR files or S-parameters files. 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 24
Apply 24

F1 to F5
FR file number indicating the loaded files. You can load up to five files.

Remote command:
Via `FLISt<ch>` suffix

Frequency Response Filename
Access the standard "File Select" dialog for loading FR files. FR files are files with predefined 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>:SELect` on page 38
`[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt:CATalog?` on page 39

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 39
`[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt<ch>:PHASe[:STATe]` on page 39

Append/Delete
Standard functions for handling the table rows.

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

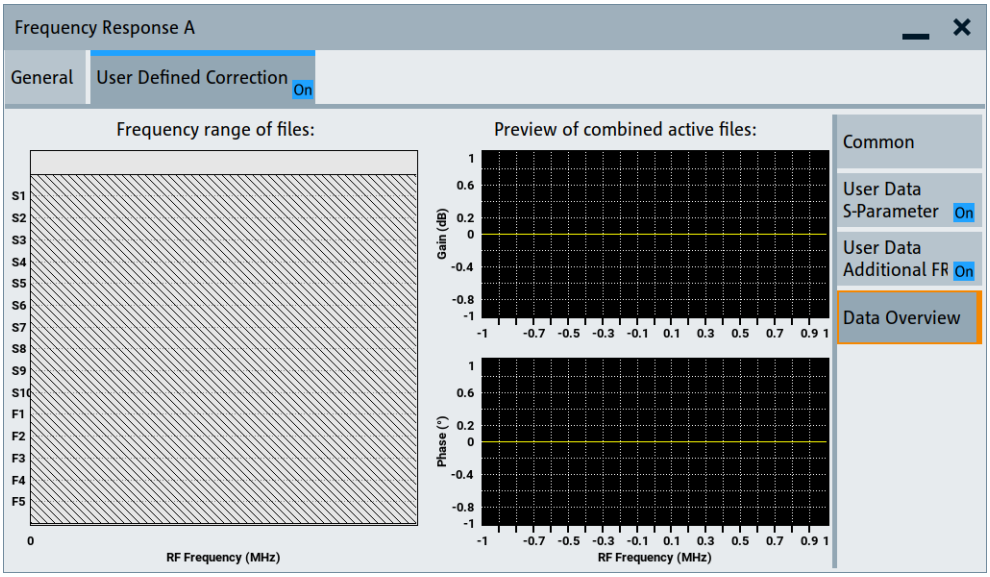
Remote command:
`[:SOURce<hw>]:CORRection:FRESponse:RF:USER:APPLy` on page 37

3.2.4 Data overview

Access:

1. Select "I/Q Mod" > "Frequency Response".

2. Select "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 Applying user-defined FRC

This section describes how to use the R&S SMW-K544 functionality and load S-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 S-parameters files. We also assume that the frequency response files are created.

This section covers the following topics:

- "To generate the baseband and RF signal" on page 26
- "To apply S-parameters file corrections" on page 26
- "To use additional frequency correction data" on page 28

To generate the baseband and RF signal

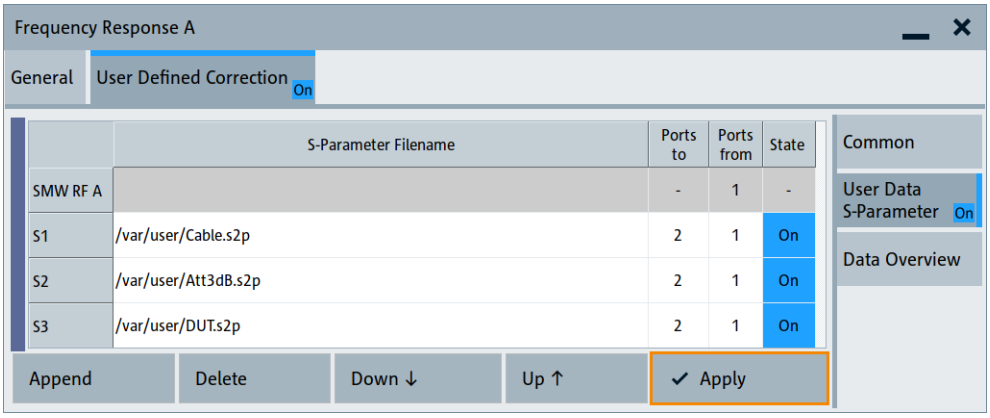
Configure the baseband signal and enable signal generation, for example as follows:

