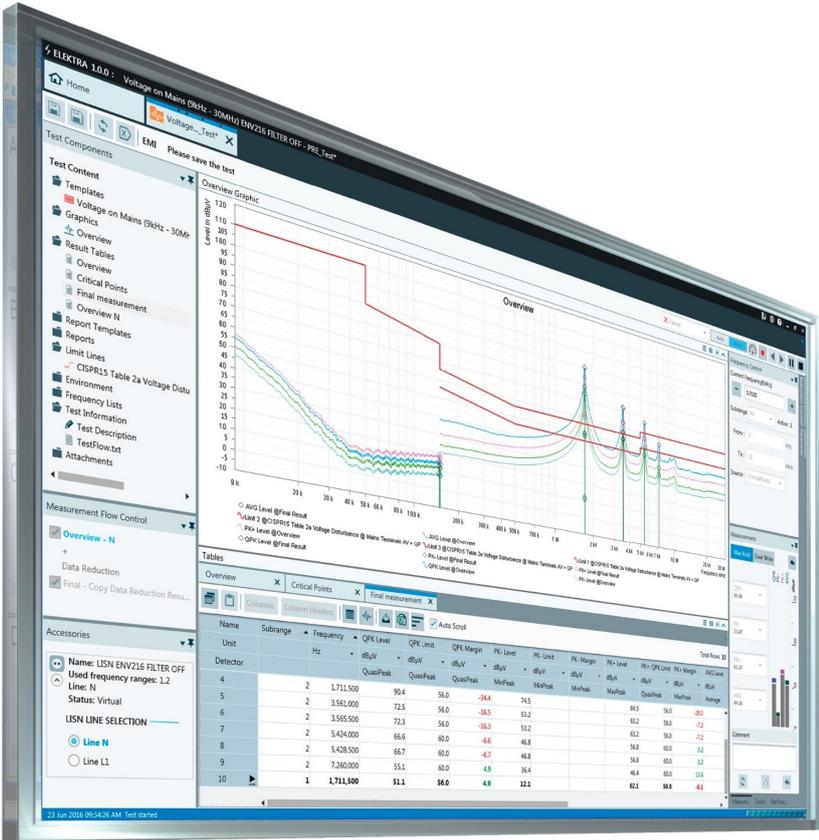


R&S®ELEKTRA

EMI Test Software

User Manual



1178396302
Version 20

ROHDE & SCHWARZ
Make ideas real



This user manual describes the R&S®ELEKTRA EMI Test Software, order no. 5601.0030.02, for electromagnetic interference (EMI) tests, software version **V5.03** and later

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1178.3963.02 | Version 20 | R&S®ELEKTRA

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

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1 Welcome

R&S ELEKTRA is the Rohde & Schwarz system software for electromagnetic interference measurements (**EMI** or "*emission*" tests).

This chapter introduces key features of the EMI Test Software, refers to the applicable test standards and provides an overview of the available documentation.

- [Key features](#)..... 9
- [EMI standards](#)..... 10
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1.1 Key features

R&S ELEKTRA is optimized for 64-bit Microsoft Windows operating systems, especially Windows 10 or later versions.

It is designed to act as a virtual instrument.

The software combines the convenience of an intuitive graphical user interface with maximum flexibility. It includes touchscreen and remote operation, both for controlling test instrumentation and for running EMI tests.

R&S ELEKTRA provides high measurement speeds by using multi-threading technology. Enhanced data transfer with next generation EMI receivers enables handling the extended data volume of those receivers.

Among others, R&S ELEKTRA provides the following key features:

- Graphical user interface (GUI) with optional [Touch operation](#)
- Template-based test preparation, measurement and report generation
- Storage of test results
- Simple selection of test templates, tables and devices, supported by an advanced search functionality
- Remote access to devices via VISA interface using LAN or GPIB
- Dynamic application extensions and device drivers
- Automated device search dialog
- Compatible with international harmonized EMI standards, guidelines & directives
- Enhanced usability for beginners and customer-specific solutions



Screenshots

Sample screenshots in this documentation are used to illustrate as much as possible of the functions provided by R&S ELEKTRA and of potential interdependencies between parameters. Note that:

- Values in these screenshots do **not** necessarily represent realistic test situations.
- The values must not at all be considered as recommended by Rohde & Schwarz.
- The screenshots shown can differ, depending on your particular equipment and configuration.

1.2 EMI standards

R&S ELEKTRA enables measuring electromagnetic interference in compliance with all relevant EMI standards worldwide. For the currently supported standards, refer to the specifications.

It is not within the scope of this manual to reproduce those standards. Instead, obtain original information on the various standards, directives, rules, regulations, proceedings and associated publications, for example at the following websites:

- [CISPR / IEC / ISO](#) (international)
- [EN / CENELEC / ETSI](#) (Europe), [FCC / CFR](#) (USA), [CCC](#) (China), ...
- [MIL-STD / EDSTAR / VG](#) (search title "EMV") / [DEF STAN / GAM](#) (military)
- [RTCA](#) (aviation / airborne), [BSI](#) (wind turbines), [DIN](#) (special interest), ...

Among the standards listed above, CISPR (or the equivalent EN standards in Europe, see [Table 1-1](#)) are especially relevant for commercial applications. The US standard MIL-STD-461 is pivotal for military and aerospace applications (see [Table 1-2](#)).

Table 1-1: Overview of CISPR / EN standards for test applications

Publication	Description
CISPR 10	CISPR organization, rules and procedures
CISPR 11, EN 55011	Industrial, scientific and medical (ISM) equipment containing a radio-frequency generator: <i>Emission</i>
CISPR 12, EN 55012	Vehicles, motor boats and internal combustion engines: <i>Emission</i> - protection of off -board receivers
CISPR 13, EN 55013	Sound / television broadcast receivers and associated equipment: <i>Emission</i> (see CISPR 32)
CISPR 14-1, EN 55014-1	Household appliances, portable electrical tools and similar apparatus, part 1: <i>Emission</i>
CISPR 14-2, EN 55014-2	Household appliances, portable electrical tools and similar apparatus, part 2: <i>Immunity</i>
CISPR 15, EN 55015	Electrical lighting and similar equipment, for example fluorescent lamps: <i>Emission</i>
CISPR 16-1, EN 55016-1	<i>Specification</i> for EMI/EMS measurement apparatus and methods, part 1: <i>Apparatus</i>

Publication	Description
CISPR 16-2, EN 55016-2	<i>Specification</i> for EMI/EMS measurement apparatus and methods, part 2: <i>Methods</i>
CISPR 16-3, EN 55016-3	<i>Specification</i> for EMI/EMS measurement apparatus and methods, part 3: <i>Reports</i>
CISPR 16-4, EN 55016-4	<i>Specification</i> for EMI/EMS measurement apparatus and methods, part 4: <i>Uncertainties</i>
CISPR 17, EN 55017	Measurement methods for the characteristics of suppression components, for example passive radio interference filters
CISPR 18, EN 55018	Overhead power lines and high-voltage equipment: <i>Emission</i>
CISPR 20, EN 55020	Sound / television broadcast receivers and associated equipment: <i>Immunity</i>
CISPR 22, EN 55022	Information technology equipment (ITE): <i>Emission</i> (see CISPR 32)
CISPR 24, EN 55024	Information technology equipment (ITE): <i>Immunity</i>
CISPR 25, EN 55025	Vehicles, motor boats and internal combustion engines: <i>Emission</i> - protection of on -board receivers
CISPR 28	Industrial, scientific and medical (ISM) equipment containing a radio-frequency generator: <i>Emission within ITU bands</i>
CISPR 29	Electronic control gear for fluorescent lamps and discharge lamps
CISPR 32, EN 55032	Multimedia equipment: <i>Emission</i> (replaced CISPR 13, CISPR 22 and EN 55103-1 on 5 March 2017, transition period ended 5 May 2018)
CISPR 35, EN 55035	Multimedia equipment: <i>Immunity</i> (published in August 2016, replacing CISPR 20 and CISPR 24, transition period until 2021)
CISPR 36, EN 55036	Electric and hybrid electric road vehicles: <i>Emission</i> - protection of off -board receivers below 30 MHz

Detailed [guidance](#) for users of the [CISPR standards](#) can be found on the internet.

In contrast with civilian applications, testing to MIL-STD-461 is more expensive due to wider frequency ranges, higher EMS power levels, lower limits and the required higher sensitivity. It is typically also used for aerospace applications.

The following table shows an excerpt of MIL-STD-461 regarding EMI (emission) tests.

Table 1-2: Overview of MIL-STD-461

Test type	Requirement	Description
Conducted emission	CE101	Power leads, 30 Hz to 10 kHz
	CE102	Power leads, 10 kHz to 10 MHz
	CE106	Antenna terminal, 10 kHz to 40 GHz
Radiated emission	RE101	Magnetic field, 30 Hz to 100 kHz

Test type	Requirement	Description
	RE102	Electric field, 10 kHz to 18 GHz
	RE103	Antenna spurious and harmonic outputs, 10 kHz to 40 GHz

The requirements (CE101 through RE103) specified in [Table 1-2](#) are assigned to the various areas of application as shown in [Table 1-3](#).

Table 1-3: Application areas of MIL-STD-461 requirements

Equipment installed in, on, or launched from the following platforms	Requirement applicability					
	CE			RE		
	101	102	106	101	102	103
Surface ships	A	A	L	A	A	L
Submarines	A	A	L	A	A	L
Aircraft, army & flight line	A	A	L	A	A	L
Aircraft, navy	L	A	L	L	A	L
Aircraft, air force		A	L		A	L
Space systems & launch vehicles		A	L		A	L
Ground, army		A	L		A	L
Ground, navy		A	L		A	L
Ground, air force		A	L		A	L

A = Applicable, **L** = Limited as specified in the individual sections of this standard, **S** = Procuring activity must be specified in procurement documentation

Table 1-4: History of MIL-STD-461 revisions

Publication	Year issued	Description
MIL-STD-461C	1986	Specific description of measurements and limits, as well as measurement equipment and methods. Note that using the most recent revision of MIL-STD-461 is not necessarily mandatory. The applicable revision is typically agreed upon in a commercial contract between producer and procuring authority.
MIL-STD-461D	1993	
MIL-STD-461E	1999	
MIL-STD-461F	2007	
MIL-STD-461G	2015	

The former MIL-STD-462D (measurement equipment and methods, issued 1993) was canceled in 1999. From then on, MIL-STD-461 is referenced, as specified above.

Besides MIL-STD-461, other US military standards exist that can be relevant for special applications, such as MIL-STD-449D, -464, -469A, -1310G, -1512, -1541A, -1542B, -1605, -1795A and -1857.

1.3 Documentation overview

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

www.rohde-schwarz.com/product/elektra

This website provides the following:

- Rohde & Schwarz contacts for information, quotes and demos
- Key facts, features and options of the software
- An overview of available software options
- [Specifications and brochures](#)
- The software's [user manuals](#)
- The current [Software](#) version, the [Release Notes and OSA](#)
- [Documents & Articles](#) like application sheets, tips and tricks
- [Video tutorials](#) and training videos
- Related products

1.3.1 User manuals and help

The user documentation is available as manuals (online format `HTML` or download format `PDF`) and as context-sensitive help in `CHM` format, embedded in the software. These documents provide explanations, step-by-step procedures, figures and examples to support you during your first experience with the software, from installation and configuration to the various EMI measurements.

Several versions of the user documentation are available:

- A *basic version* for software features with the "ELEMI-E" license, alone
 - User manual, available at www.rohde-schwarz.com/manual/elektra-emc
 - Embedded help, available in the software via the [F1] key
- A *main version* for software features with all available [licenses](#), except the "ELEMI-T" license
 - User manual, available at www.rohde-schwarz.com/manual/elektra-emc
 - Embedded help, available in the software via the [F1] key

The R&S ELEKTRA installer also saves the manuals in `PDF` format on your computer in the following directory:

```
C:\Program Files\Rohde-Schwarz\ELEKTRA\x.xx\Documentation
```

1.3.2 Specifications and brochures

The specifications document, also called data sheet, contains the technical specifications of the software. The brochure provides an overview of the software and deals with its specific characteristics.