1. In the block diagram, select "Baseband" > "ARB" > "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".

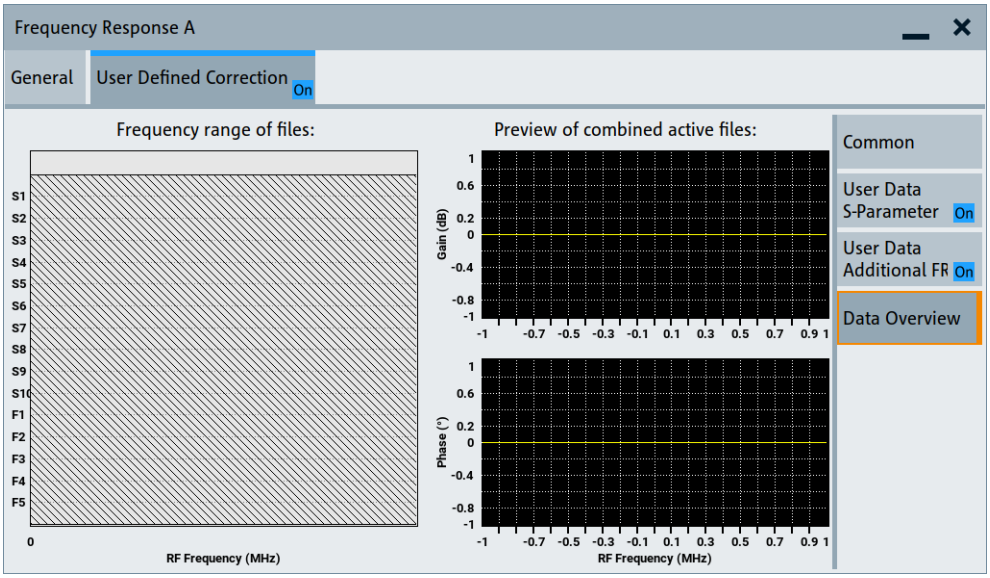
To apply S-parameters file corrections

We assume that you have characterized the components (cable, combiners, DUT), for example with vector network analyzer, and have created the required S-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 SMW200A.
2. Select "I/Q Mod" > "Frequency Response".
3. Select "General" > "Optimization Mode" > "High Quality".
4. Select "User Defined Correction" > "User Data S-parameter".
   a) In the S-parameter table, select "S1" > "S-Paramater Filename".
   b) Navigate to the S-parameter file.
5. If you use several files, select "Append".
6. Load these files in the same manner.
7. For each of the files, select "State" > "On".
8. Select "Apply".