See www.rohde-schwarz.com/brochure-datasheet/elektra-emc

1.3.3 Release notes and open-source acknowledgment (OSA)

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

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

See www.rohde-schwarz.com/software/elektra-emc

The R&S ELEKTRA installer saves the release notes, the open source acknowledgment and some application notes also in the following directory on your computer:

```
C:\Program Files\Rohde-Schwarz\ELEKTRA\x.xx\Documentation
```

1.3.4 Application notes, white papers, etc.

These documents deal with special applications or background information on particular topics. The documents & articles with application sheets, tips and tricks for the software are available at:

www.rohde-schwarz.com/appnote (search for *elektra*)

www.rohde-schwarz.com/search/applications_63466.html?term=elektra

1.3.5 Video tutorials

Video tutorials and a series of training videos offer guided examples and demonstrations on using the software.

www.rohde-schwarz.com/product/elektra > R&S ELEKTRA Training Video Series

2 Software installation

This chapter contains information on how to install R&S ELEKTRA, downloaded from www.rohde-schwarz.com/software/elektra. The installation of several different versions of R&S ELEKTRA on one local computer is possible.

Existing data sets of other software packages are not affected by R&S ELEKTRA. If any version of R&S ES-SCAN has previously been installed, it is not required to uninstall it before installing R&S ELEKTRA.

When the [System requirements](#) are provided, R&S ELEKTRA can be installed: Follow the procedure described in [Chapter 2.2, "Software installation procedure"](#), on page 16. A wizard in the setup file ELEKTRASetup_Vx.xx.exe guides the installation.

• System requirements	15
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• Language selection	26
• Migration Tool - XML data converter	26
• Network firewall settings	30
• Modify, repair or remove installation	30

2.1 System requirements

Before installing R&S ELEKTRA, make sure that the computer meets the following minimum system requirements:

- Microsoft-Windows-based PC with Intel Core i5 processor
or
Laptop / [tablet PC](#) with Intel Core i7 processor
- Clock rate: at least 2 GHz (recommended)
- Memory: >8 GByte RAM recommended
- Storage: 250 GByte hard drive, solid-state disk (SSD) recommended
Free storage: >50 GByte free drive space recommended
- Operating system (64 bit): Windows 10
- Administrator access rights (only for software installation)
- Super VGA monitor, display resolution at least 1280 x 720 pixels, 65536 colors
- USB 2.0 interface
- 100 Mbit LAN interface

If your computer does not meet these requirements, the performance of the software can be impaired.



R&S VISA for control of local area networks (LAN) is included in the installation, but you can use any VISA version already available on your computer (optionally supporting GPIB, too).



If you install the software on a tablet computer and you need more USB ports than it provides, you can connect an external USB hub that offers more USB ports.

For connecting your tablet computer to the Ethernet, consider using a wireless LAN connection (Wi-Fi).

2.2 Software installation procedure

To install the software on a local computer or in a network

1. Terminate other active programs (recommended).
If any **other instances of R&S ELEKTRA** are active, be sure to **terminate** them.
2. In your browser, navigate to www.rohde-schwarz.com/software/elektra.
3. Download the R&S ELEKTRA setup file.
4. Navigate to your download directory.
5. Right-click `ELEKTRASetup_Vx.xx.exe`
6. Select "Run as administrator".

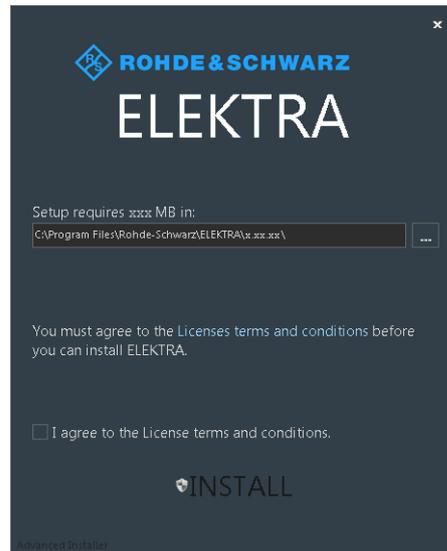
Tip: Depending on your user-rights configuration, consider executing this whole procedure after signing into your Windows account with administrator rights, to avoid conflicts of access rights during installation. If unsure how to proceed, or if conflicts of access rights occur during installation, ask your system administrator for support.

7. Wait for the R&S ELEKTRA installation wizard to launch.
8. The wizard automatically checks the installation prerequisites:
 - Microsoft .NET Framework
 - Visual C++ 2010 SP1 Redistributable x64
 - Visual C++ 2012 Redistributable x64
 - Visual C++ 2019 Redistributable x64
 - Firebird Server 3.0 (64-bit)
 - R&S License Server
 - R&S Smart Card Minidriver
 - R&S VISA
 - VISA Shared Components

If any of these programs in the required versions are missing on the computer, the wizard installs them in a background process.

Depending on the installation environment, the wizard can bring up additional messages. In this case, proceed as indicated.

9. The installation wizard brings up the following dialog:

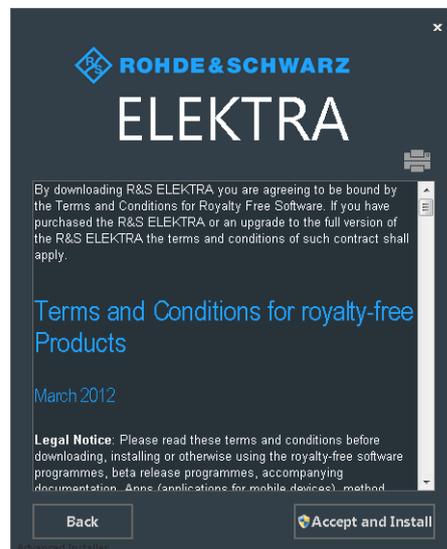


To continue the installation, the software expects you to agree to the license terms and conditions.

If you know the content and agree with it, activate the checkbox, click "INSTALL" and proceed with [step 12](#).

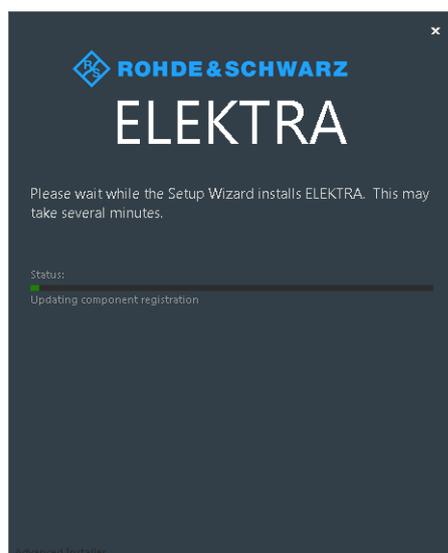
10. Otherwise click the link for "Licenses terms and conditions" to read them.

The following "End User License Agreement" (EULA) comes up:



If you wish to print the license text, click the printer icon on top of the text.

11. To continue the installation, select "Accept and Install".
12. Wait while the wizard executes the installation of R&S ELEKTRA:



13. If the wizard finds one or more **previous** installations of R&S ELEKTRA, it prompts you with the following dialog:

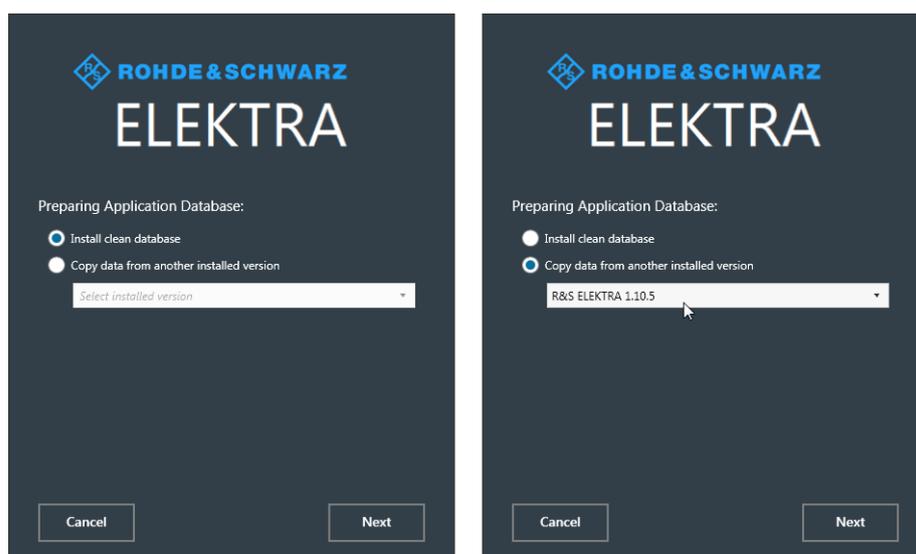
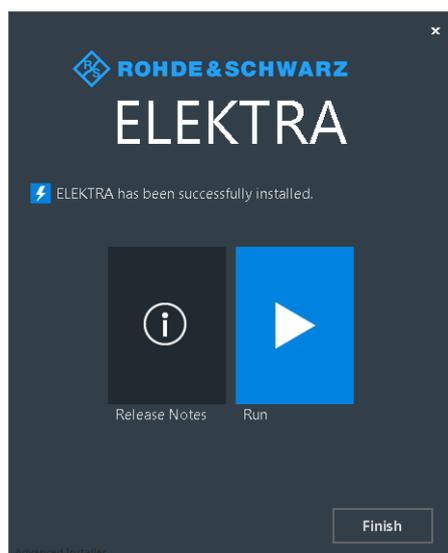


Figure 2-1: Dialog for installing a clean database (left) or copying data from an existing database

Select your preference as in the figure above.

The wizard either installs a clean new database or copies existing data into the database of your new installation.

14. Click "Next" to proceed without or with copying data from a previous database, according to your selection.
15. In the final setup dialog, select how to complete the installation:

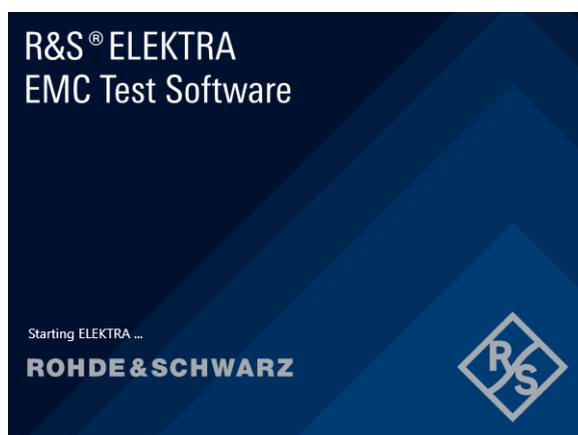


Select one of the following actions:

- Open the "Release Notes" document.
- "Run" the software.
- "Finish" the installation.



When the [Software installation](#) is completed, double-click the new desktop icon to start R&S ELEKTRA:



2.3 License dongle



R&S ELEKTRA is protected by encryption. You can start the software with licenses installed only, if the **"R&S EMCPC" license dongle** is connected to the computer. This dongle is a mini smart-card reader within a USB flash drive that contains a license smart card. It unlocks the licenses that have been activated for your R&S ELEKTRA serial number.

If your computer has a smart card reader slot, you can directly insert the license smart card into this slot, without using the dongle, as described in [Chapter 2.3.1, "Using the smart card reader"](#), on page 21.

To start R&S ELEKTRA with your set of licenses, connect the license dongle to a USB port of your computer.

If you start R&S ELEKTRA without the license dongle connected, the software can only run in demo mode. The following dialog comes up:

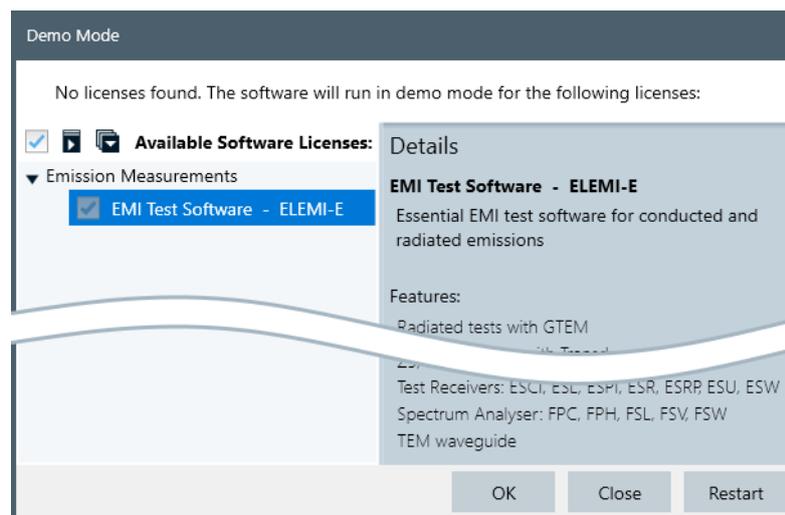


Figure 2-2: Demo mode message if there is a missing license dongle

The "Details" section on the right side of the dialog provides information on the highlighted license.

In this dialog, you can select how to proceed:

- **"OK"**: Run R&S ELEKTRA without licenses, hence, in demo mode. No physical measurements can be made, but you can execute tests with simulated data.
- **"Close"**: Shut down the software.
- **"Restart"**: Using this button is the easiest procedure, if you have not yet connected the license dongle, but the dialog just reminded you of doing it now. Insert the license dongle to a USB port of your computer, then click "Restart". The software shuts down and automatically restarts.

With the license dongle connected, the "Demo Mode" dialog does not come up. Instead, the software starts with the licenses available on the dongle, see [License Management](#).

2.3.1 Using the smart card reader

The R&S ELEKTRA software requires a smart card containing the software license to be connected to the PC when you are using the software. The R&S EMCPC license dongle that contains the software license consists of a smart card and a USB dongle. The smart card can be used in the supplied USB dongle or in a smart card reader. The R&S EMCPC license dongle is available as a separate product and *must be ordered in addition to the software*.

You can connect the smart card in two ways.

- Connect the smart card in mini-sim format.
To connect the smart card in mini-sim format, use the USB smart card reader (dongle) provided with the smart card.
- Connect the smart card in its full size.
To connect the full-size smart card, an interface compatible to the card format is required.

The following devices are able to read the full-size smart card.

- Smart card reader integrated in a keyboard, notebook, or in a desktop PC (e.g. OMNIKEY)
- Smart card reader connected to the computer via serial bus or USB (e.g. OMNIKEY)
- USB reader connected to a LAN-to-USB converter to distribute the license via the network (e.g. DIGI AnywhereUSB/2)



Licensing support

If you have any difficulties with the licensing system, support is only assured if you use the R&S EMCPC license dongle.

Using the R&S EMCPC USB smart card reader (dongle)

The R&S EMCPC license dongle consists of a full-size smart card and a USB smart card reader (dongle).



1. Break out the smart card in mini-sim format.



2. Remove the rear cover of the USB dongle.
To do so, pull up the cover at its edge next to the USB connector.



3. Insert the smart card with the chip facing downwards, and the angled corner (orange circle) facing away from the USB dongle:



4. Insert the smart card as far as possible.
5. Close the cover of the USB dongle.

The smart card reader is ready for operation with any USB interface.



Drivers

When you connect the reader to the computer, MS Windows automatically installs the necessary drivers. No manual driver installation is required. For further information, refer to the manufacturer's website at www.acs.com.hk/en/products/331/acr39t-a1-smart-card-reader.

2.4 Configuration Wizard for creating basic data



In the original delivery state of R&S ELEKTRA, the newly installed database is empty. To prepare some basic data for tests, you can run a special wizard tool at any time: The "Configuration Wizard" is designed to generate only dedicated content for your use cases, to avoid overstuffing the database with unnecessary data. Such a customer-specific software setup facilitates the process of getting started with the required EMI tests.



The content and data generated from the configuration wizard shows examples for typical cases and can differ from the actual requirement. Before executing the test, we recommend that you update the parameters accordingly to the requirement.



Avoid overstuffing the database

We recommend not to create more data than necessary. Here is one reason for limiting the number of entries that you let the wizard create: With more data subsets, [deleting](#) device entries from the [Device List](#) becomes very complex due to interdependencies between related entries. For example, test templates that have references to specific devices prevent deleting these device entries.

Instead, you can always come back to the wizard and let it create additional entries that you may require later.

Depending on your test scenarios, instruct the wizard to load sets of suitable data into the database. This data includes the appropriate limit lines, device drivers, specific test templates for the applicable standards, and the like.

The "Configuration Wizard" is available as follows:

- From any dialog, by going to "Home" > "Tools" > "Configuration Wizard".



- In the [Welcome screen with configuration wizard for creating sample test data](#), which is [optionally shown](#) on startup of the software:

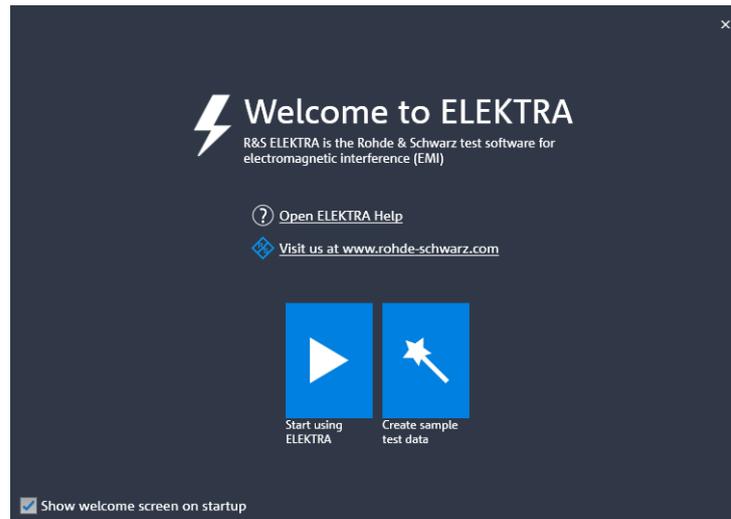
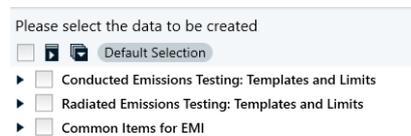


Figure 2-3: Welcome screen with configuration wizard for creating sample test data

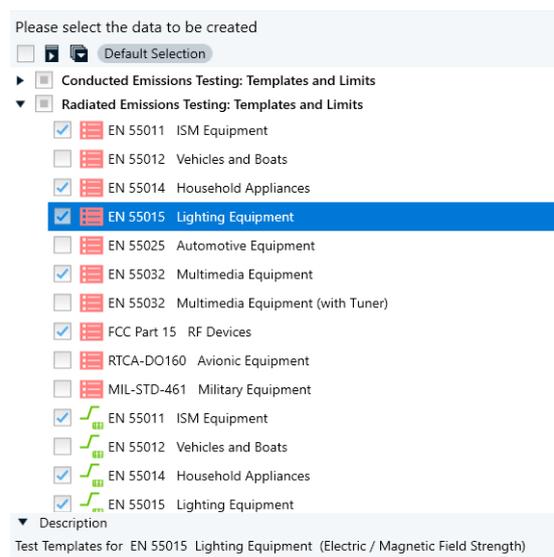
From the welcome screen, you can skip the wizard and run R&S ELEKTRA without creating basic data, by selecting "Start using ELEKTRA". Otherwise, select "Create sample test data".

To execute the "Configuration Wizard", proceed as follows:

1. Start with the following dialog:

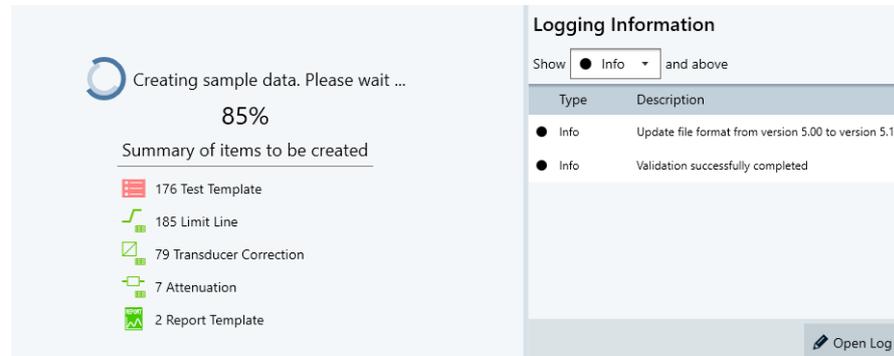


2. Select "All" or "Default Selection" or (recommended) exactly those data that you want the wizard to create:



- Click "Finish & Execute" to complete the procedure.

The wizard creates sample data:



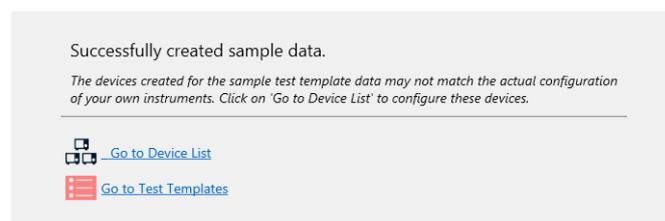
Note: The figures on the left do not represent the number of created items, but the number of import files. Each file can include references to several items, while the different files also avoid item redundancies. Therefore, the number of created items can typically differ from these figures.

- During the data creation, you can select which logging information is shown.
 - "Process" shows all logging information
 - "Info" shows the next higher level, only
 - "Warning" shows warnings and errors, only
 - "Error" shows errors, only

While the dialog is still shown, you can open the log in a viewer by clicking the "Open Log" button on the lower right. Later, you can still find it as an "Import_(...).log" file in a time-stamped subdirectory of the folder "c:\ProgramData\Rohde-Schwarz\ELEKTRA\x.xxx\Logs\...".

- Wait for the wizard to complete the sample data creation.

When this process is completed, R&S ELEKTRA shows the following dialog:



- Optionally click "Log" to see information about the creation procedure.
- Click "Go to ..." or "Done" or "Close" to leave this dialog.

2.4.1 Recovering data

If R&S ELEKTRA crashes or is shut down unexpectedly during a running test, the software automatically tries to recover data that was not saved. The restarted R&S ELEKTRA brings up a dialog that asks you how to proceed with recovered items:

-  "Keep" = recover the data (hence, save it to the database)
-  "View" = open a dialog to view, edit and save the data
-  "Discard" = delete the data (hence, the data is not recovered)



The recovery feature's auto save function is executed approximately every 5 minutes. Even if data recovery is possible, any data that was created within the last few minutes (up to 5 minutes) before the shut-down can still be lost.

2.5 Language selection

To adjust the language setting, especially when running R&S ELEKTRA for the first time, click the globe symbol and select your language:

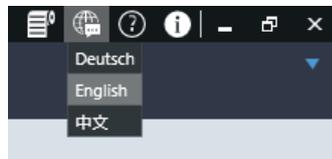


Figure 2-4: Language options are German / English / Chinese

Upon selecting a language that is different from the current setting, a dialog opens to let you decide:

- "No": The dialog closes and the software remains active with the previous language setting.
- "Yes": R&S ELEKTRA immediately shuts down and restarts to activate the new language setting.



The help content (accessible via [F1] or ) is available only in English, independent of the selected language.

2.6 Migration Tool - XML data converter

Access:

```
C:\Program Files\Rohde-Schwarz\ELEKTRA\x.xx.xx\
ELEKTRAMigrationTool.exe
```

Or use the MS Windows "Start" button > All programs > R&S ELEKTRA > x.xx.xx > ELEKTRA x.xx.xx Migration Tool

The "ELEKTRA Migration Tool" converts data from R&S ES-SCAN or R&S EMC32 to XML data for R&S ELEKTRA.