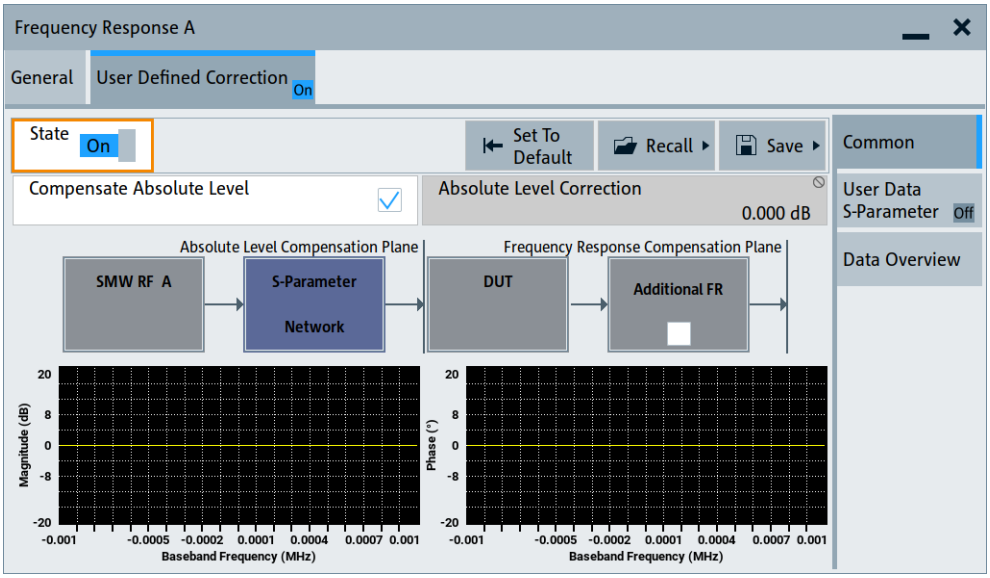


9. Select "User Defined Correction" > "Data Overview" to observe the frequency range covered by the loaded files.



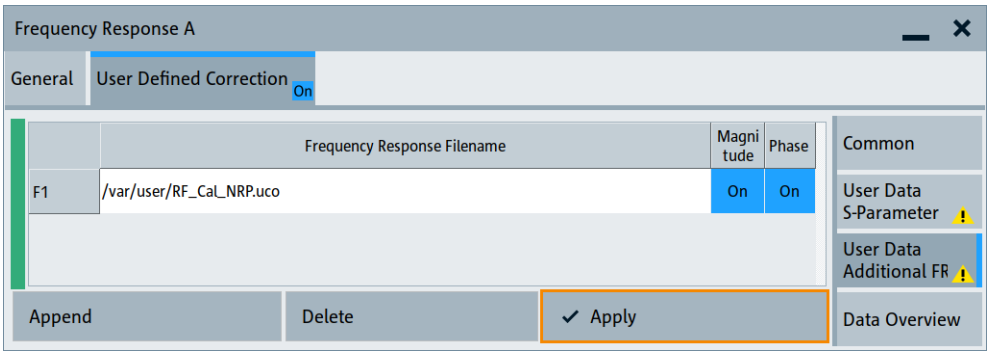
The dialog also shows an overview of the aggregated correction data of all active files.

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

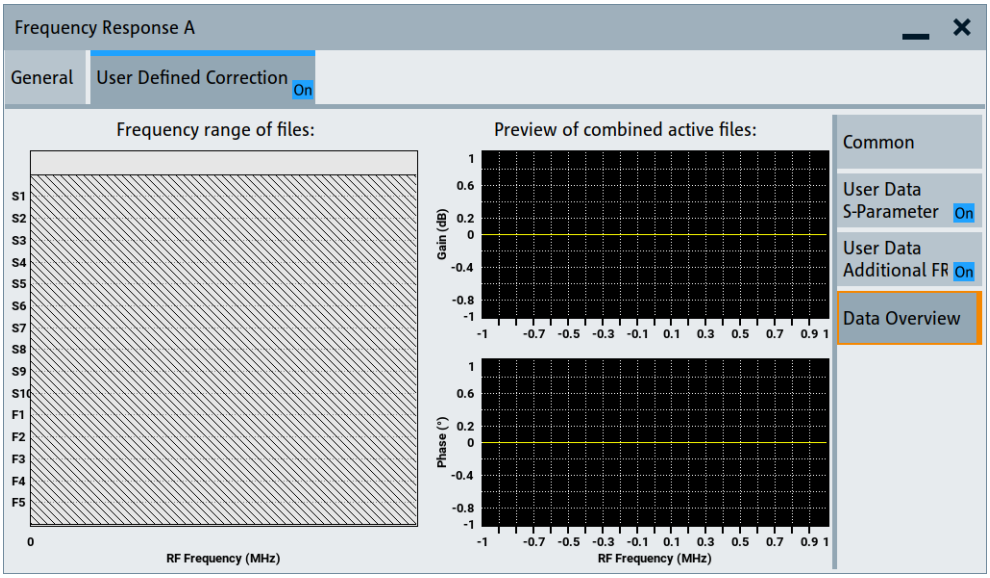


To use additional frequency correction data

1. Select "User Defined Correction" > "Common" > "Additional FR" > "On".
2. Select "User Defined Correction" > "User Data Additional FR":
   a) In the frequency response table, select "F1" > "Frequency Response Filename".
   b) Navigate to the `*.uco` file.
3. If you use several files, select "Append".
4. Load the files in the same manner.
5. For each of the files, select "Magnitude" > "On" and "Phase" > "On".
6. Select "Apply".



7. Select "User 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 SMW200A has already been set up for remote operation in a network as described in the R&S SMW200A 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 SMW200A user manual.

Common suffixes

The remote commands use the following common suffixes:

Suffix	Value range	Description
`SOURce<hw>`	[1] to 4	Available baseband signals Only `SOURce1` possible if the keyword `ENTity` is used.
`SLISt<hw>`	1 to 10	S-parameter list file number. You can load up to 10 files.
`FLISt<hw>`	1 to 5	Frequency response (FR) list file number. You can load up to five files.

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

- Programming examples 30
- General commands 32
- Common commands 35
- S-parameter commands 37
- Frequency response (FR) list commands 38

5.1 Programming examples

Example: To configure a baseband test signal

```
// Create a test signal, for example an unsymmetrical multicarrier signal.
:SOURce1:BB:MCCW:CARRier:COUNt 200
:SOURce1:BB:MCCW:CARRier:SPACing 500000
:SOURce1:BB:MCCW:EDIT:CARRier:STARt 100
:SOURce1:BB:MCCW:EDIT:CARRier:STOP 199
:SOURce1:BB:MCCW:EDIT:CARRier:STATe 0
:SOURce1:BB:MCCW:EDIT:CARRier:EXECute
:SOURce1:BB:MCCW:STATe 1
```

```
// Output the modulate multicarrier signal.
:OUTPut1:STATe 1
:SOURce1:FREQuency:CW 2143000000
:SOURce1:POWer:POWer -20
```

Example: To enable high-quality table I/Q modualtion optimizations

```
:SOURce1:CORRection:FRESponse:RF:OPTimization:MODE QHT
:SOURce1:CORRection:FRESponse:RF:OPTimization:BANDwidth:MODE AUTO
:SOURce1:CORRection:FRESponse:RF:OPTimization:BANDwidth:VALue?
// Response in Hz: 160000000
// Optimization bandwidth is 160 MHz.
:SOURce1:CORRection:FRESponse:RF:OPTimization:LOCal
:SOURce1:CORRection:FRESponse:RF:OPTimization:HOLD:STATe 1
```

Example: To apply user-defined FRC

This example illustrates frequency response corrections from S-parameter files `*.s<n>p`. We assume that the S-parameter files `cable.s1p` and `combiner.s3p` are available in the user directory `/var/user/` of the instrument. These files contain corrections for a cable and a combiner as typical components of a test setup.

```
// Enable absolute level compensation.
:SOURce1:CORRection:FRESponse:RF:USER:ALEVel:STATe 1
// Load S-parameter files that contain the user-defined corrections.
:SOURce1:CORRection:FRESponse:RF:USER:SLISt:CATalog?
// Response: "None,None,None,None,None,None,None,None,None,None"
// The S-parameter list has no files. You can load up to ten files.
// Select available S-parameter files.
:SOURce1:CORRection:FRESponse:RF:USER:SLISt1:SELect "/var/user/cable.s1p"
// The *.s1p file contains a single-port measurement.
:SOURce1:CORRection:FRESponse:RF:USER:SLISt1:PORTs:FROM 1
:SOURce1:CORRection:FRESponse:RF:USER:SLISt1:PORTs:TO 1
:SOURce1:CORRection:FRESponse:RF:USER:SLISt1:STATe 1
// You can also skip rows, for example skip the second row.
:SOURce1:CORRection:FRESponse:RF:USER:SLISt3:SELect "/var/user/combiner.s3p"
:SOURce1:CORRection:FRESponse:RF:USER:SLISt3:STATe 1
:SOURce1:CORRection:FRESponse:RF:USER:SLISt:CATalog?
// Response: "None,None,None,None,None,None,None,None,None,None"
// If you do not apply changes to the S-parameter list, the list remains empty.
:SOURce1:CORRection:FRESponse:RF:USER:APPLy
:SOURce1:CORRection:FRESponse:RF:USER:SLISt:SIZE?
// Response: "2"
:SOURce1:CORRection:FRESponse:RF:USER:SLISt:CATalog?
// Response: "/var/user/cable.s1p,None,/var/user/combiner.s3p,..."

// Optionally, exclude S-parameter files from the configuration.
// Disable a file in the list.
:SOURce1:CORRection:FRESponse:RF:USER:SLISt4:STATe 0
// Or, unselect the file.
:SOURce1:CORRection:FRESponse:RF:USER:SLISt4:SELect "None"
// Apply the changes.
```

```
:SOURce1:CORRection:FRESponse:RF:USER:APPLy
:SOURce1:CORRection:FRESponse:RF:USER:SLISt:CATalog?
// "/var/user/cable.s1p,None,/var/user/combiner.s3p,None,None,None,None,None,
// None,None"
// Optionally, clear the whole S-parameter list to empty the list.
:SOURce1:CORRection:FRESponse:RF:USER:SLISt:CLEar

// Apply FRC with RF list files with file extensions *.fres or *.uco. For RF
// list files, measure the channel response, save and load the required files.
// The following example assumes that the files tr_channel.fres and ucor.uco
// are available in the user directory of the instrument.
:SOURce1:CORRection:FRESponse:RF:USER:FLISt:STATe 1
:SOURce1:CORRection:FRESponse:RF:USER:FLISt1:SELect "/var/user/tr_channel.fres"
:SOURce1:CORRection:FRESponse:RF:USER:FLISt1:MAGNitude:STATe 1
:SOURce1:CORRection:FRESponse:RF:USER:FLISt1:PHASe:STATe 1
:SOURce1:CORRection:FRESponse:RF:USER:FLISt2:SELect "/var/user/ucor.uco"
:SOURce1:CORRection:FRESponse:RF:USER:FLISt:APPLy
:SOURce1:CORRection:FRESponse:RF:USER:FLISt:CATalog?
// Response: "tr_channel.fres, ucor.uco"
:SOURce1:CORRection:FRESponse:RF:USER:STATe 1
:SOURce1:CORRection:FRESponse:RF:USER:ALEVel:VALUe?
// Response: "0.78"
:SOURce1:CORRection:FRESponse:RF:USER:STORe "/var/user/frc"
:SOURce1:CORRection:FRESponse:RF:USER:PRESet
:SOURce1:CORRection:FRESponse:RF:USER:LOAD "/var/user/frc"
```