This section describes using the migration tool with R&S ELEKTRA. Further information is available also in the application note "1SL396", available at www.rohde-schwarz.com/appnote/1SL396.



To convert data from a previous version of R&S ELEKTRA to a current version, use the "Export" and "Import" functions in R&S ELEKTRA.



Previous EMI Test Software products like R&S ES-SCAN are based on a file system that allows editing data manually. In contrast, R&S ELEKTRA is based on a database that does not permit direct user access to any data or file content. To view or modify data, always use the functions provided by the user interface of R&S ELEKTRA. For more information, see [Test container](#).

To convert data from R&S ES-SCAN to an XML format that can be interpreted by R&S ELEKTRA, run the program `ELEKTRAMigrationTool.exe`. A two-step dialog comes up: first select the source application, which is R&S ES-SCAN, then select the data folder:

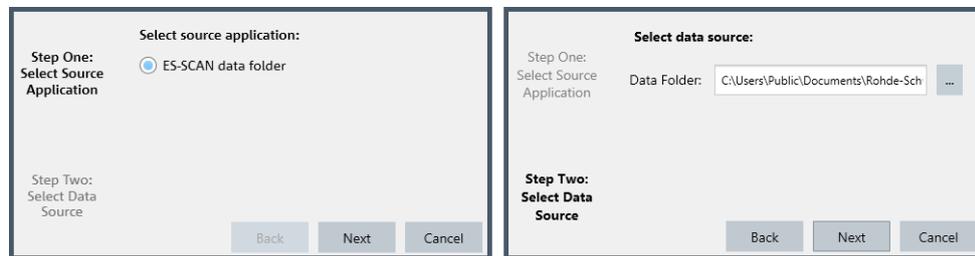


Figure 2-5: Selecting an R&S ES-SCAN data folder as the source for data migration

In [Figure 2-5](#), in the dialog on the left-hand side, click "Next". In the dialog on the right-hand side, select a "Data Folder" that contains files generated by R&S ES-SCAN, then click "Next".



Make sure that the `C:\ProgramData` folder, which contains the data files, is not hidden. To do so, verify the folder properties in Windows Explorer: If the folder has the attribute "hidden", uncheck this attribute.

With your source data selection, R&S ELEKTRA prepares the appropriate settings. It displays the following dialog window ([Figure 2-6](#)) and a pop-up message box (5). You can start using the tool after acknowledging the pop-up message.

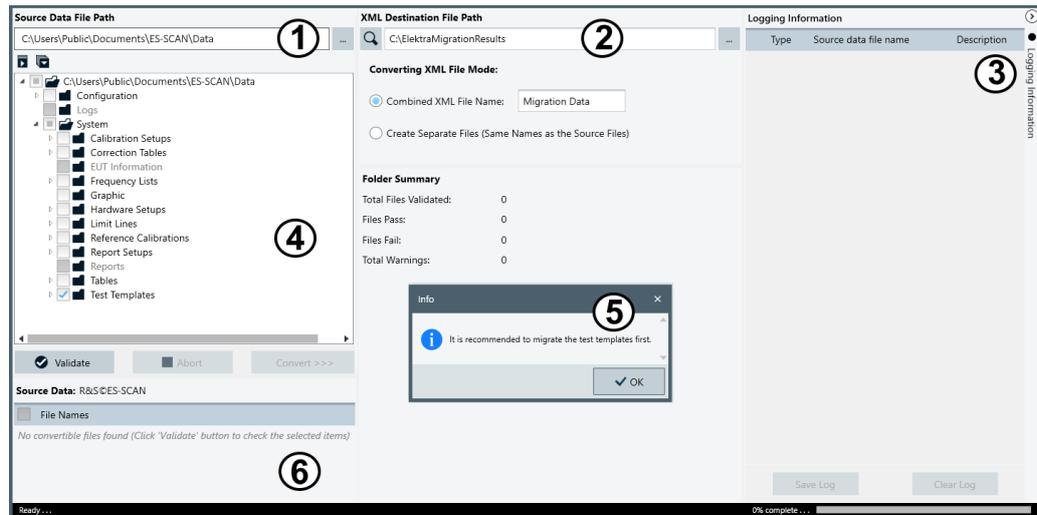


Figure 2-6: Start window of the XML converter

- 1 = Selection of "Source Data File Path"
- 2 = Selection of the "XML Destination File Path"
- 3 = Logging information (can be hidden)
- 4 = Selection of the folders with the "Source Data" files
- 5 = Pop-up message that recommends migrating the test templates first
- 6 = Selection of "Source Data" files, files are available only after the "Validate" button is clicked

The following section describes using the R&S ELEKTRA migration tool.

You can select the "Source Data File Path" (1) in detail. For example, let the tool only migrate files from specific subdirectories.

By default, when converting EMC32 data, the migration tool selects the "Test Templates" folder automatically. When the tool migrates test templates, it also converts all relevant data referenced in the test templates, such as hardware setups, devices and correction tables. Hence, we recommend that you migrate the test templates first.

When you click "Validate", the tool triggers a plausibility check for the selected items or dependent files. It generates a validation status for each data file in the selected folders. There are three validation status levels:

- Green checkmark - no errors found
The data files can be converted.
- Yellow exclamation mark - warnings found.
The data files can be converted, but require attention, additional manual interaction or data input.
- Red exclamation mark - errors found
The data files cannot be converted.

You can also validate multiple files.

The selections described above determine the list of "Source Data" files that are available for migration:

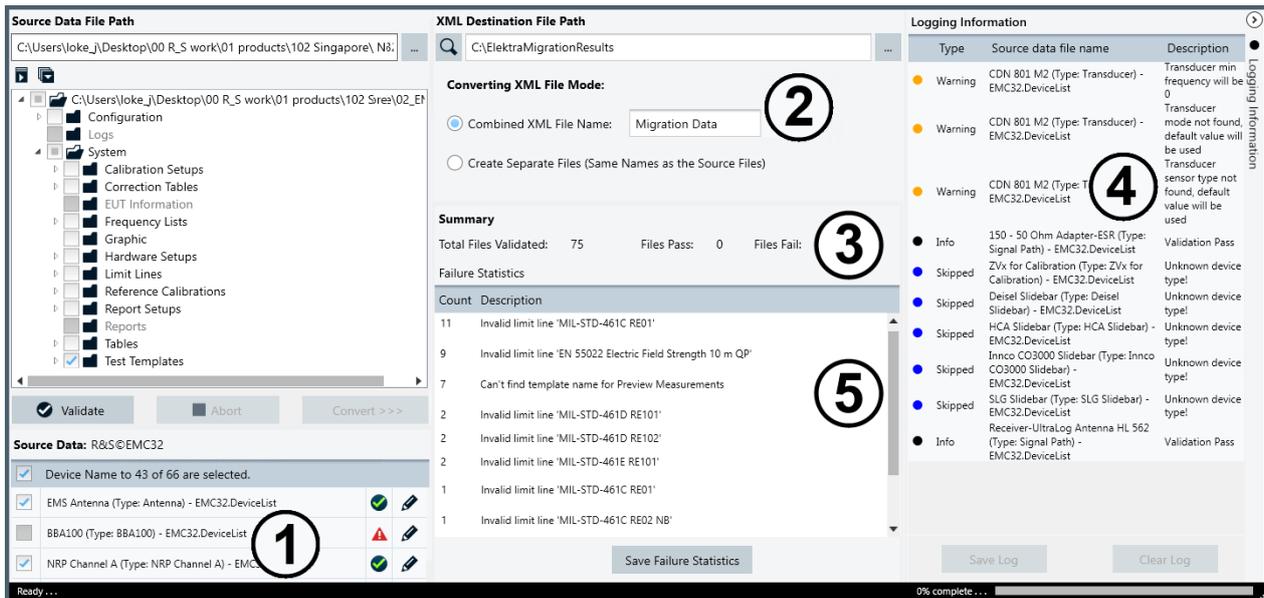


Figure 2-7: Source data selected for conversion to XML data (EMC32)

- 1 = Selection of "Source Data" files
- 2 = Selection of the "Converting XML File Mode"
- 3 = "Folder Summary"
- 4 = List of "Logging Information"
- 5 = "Failure Statistics" for migration of items

The source data selection limit interface has the same operation as in R&S EMC32 (Figure 2-7), but differs in that you can select the data files directly.

In the list of "Source Data" files (1), you can select the available files individually. In this dialog section, if you check the checkbox on top of the list, the tool selects all files that have passed validation (see sections (3) and (4) in Figure 2-7).

In section (2), specify a destination path for saving the result of the data migration. Also specify in this dialog, if you want the migration tool to create one combined XML file containing all the converted data or separate XML files.

Section (3) provides a summary of the folder's content. R&S ELEKTRA validates the available files and lists their "Logging Information" (4). It shows either "Validation Pass" or briefly describes any issues.

Section (5) shows all migration failures and the reasons for failure, where applicable. To save a log, click "Save Failure Statistics".

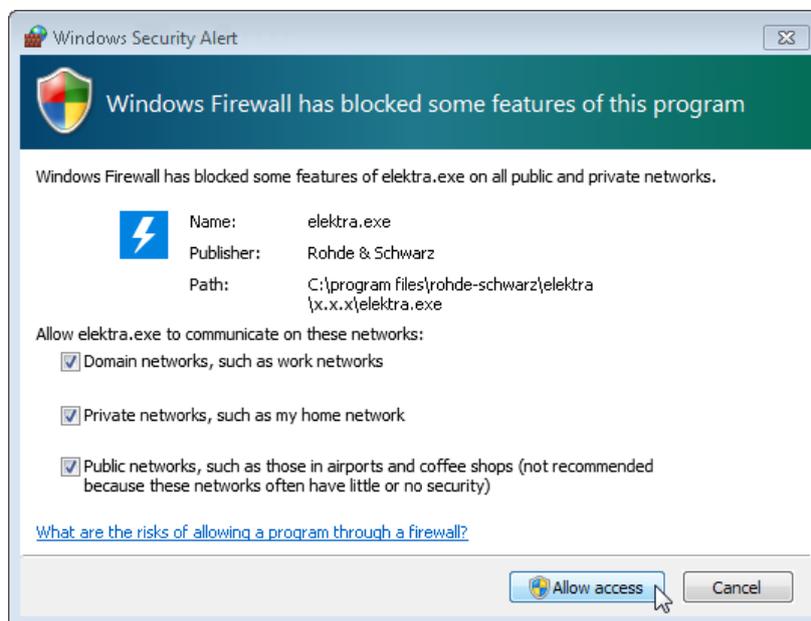
When the data selection, validation and destination are completed, click "Convert >>>".

The migration tool executes the XML data conversion and shows a "Conversion Report".

As a result, XML files that contain the converted data are now available for import, as described in Chapter 4.8.2, "Import", on page 170.

2.7 Network firewall settings

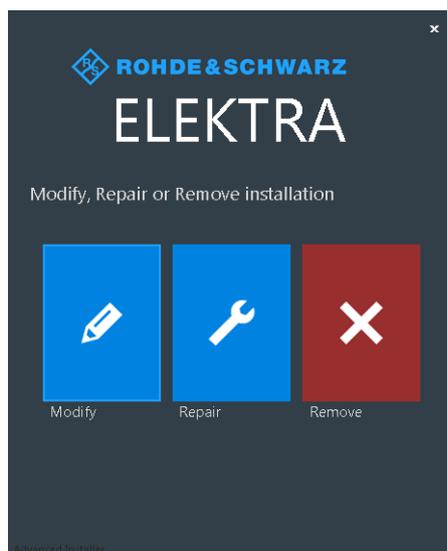
At some point in time, typically while configuring devices or during a first measurement, the Windows firewall system brings up the following security alert:



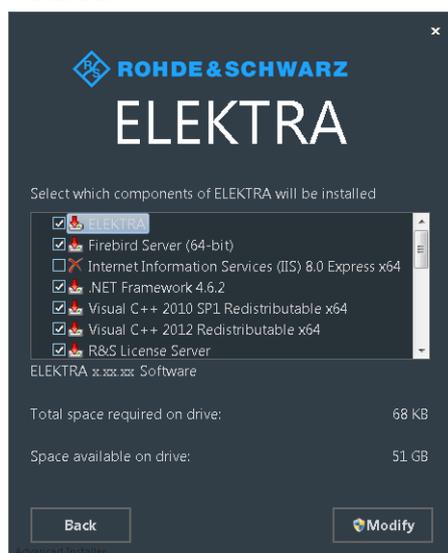
Tick all checkboxes to make sure that R&S ELEKTRA can communicate with devices in any kind of network. Then click "Allow access".

2.8 Modify, repair or remove installation

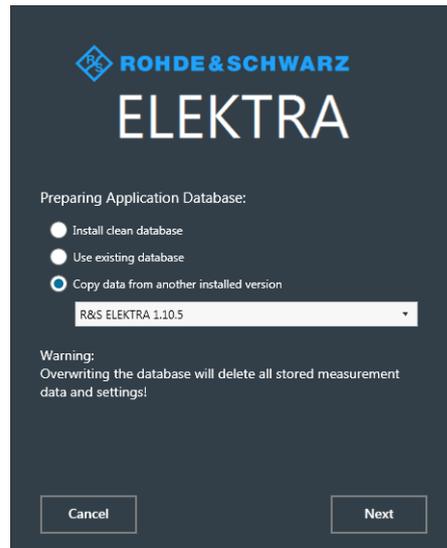
If R&S ELEKTRA is already installed, rerunning `ElektraSetup_Vx.xx.exe` for the same software version does not overwrite the installation, but calls up a wizard to modify, repair or remove it:



- **"Modify"** brings up a dialog for custom selection of desired components to be installed:



To execute the installation of custom selected components, click "Modify". In the next step, if the wizard finds one or more previous installations of R&S ELEKTRA, it prompts you with a dialog for handling the database of this installation:



- "Install clean database" resets your database to the clean state of the first installation of this version.
If you have generated data in the meanwhile, the wizard creates a [Backup](#) and then overwrites the existing database with its default ("clean") state.
- "Use existing database" leaves your current database unchanged.
- "Copy data from another installed version" lets you select the database of an older installation for overwriting your current database.
If you have generated data in the meanwhile, the wizard creates a [Backup](#) and then overwrites the existing database with the selected older database.

NOTICE

Loss of settings and measurements

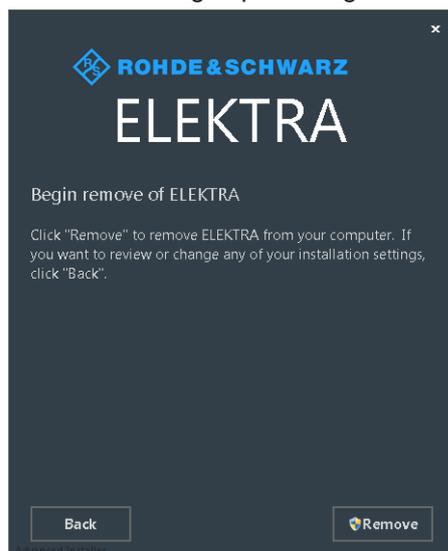
If you have already generated any data in the current database (settings and measurements), you lose this data when you select "Install clean database" or "Copy data from another installed version". If you do not wish that R&S ELEKTRA overwrites any data, select "Use existing database".

- **"Repair"** brings up a dialog for running an installation repair routine:



To execute the repair procedure, click "Repair".
This selection leaves your current database unchanged.

- **"Remove"** brings up a dialog for removing R&S ELEKTRA from the computer:



To execute the removal procedure, click "Remove".



Removing / uninstalling the software does not delete the database.

However, migrating to a different (higher) version of R&S ELEKTRA can require to copy the database of the previous (lower) version of R&S ELEKTRA, as described in [step 13](#) of the installation procedure.

Alternatively, you can [Export](#) old data and [Import](#) it into the new version of R&S ELEKTRA.

3 Getting started

This chapter guides through the basic steps of operating the software. Starting with an overview of the software structure and the user interface, it describes the test preparation, test execution, results evaluation and reporting.

Software structure overview

To understand the interaction of the main components for EMI tests in R&S ELEKTRA and their [Configuration](#), it is important to know the specific hierarchy that they follow:

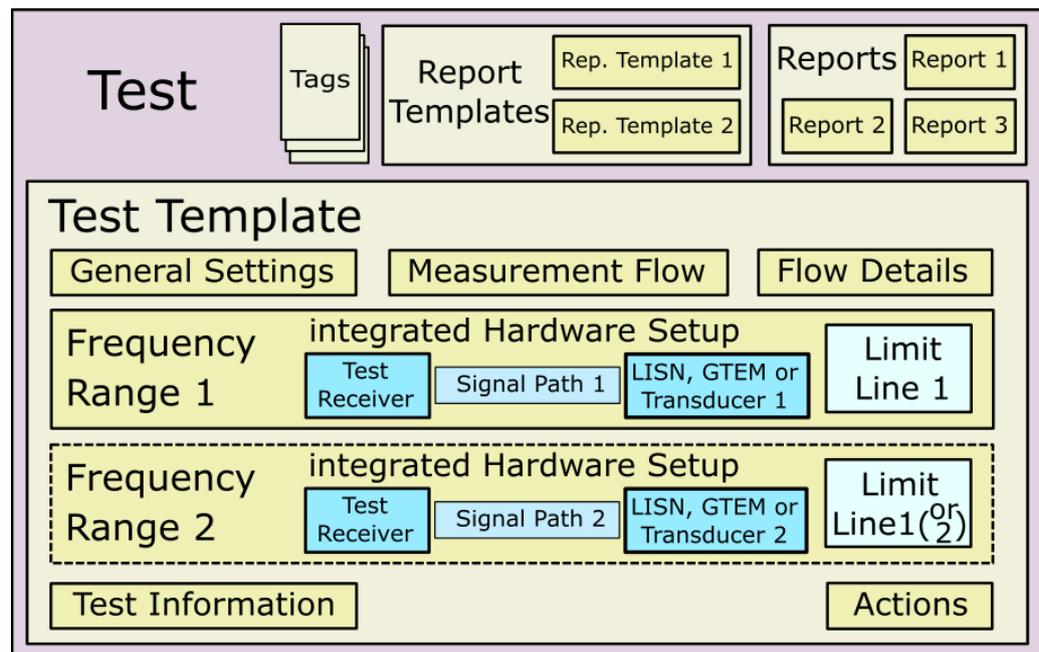


Figure 3-1: Hierarchy of main components within R&S ELEKTRA

What does this figure tell about components in the various hierarchical levels?

For example, the test is on the highest level of hierarchy. It can contain every other component (tags, reports, test templates, devices, etc.), but it cannot be contained in any of those components. The following list gives a complete overview.

A **test** is generated and stored in the database as a unique set of data, which is also called the **Test container**. It contains:

- Exactly one copy of a **test template**, which has:
 - **General Settings**
 - A **Measurement Flow** with **Flow Details**
 - **Frequency Ranges**
 - **Test Information**
 - **Actions**

The test template can be made up of several frequency ranges, each containing a **limit line** and a hardware setup with *references* to the following components in the **Device List**:

- The **Test Receiver**
- A **Signal Path**
- A **LISN, Transducer** or **TEM Waveguide**
- Optionally one or several **report templates** for generating an arbitrary number of **reports**, which are exclusively contained in a test.
- Optionally one or several **user tags**



Where do the *components integrated in a Test container* come from?

Integrated components are either **newly created**, or **copies**, or **references**.

In detail:

- Those components, which are **newly created** for a test, or which are **copies** of original components in a list of items, include:
 - The **test template**
 - Report templates
 - Reports (which are, however, never copied, but always newly created out of report templates)
- Those components, which are **references**, include:
 - Limit lines within the test template

...and references that link to *items in the Device List*:

 - The receiver
 - The signal path
 - The LISN, transducer or TEM waveguide

From [Figure 3-1](#), you can see how these components are integrated into each other on different hierarchical levels. From the note above, you can see where the components come from. To summarize this structure:

- References for the receiver, the signal path, the transducing device and the limit line are part of the test template and its integrated hardware setups.
- The copy of a test template is integrated into a test, which is stored as a **Test container**.
- Reports are created from report templates to compile test results. Reports are exclusively stored in the test container.

For an illustrative example, see [Chapter 8, "Measurement examples"](#), on page 233.

The **configuration** of all components is described in detail in [Chapter 4, "Configuration"](#), on page 52.

The following sections explain how to get started with:

- [User login](#)..... 36
- [Graphical user interface](#)..... 37
- [Common action buttons](#)..... 39

• Touch operation	44
• Measurement settings	44
• Performing a test	45
• Test results	46
• Verdict	48
• Reporting	50

3.1 User login

When you start R&S ELEKTRA with your [License dongle](#) connected, and if more than the default "Admin" user (R&S ELEKTRA administrator) is defined, the following "User Login" dialog comes up:

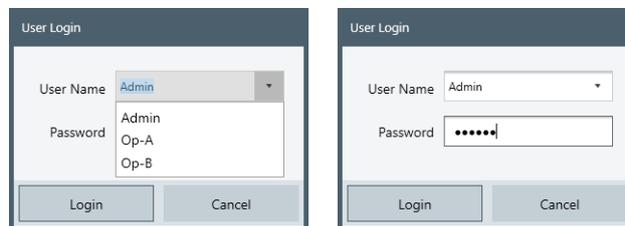


Figure 3-2: User login dialog

Left = Enter your user name or select it from a drop-down list

Right = Enter your password

- If you are the default administrator, your "User Name" is `Admin` and your "Password" is either empty or you have set it already during a previous session.
- The drop-down list (left in [Figure 3-2](#)) contains only names of users that have already logged in during a previous session. If your user name is missing in the list, typically during your 1st login, you must type it in.
- If you enter a wrong user name, the dialog displays a message: "The user name and/or password is incorrect."
- If you are no administrator but any other user of R&S ELEKTRA, get your "User Name" from an administrator. Your "Password" is either empty or you have set it already during a previous session. If you have lost your password, an administrator can reset it.

For changing your password, see ["User Information"](#) on page 54.

Each user is identified by an individual "User Name", which is assigned to a combination of roles and groups:

- The role assignment "Operator", "Expert" or "Admin" establishes specific permissions.
- The assignment to one or more groups establishes specific data access rights.

For example, as a member of an operator group, typically you have restrictions on modifying or deleting some basic content, such as test templates or device entries. Ask your administrator for the roles and permissions that apply to you.

3.2 Graphical user interface

R&S ELEKTRA features a graphical user interface (GUI) in a versatile design. The main dialog is the "Dashboard", which is always available via "Home" > "Dashboard" from any other dialog. The "Dashboard" dialog provides direct access to all software components.