5.2 General commands

[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:MODE 32
[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:BANDwidth:MODE 33
[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:BANDwidth[:VALue] 33
[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:HOLD[:STATe] 34
[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:LOCal 34

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

Sets the optimization mode for frequency response correction.

This optimization mode also uses the I/Q modulator and vice versa via the command:

`SOURce<hw>:BB:IMPairment:OPTimization:MODE`

For details, see R&S SMW200A User Manual.

Parameters:
<FreqRespOptMode> FAST | QHIGh | QHTable

FAST
Optimization by compensation for I/Q skew.

QHTable
Requires an active connection between an R&S SZU and the R&S SMW200A.
Improves optimization while maintaining the modulation 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 or QHTable with an R&S SZU connected, see above.

Example: See Example "To enable high-quality table I/Q modualtion optimizations" on page 31.

Manual operation: See "Optimization Mode" on page 16

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

For high-quality I/Q modulation optimizations, sets the mode to set the signal bandwidth

To enable these optimizations, see the following command:

`[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:MODE` on page 32

Parameters:
<FreqRespOptBwMo>AUTO | MANual

AUTO
Automatic bandwidth settings

MANual
Manual bandwidth setting via the following command:
`[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:BANDwidth[:VALue]` on page 33

*RST: AUTO

Example: See Example "To enable high-quality table I/Q modualtion optimizations" on page 31.

Manual operation: See "Optimization Bandwidth" on page 17

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

Sets the signal compensation for manual bandwidth mode.

See [:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:BANDwidth:MODE on page 33.

For more information, refer to the specifications document.

Parameters:
<FreqRespOptBwVa> integer

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

Example: See Example "To enable high-quality table I/Q modualtion optimizations" on page 31.

Manual operation: See "Bandwidth" on page 17

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

For high-quality I/Q modulation optimizations, retains the last calculated correction values as long as one of the following holds:

- SOURce1:CORRection:FRESponse:RF:OPTimization:HOLD:STATe 0
- SOURce1:CORRection:FRESponse:RF:OPTimization:LOCal

To enable these optimizations, see the following command:

[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:MODE on page 32

Parameters:
<FreqRespHoldSta> 1 | ON | 0 | OFF

*RST: 0

Example: See Example "To enable high-quality table I/Q modualtion optimizations" on page 31.

Manual operation: See "Hold Filter" on page 18

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

For high-quality I/Q modulation optimizations, triggers optimization for the current settings.

To enable these optimizations, see the following command:

[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:MODE on page 32

Example: See Example "To enable high-quality table I/Q modualtion optimizations" on page 31.

Usage: Event

Manual operation: See "Optimize for current setting" 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 35
[: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? 36
[: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 the frequency response correction.

Parameters:

<FreqRespState> 1 | ON | 0 | OFF

*RST: 0

Example: See Example "To apply user-defined FRC" on page 31.

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 "To apply user-defined FRC" on page 31.

Manual operation: See "Save/Recall" on page 20

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

Sets the 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 "To apply user-defined FRC" on page 31.

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 "To apply user-defined FRC" on page 31.

Manual operation: See "Save/Recall" on page 20

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

Enables absolute level compensation at the current center frequency.

Query the level correction value with the following command:

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

You cannot enable absolute level compensation and user correction simultaneously. These functions exclude each other.

See also section "About user correction" in the R&S SMW200A user manual.

Parameters:

<FreqCorrRfAlSta> 1 | ON | 0 | OFF

*RST: 0

Example: See Example "To apply user-defined FRC" on page 31.

Manual operation: See "Compensate Absolute Level" on page 20

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

Queries the absolute level correction value. Querying real values requires enabled absolute level compensation:

`SOURce1:CORRection:FRESponse:RF:USER:ALEVel:STATe 1`

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

Return values:

<FreqCorRfAbsLVa> float

Range: -100 to 100
Increment: 0.001
*RST: 0
Default unit: dB

Example: See Example "To apply user-defined FRC" on page 31.

Usage: Query only

Manual operation: See "Absolute Level Correction" on page 20

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

Uses FR list files for user-defined corrections.

Load the FR lists, enable them and apply the configuration with the corresponding FR list commands.

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

Example: See Example "To apply user-defined FRC" on page 31.

Manual operation: See "Additional FR" on page 20

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

Applies the values from all enabled S-parameters correction files.

Example: See Example "To apply user-defined FRC" on page 31.

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....37
[: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>[:STATe]....38
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt:CATalog?....38
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt:SIZE?....38
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt:CLEar....38
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:APPLy....38

[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt<ch>:SELect
<FreqRespRfSlsel>

Selects an existing S-parameter file with file extension `*.s<n>p` from the default directory or from a specific directory.

Parameters:
<FreqRespRfSlsel> string
Filename incl. file extension or complete file path
Use `"none"` to unload a file.

Example: See Example "To apply user-defined FRC" on page 31.

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>
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt<ch>[:STATe]
<FreqRespSLiStat>
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt:CATalog?
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt:SIZE?
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt:CLEar
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:APPLy

Applies the values from all enabled S-parameters correction files.

Example: See Example "To apply user-defined FRC" on page 31.

Usage: Event

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

5.5 Frequency response (FR) list commands

[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt<ch>:SELect 38
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt<ch>:PHASe[:STATe] 39
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt<ch>:MAGNitude[:STATe] 39
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt:CATalog? 39
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt:SIZE? 39
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt:CLEar 39

[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt<ch>:SELect
<FreqCorrRfFlSel>

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

Parameters:

<FreqCorrRfFlSel> string

Filename incl. file extension or complete file path
Use `"none"` to unload a file.

Example: See Example "To apply user-defined FRC" on page 31.

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

Deletes all entries in the list.

Example: See Example "To apply user-defined FRC" on page 31.

Usage: Event

List of commands

[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:BANDwidth:MODE....33
[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:BANDwidth[:VALue]....33
[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:HOLD[:STATe]....34
[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:LOCal....34
[:SOURce<hw>]:CORRection:FRESponse:RF:OPTimization:MODE....32
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:ALEVel:VALue?....36
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:ALEVel[:STATe]....36
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:APPLy....37
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:APPLy....38
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt:CATalog?....39
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt:CLEar....39
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt:SIZE?....39
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt[:STATe]....37
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt<ch>:MAGNitude[:STATe]....39
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt<ch>:PHASe[:STATe]....39
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:FLISt<ch>:SELect....38
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:LOAD....36
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[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt:CATalog?....38
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt:CLEar....38
[:SOURce<hw>]:CORRection:FRESponse:RF:USER:SLISt:SIZE?....38
[: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....37
[: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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