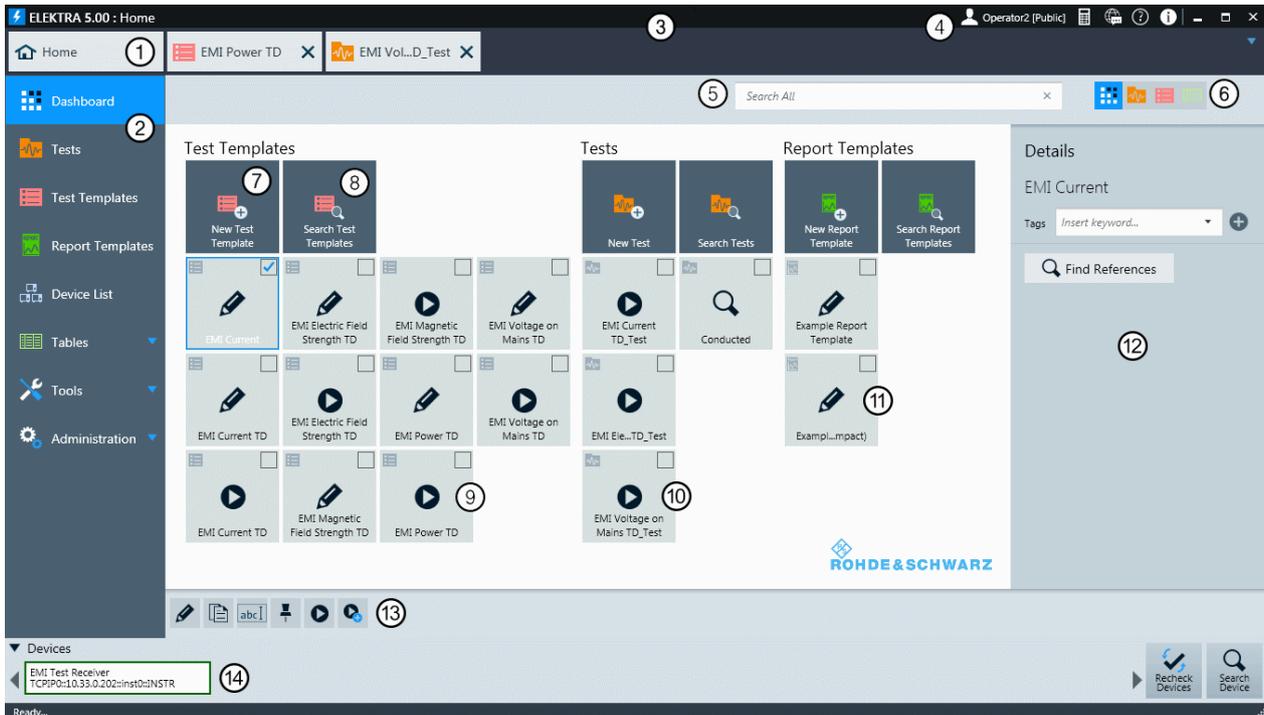


Figure 3-3: The Dashboard dialog

- 1 = Tab bar area with the [Home](#) button, which brings up the home menu (2) with the most recently selected dialog (here: the "Dashboard"). Next to the home button, two more tabs are available in the tab bar area in this example: a test template and a test
- 2 = [Home menu](#) with the "Dashboard" dialog currently selected (highlighted in blue). Buttons for other dialogs are below: "Tests", "Test Templates" etc.
- 3 = Title bar
- 4 = Global function buttons in the title bar, see [Home menu](#)
- 5 = [Dashboard search](#) field, here with default filter for searching everywhere
- 6 = Filter buttons for the [Dashboard search](#)
- 7 = Create button (here for a new [test template](#)). To the right: equivalent buttons for creating other items
- 8 = [Search](#) button (here for "Test Templates"). To the right: equivalent buttons for searching other items
- 9 = [Pinned](#) "Test Templates", with the first one being selected (checkbox and blue frame) and some others being "Pinned as New Test Direct" (for "Create test from template"), see [EMI tests](#)
- 10 = [Pinned](#) "Tests", with the last one being a [search result list](#) for tests with the keyword "Conducted"
- 11 = [Pinned](#) "Report Templates"
- 12 = Item details, here for the selected "Test Template" (9) among the [pinned](#) items
- 13 = Actions bar, contains [action buttons](#) for all actions that can be executed for the selected one or more items, here a "Test Template" (9)
- 14 = Device status bar, shows connectivity status of devices in the [Device List](#) and allows checking or searching for connections

The "Dashboard" dialog shown in the figure above summarizes your pinned (favorite) items in the following categories:

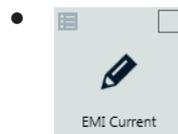
- "Test Templates"
- "Tests"
- "Report Templates"



Instead of executing an action in the **individual** dialog of any of these items, most actions can also be executed in the "Home" > "**Dashboard**" dialog: Check an item's checkbox and click the required [action button](#).

As a prerequisite, the item must be [pinned](#) to the "Dashboard".

A pinned item can have one of the following functions:



It can act as a link for **opening this item**.



It can act as a link for **creating a test** from a test template.



It can act as a link for **opening a pinned [search](#)**.

In the home menu (labeled (2) in [Figure 3-3](#)), below the "Dashboard" button, you have access to the following software components:

- [Tests](#)
- [Test Templates](#)
- [Report Templates](#)
- [Device List](#)
- [Tables](#)
- [Tools](#)
- [Administration](#)

For details on how to work with these components, see the chapters listed above and [Chapter 4, "Configuration"](#), on page 52 and [Chapter 6, "Special software features"](#), on page 199.

3.3 Common action buttons

This chapter describes the usage of several common action buttons that are available in many dialog windows of R&S ELEKTRA. The buttons are located in the actions bar of the [Graphical user interface](#). Some action buttons are also located directly in each row of the list of items.

The available set of buttons depends on the exact selection and type of items. An example is shown in [Figure 3-4](#):

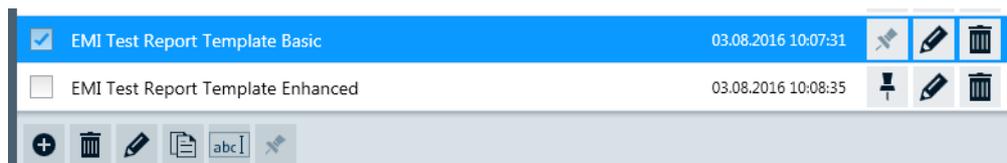


Figure 3-4: Example of some action buttons that are available for a selected report template

For details on how to handle the other, dialog-specific action buttons, see [Chapter 4, "Configuration"](#) and its subchapters:

- [Chapter 4.3, "Tests"](#)
- [Chapter 4.4, "Test Templates"](#), especially section [Handling test template items](#)
- [Chapter 4.5, "Report Templates"](#)
- [Chapter 4.6.1, "Action buttons in the Device List"](#) (different from the action buttons described below)

Refer also to the following [Special software features](#):

- [Handling changed items](#)
- [Dashboard search](#)
- [Searches](#)
- [Arranging elements in tests](#)
- [Keyboard shortcuts](#)



Save (in component configuration dialogs, tables and tests)

Saves the configuration that you defined, for example in a new [test template](#), or saves a completed [test](#). If you have changed any settings, you can leave but not close the dialog. To close a changed configuration dialog or an executed test, you must decide if you want to save or discard the changes or measurement results.

R&S ELEKTRA supports the shortcut key "[Ctrl + s]" for the "Save" command.



Save (in Administration settings dialogs)

Saves the changes that you made, for example at [Administration](#) > "Graphic Settings". If you leave this dialog without saving, the changes in your settings have no effect and are lost upon shutting down R&S ELEKTRA.

The shortcut key "[Ctrl + s]" is not supported.

**Save As**

Saves a configured component with a name that you can specify. Only available, if the component has been saved before.

R&S ELEKTRA supports the shortcut key "[F12]" for the "Save As" command in component configuration dialogs, tables and tests.

**Discard all Changes**

Resets your changes in a settings dialog to the previously saved values.

**Reset to Default**

Overwrites any changes that you made in a settings dialog with preset default values.

**Select ...**

To select any existing item (typically a row in a table), either directly click this item, or click the item's checkbox.

- Clicking checkboxes allows both multiple selections and unselecting items.
- To [Rename](#) an item, click the item name.

Depending on the selection and type of items, additional action buttons are displayed.

Note: For a disambiguation of the term "select", see [Select / Create New / Edit](#).

**Pin to Dashboard (Edit)**

Adds ("pins") the selected one or more items to the "Dashboard". Multiple selected items can be pinned simultaneously. Once pinned, the icon changes to .

For the special  version of this button, called "Pin to Dashboard (Create Test)", as opposed to , see [Handling test template items](#).

Note: Instead of pinning individual items to the "Dashboard" dialog, they can also be included there by a pinned [Search](#).

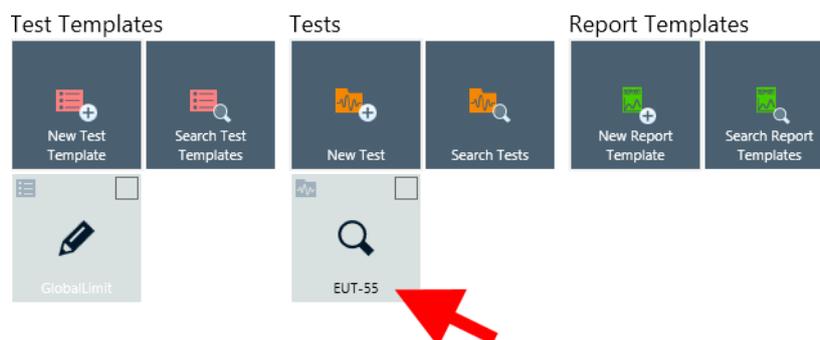


Figure 3-5: A search labeled "EUT-55" is pinned to the Dashboard

Clicking such a pinned search brings up a list of search results, see [Figure 6-2](#).

**Unpin from Dashboard (Edit)**

Removes ("unpins") the selected one or more items from the "Dashboard". Multiple selected items can be unpinned simultaneously. Once unpinned, the icon changes to .

For the special  version of this button, called "Unpin from Dashboard (run test)", as opposed to , see [Handling test template items](#).



Open

Click "Open" to view, configure, edit or evaluate the selected item or items. Multiple selected items can be opened simultaneously.



Delete

Click "Delete" to delete the selected item or items. Deletion is protected by the following alert: "Are you sure you want to delete the selected item(s)?"

Confirm with "OK" or "Cancel" the deletion process. Multiple selected items can be deleted simultaneously.



Create: ...

Generates a new item of a type that depends on the current dialog context. In some cases, the type of item must be selected from a list, before the dialog for specifying the new item opens. If any content in such a dialog is entered or changed, this state is marked in the dialog's tab by an asterisk (*), which disappears upon saving.

A new item must be saved to keep the entries, or it can be closed without saving to discard the entries. Closing an item without saving is protected by the following alert: "Would you like to save your changes?"

Options are "Save", "Don't Save" or "Cancel" to return to the dialog without saving.



Copy

Generates an identical copy of the selected item or items. The new copy of an item is listed with the addition "- Copy" in its name, or "- Copy (1)" etc., if previous copies exist. Multiple selected items can be copied simultaneously.



Rename

Edit the name of any single selected item. Alternatively, the name can be clicked directly to edit it:



Import ...

Only available for [Tables](#). Imports a table from an external file into the R&S ELEKTRA database as described in "[Importing tables](#)" on page 161.



Select / Create New / Edit

In many cases, the  button brings up a dialog for **selecting** an item. Depending on the context, you can **create** an item of the same type, **add** a device, **edit** or **rename** one of the listed items. To quit from this dialog, click "Cancel".

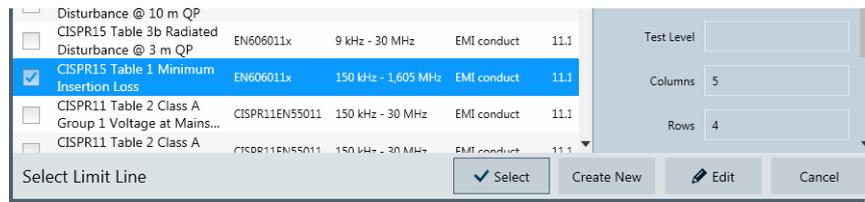


Figure 3-6: Example of selecting a limit line - with additional options Create New or Edit

Note: The term "to select" has an ambiguous meaning, illustrated in [Figure 3-6](#):

1.) The item highlighted in blue is "selected" (or marked) by clicking the checkbox or the row.



2.) To use this item in a given context, it can be "selected" (or adopted) by the "Select" button:



Most of the [Common action buttons](#) require to select an item in the first meaning of "marking" it, to decide what to do next with this item.

However, in the remainder of this manual, "selecting" an item typically has the second meaning of "adopting" it for further usage. For example, select a limit line to integrate it into a test template.

Details

To see information details of an item in any components dialog (for example "Home" > "Tests"), select the checkbox at the left end of the item's row. This selection brings up a "Details" list in the right part of the components dialog.

To see information details of a pinned item in the "Dashboard" dialog, select the checkbox in the top-right corner of the component's icon. This selection brings up a "Details" list in the right part of the "Dashboard" dialog.

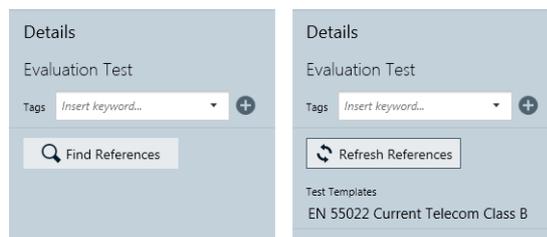


Figure 3-7: Example of a details list (here of a test), left: before searching for references, right: after

The information in the list depends on the type of the selected item and its content.

If you select more than one item, the software displays only information that is common to all selected items.

Tags ← Details

Displays user-defined "Tags" of the selected component or components. Tagging especially facilitates finding groups of components that you have labeled with the same specific tag or tags.

To add a tag to an item, select the item to display the "Details" dialog, enter the tag text and hit [Return] or click the "+" sign next to the input field.

A [search](#) cannot be tagged.

Tags are shown for selected items in the "Dashboard" and in the lists of items (for example "Tests"). Note that tags are not visible in opened items, except while using the "Save" dialog. This dialog shows tags and also allows defining new tags.

To delete a tag, click the "X" sign next to it.

Note: If R&S ELEKTRA [recovers](#) an item, for example a test or a test template, after an unexpected program shut-down, the tag "Recovered Data" is automatically added to this component.

Find References ← Details

"Find References" searches for references from the selected component to other components, which either use this component or are used by it. For example, a test can have references to a test template.

Once you have executed a search for references, the "Find References" button changes to "[Refresh References](#)", which allows repeating the search.

[Pinned "Search" items](#) do not have any references.

Note: A test is always based on a **copy** of the test template that was used to create the test. Upon test creation, this copy is integrated into the [Test container](#). Therefore, the original test template is not directly referenced in the test.

This relationship becomes obvious, for example, if you modify the original test template: the copy of this test template inside the test container remains unmodified.

Nevertheless, just **for operator orientation**, the displayed reference indicates that the test was created using this test template.

Refresh References ← Details

Repeats the [search for references](#) and displays the updated results. Refreshing can be useful, for example, after modifying a referenced item.

**Collapse Content**

The arrow pointing down indicates that some expanded content below the arrow can be collapsed.

Click to collapse (hence minimize) the content, for example a settings dialog or a list.

**Expand Content**

The arrow pointing to the right indicates that some collapsed content can be expanded.

Click to expand (hence unfold) the content, for example a settings dialog or a list.

3.4 Touch operation

R&S ELEKTRA can be installed on a tablet computer (MS Windows) with a touch-sensitive display. In this case, finger-touch operation intuitively replaces conventional mouse operation of the software.

Example:

You can **zoom** a test chart in conventional mouse operation by drawing a rectangle around the area that you wish to see enlarged. On the contrary, in touch operation, you would enlarge this area by stretching the chart by a two-fingers gesture.

The following touch actions replace mouse actions:

Table 3-1: Correlation of mouse and touch actions

Mouse operation	Touch operation	Gesture icon
Click	Tap	
Double-click	Double-tap	
Click and hold	Touch and hold	
Right-click	Touch, hold for 1 second and release	
Drag-&-drop (= click and hold, then drag and release)	Touch and hold, then drag and release	
Zoom by drawing a rectangle	Two-finger zoom ("pinch to zoom")	
Mouse wheel to scroll up or down	Swiping a window area down or up	
Dragging scrollbars to scroll up or down, left or right	Swiping a window area down or up, right or left	

This manual describes all user operations as if executed with a mouse. If instead you use a tablet computer with touch operation, proceed according to the correlations given in [Table 3-1](#). Exceptions apply in those cases that are considerably different from the general correlations. In these cases, both types of operation are described.

On the tablet computer, if you select a field for keyboard input, R&S ELEKTRA automatically brings up an on-screen keyboard. If it overlaps with an input field or covers a relevant display area, undock the on-screen keyboard. Once it floats, you can move it out of the way.

3.5 Measurement settings

R&S ELEKTRA controls your test devices during EMI measurements. Some devices require dedicated measurement settings, depending on the test scenario.



Measurement settings vs. device properties

R&S ELEKTRA stores **measurement settings** in each test template, which makes these settings available in each test based on this test template. However, measurement settings can differ among your test templates, which allows adapting the settings individually (per test template) to your various testing requirements.

On the contrary, **device properties** are stored directly in the [Device List](#), which assures that these properties are globally available only once for each device. However, test templates also provide a view of the device properties. Be aware of the following: If you modify any device properties anywhere (in the device list or in a test template), these properties are changed for all instances that use this device.



Note that settings in the "Functional Check" dialogs in the device list are **no globally effective measurement settings** and do not take effect in any test templates or tests. Use these settings only for functional checks of the device.

However, for simplicity, the devices' measurement settings are described in the "Functional Check" dialogs, because you can find this place easily. It is always available in the user interface, independent of your configuration scenario.

Dialogs for specifying measurement settings

To specify measurement settings for your tests, use the following dialogs:

- **"EMI"**: in an EMI test template, proceed as follows:
 - Select (highlight) the "Overview Measurement" or the "Final Measurement" in the [Measurement Flow](#).
 - Then go to the "Measurement Settings" dialog in the "Flow Details", see [Figure 4-12](#).
 - In a frequency range, select (highlight) an active device, for example the test receiver or spectrum analyzer.
 - Go to the [Settings \(Overview\)](#) or [Settings \(Final\)](#) dialog.

3.6 Performing a test

Generally, performing EMI tests with R&S ELEKTRA involves the following steps:

1. Determining, **which types of test** to perform, as suggested in the EUT-related [Test matrix](#).
This decision leads to the applicable **EMI standards** (for example CISPR, IEC/EN, or MIL-STD-461).
2. Determining the test concept based on those standards.
3. Planning the hardware setups for the **tests** of EUTs.
This planning leads to a list of required devices and signal paths. A wizard for [pre-configuring](#) entries in the software's database support you in this task.

4. Establishing a useful **data nomenclature** with speaking names for saving, e.g., limit lines [and other tables](#), various templates, devices and the like.
5. Physically **setting up the hardware** for the respective measurement, and **connecting the devices** to the PC. The software requires this setup to perform the following steps:
6. Entering the measurement **devices** in R&S ELEKTRA by creating or editing entries in the [device list](#). A [search function](#) for network devices supports you in this task. If a firewall message comes up, see [Network firewall settings](#).
7. Creating or editing [limit lines](#) in R&S ELEKTRA according to the relevant standards.
8. Configuring EMI test settings (together with configuring the hardware setups) in R&S ELEKTRA [test templates](#).
9. **Creating tests** as described in [Chapter 4.3.1, "Configuring tests"](#), on page 56
10. **Running tests** as described in [Chapter 7, "Running tests"](#), on page 209.

Once a test is completed, **save** it and proceed with the following steps:

- **Evaluating** the results as described in [Chapter 3.7, "Test results"](#), on page 46.
- Generating **test reports** as described in [Chapter 3.9, "Reporting"](#), on page 50.



These steps can become clearer in [Chapter 8, "Measurement examples"](#), on page 233. Or refer to a "Step by Step Guide" for R&S ELEKTRA, available on the internet at www.rohde-schwarz.com/applications (search term *elektra step*).



For compliant EMI tests, all details of the measurement procedure must be taken from the applicable [EMI standards](#). R&S ELEKTRA supports you in this task. However, it is outside of the scope of this software to ensure that all regulations from the relevant standards are properly applied. Therefore, the compliance of testing remains in your responsibility.

3.7 Test results

Once a test has been run and saved, the whole [Test container](#) with all measurement results is stored in the database. To see the test results, make sure to have the test opened.

Access: "Home" > "Tests" > "Open" > "... test"

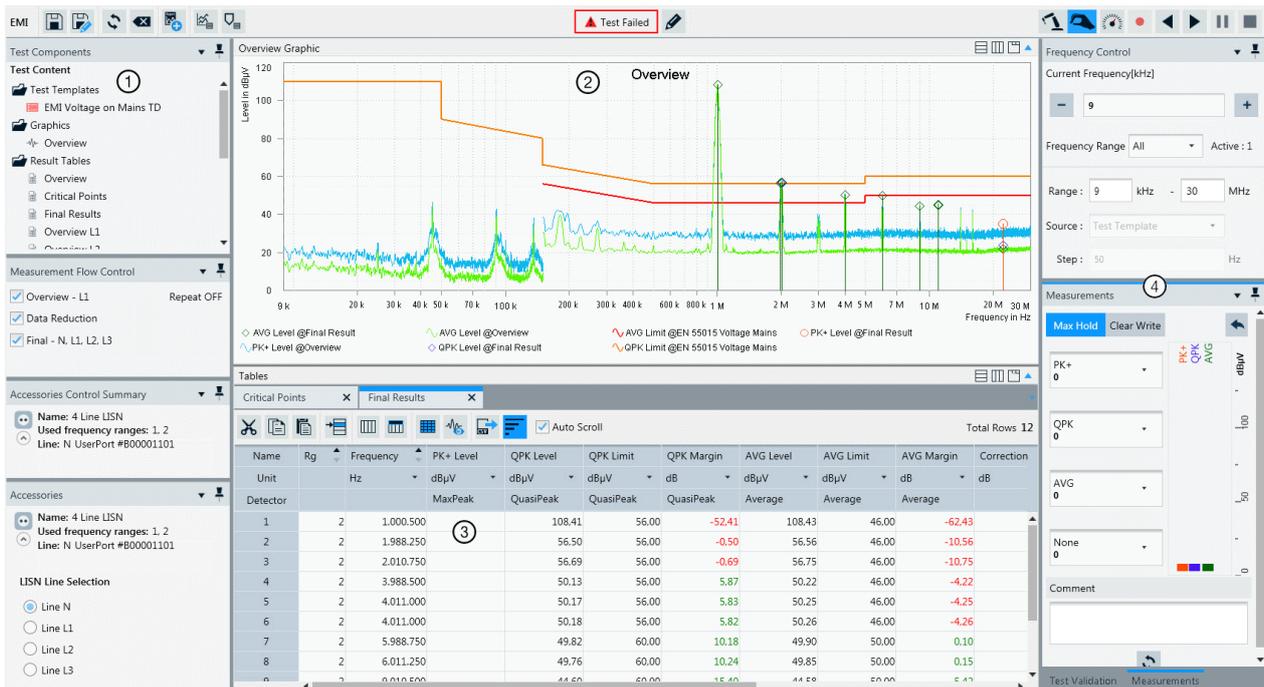


Figure 3-8: Example of a test window

- 1 = Side panels on left-hand side (see list below and [Using the test control elements](#))
- 2 = Test charts. For details on how to work with these graphics, see [Configuring test charts](#) and [Test result graphics](#)
- 3 = Test result tables. For details on how to work with these tables, see [Configuring test tables](#), and [Test result tables](#)
- 4 = Side panels on right-hand side (see list below and [Using the test control elements](#)). On the top right, find the [Test control toolbar](#)

You can use the following side panels on the left-hand and right-hand side:

- [Test Components](#)
- [Measurement Flow Control](#)
- [Accessories Control Summary](#) and [Accessories](#)
- [Frequency Control](#)
- [Measurements](#)
- [Test Validation](#)



Overview of LISN results

If the transducer used in the measurement is a LISN, the "Overview Graphic" and the "Overview Table" show merged maximum levels measured on any of the selected lines.

For example, consider a test template that defines measurements on lines N and L1: The overview results can comprise levels measured on line N in some parts of the frequency range and measured on line L1 in other parts of the frequency range. The "Line" column in the test table indicates, from which line the level result in each row was taken.

To see the results of an individual line, open its "Result Table" from the [Test Components](#) dialog and click the [Show Graphic Display](#) button (🖨).

The chart in the "Overview Graphic" and the values in the "Final Results" table represent a view of the test results. However, a complete EUT testing task typically also requires *evaluating* the measurement results. An example is finding broadband signals or specific frequencies, at which the minimum [Margin](#) between measured level and a limit line is violated. Evaluation is intended to provide crucial information (see [Verdict](#)) to decide whether an EUT conforms with a given EMI standard.

The software evaluates the [Verdict](#) based on the [limits](#), only. Further evaluation of the test results is a user task.

After having performed the required evaluation tasks, proceed with [Reporting](#).

3.8 Verdict

The "Verdict" is a label for EMI test results, which is either assigned automatically or [edited](#) manually. It can state that a test is "Failed", "Inconclusive" or "Passed":

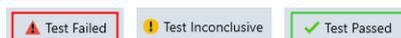


Figure 3-9: Test verdict: Failed, Inconclusive or Passed

The following rules apply for automatic verdict assignment:

- **Start condition:** A [newly created](#) or [cleared](#) test (but not a [refreshed](#) test) is set to the verdict "Inconclusive".
- **Evaluation:** R&S ELEKTRA calculates the verdict for a test, when the [automatic](#) measurement sequence is successfully completed, including the "Final Measurement". See also [Chapter 3.8.2, "Unexpected verdict"](#), on page 50.
- **Algorithm:** The verdict depends on *all margin values* in the "Final Result" table. At each frequency point, the [Margin](#) is defined as the limit line's value minus the measured level value. Hence, if the level remains below the limit, the margin is positive.

The three verdict states are derived as follows:

- Initially, or if there is a test interruption, the verdict is set to or stays **"Inconclusive"**
- If no limit line is set, the verdict stays **"Inconclusive"**

- If at least one frequency has a margin value < 0 , the verdict is **"Failed"**
- Else (hence, no margin value < 0), if at least one frequency has a margin value ≥ 0 , the verdict is **"Passed"**
- Else, if no margin values exist (for example, if the measured values are not covered by a limit line), the verdict is **"Passed"**
- **Revaluation:** If a verdict was calculated for a completed test and you manually change one or several limit lines or measurement values in the "Final Results" table, R&S ELEKTRA immediately recalculates the verdict.
- **Interruption:** If you or R&S ELEKTRA pause or suspend a test or you resume or continue it, after it was stopped by an exception, the verdict is set to **"Inconclusive"**. Note that in this situation, the software does not recalculate the verdict after operator intervention, such as changing limit lines or measurement values.
- **Limitation:** [Interactive measurements](#) have no influence on the verdict.

3.8.1 Editing the verdict

Independent of the automatic verdict assignment, R&S ELEKTRA allows you to select the verdict manually. This feature is in accordance with your option to edit measured values, see [Chapter 7.3, "Test result tables"](#), on page 229. As an operator, you are responsible for the test results.

To select the verdict manually, click the "Edit" button (✎) next to the verdict in an opened test. The following dialog comes up:

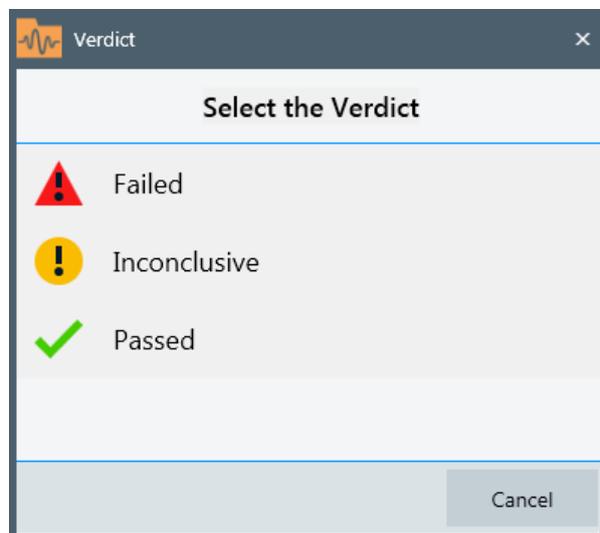


Figure 3-10: Verdict types

Click the verdict type that you wish to select. Your selection is immediately assigned to the test. To keep this change, save the test.

3.8.2 Unexpected verdict

If the verdict of an EMI test differs from what you expected from the displayed test results:

- Even if there are frequency points in the overview measurement with levels exceeding the associated limit, the verdict can be "Passed", because it refers to the final measurement results. For example, during the overview measurement there can be spurious signals from ESD spikes, generated by a moving antenna or turntable, or some sporadically strong ambient signals.
- Another reason can be a mismatching detector setting in the limit line table.

If the [test template](#) skips the [final measurement](#), use the correct detectors in the [Overview Measurement](#). R&S ELEKTRA supports you in using the correct detector: When you disable the final measurement in the test template, the software automatically sets the final measurement detector in the overview measurement and alerts you of this setting.

3.9 Reporting

To generate a report for a completed test or to open an existing test report, first open the test.

Access: "Home" > "Tests" > "Open" "... test"

Report generation procedure



1. Click "Add Report" to create a report based on a default report template.

If you use the "Add Report" button **without** a preselected report template in the "Report Templates" folder of the "Test Components" menu, a non-preconfigured ("empty") report opens.

Also, R&S ELEKTRA adds a non-preconfigured report template to the "Report Templates" folder.

For **better** report preconfiguration, proceed as follows:

2. In the "Test Components" dialog, if the "Report Templates" folder is not yet open, click its icon to open it.
3. Right-click the "Report Templates" folder.
A context menu opens.
4. Select one of the following options:
 - "New Report Template" is equivalent to "Add Report" without a preselected report template.
Selecting this option immediately creates a non-preconfigured report template and a report based on it.
 - "Add global Report Template" allows selecting from a list of standard report templates.

Selecting a template adds it to the "Report Templates" folder and immediately creates a report based on this template.

5. You can modify the report as described in [Chapter 4.5, "Report Templates"](#), on page 124.

To update the report contents, for example, if report template components or test contents have changed since creating the report, click "Refresh" (↻) in the *top menu of the report*. Do **not** confuse this button with the taller "Refresh" button (↻) in the *top menu of the test*.

To save a report in the R&S ELEKTRA database together with the test, select "Attach" (the paper-clip icon 📎). This action opens the "Reports" folder in the "Test Components" menu, where the attached report can now be seen. If the "Reports" folder is not open, click its icon to see attached reports.

Optionally, click the "Export" button (📄➔) or (📄➔) to save a report as a PDF or DOCX file in a selectable folder outside of the R&S ELEKTRA database.

To open a report in a separate window of a PDF file viewer program, or in Microsoft Word for DOCX, if installed, double-click the attached report in the "Test Components" menu.

4 Configuration

R&S ELEKTRA supports the creation of user-specific test cases for custom application scenarios.

This chapter describes the configuration of the following software components:

- The [Home menu](#) - see page 52
- The [Dashboard dialog](#) - see page 54
- [Tests](#) - see page 55
- [Test Templates](#) - see page 73
(with included hardware setup and [Limit Lines](#))
- [Report Templates](#) - see page 124
- The [Device List](#) - see page 130
(with the receiver, signal paths and various transducing devices)
- Various [Tables](#) - see page 159

This chapter also describes the use and configuration of the following:

- [Tools](#) - see page 168
- [Administrative settings](#) - see page 172

Related subjects:

- The [configuration wizard](#) is a tool for the application-specific generation of sample data and templates for tests.
- Measurement devices connected to the computer that runs R&S ELEKTRA can be automatically searched, checked and integrated into the [Device List](#).
- For an **overview** of the "Dashboard" dialog, see [Chapter 3.2, "Graphical user interface"](#), on page 37.
- For the most basic **action buttons**, see [Chapter 3.3, "Common action buttons"](#), on page 39.

4.1 Home menu

This chapter describes the configurable items in the "Home" view of the [Graphical user interface](#). You can configure settings in the dialogs of the home menu (or navigation menu, left) and in the title bar (top right).

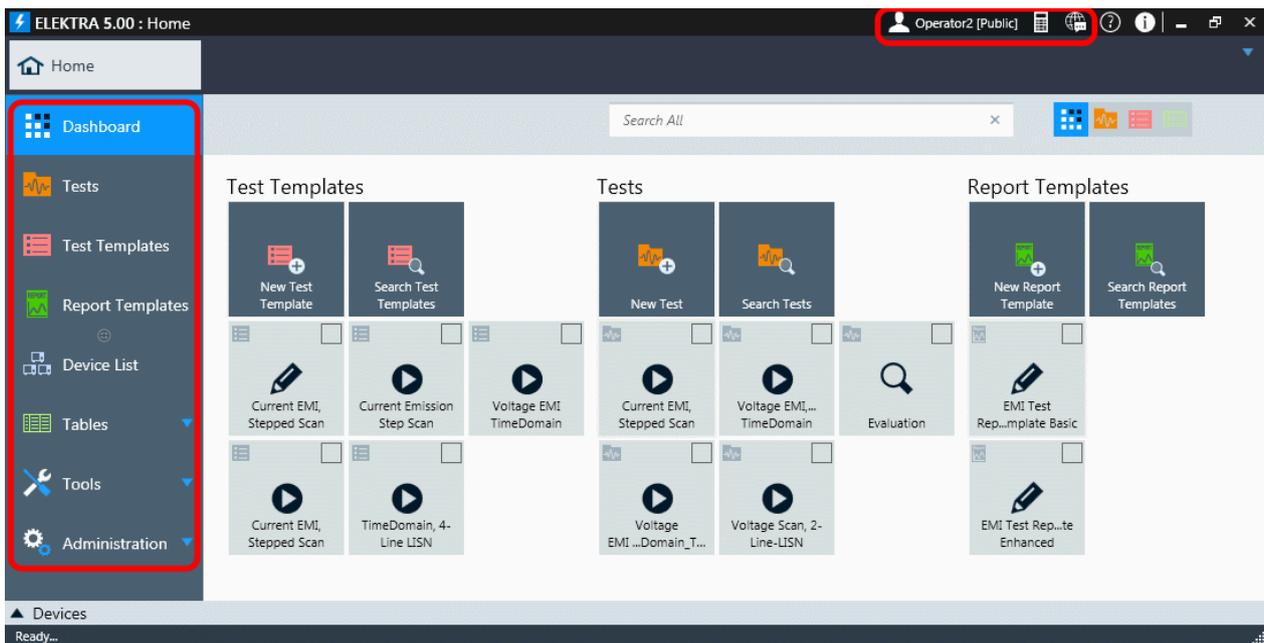


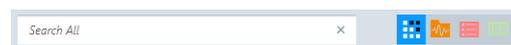
Figure 4-1: Configurable items in the home menu and in the title bar

Red frame at left hand = Configurable items in the home menu
 Red frame on top right = Configurable settings in the title bar

- The "Home" button shows the name of the active test site, if enabled. However, with an "ELEMI-E" license, only, you cannot change the test site.
- For a description of the configurable settings in the **title bar** (top), see below:
 - [User Information](#)
 - [Language selection](#)
- For the calculator  button, see [Unit Converter](#).
- For the help  button, see [Embedded help](#).
- For the info  button, see [Product information](#).
- For a description of the configurable items in the **home menu** (left), refer to the appropriate chapter, which you can select from the overview in [Chapter 4, "Configuration"](#), on page 52.
- For a description of the dashboard search, see [Chapter 6.2, "Dashboard search"](#), on page 199.



Dashboard search



Language selection

The language selection button  in the title bar selects one of the available language options. For description of the language settings, see [Chapter 2.5, "Language selection"](#), on page 26.



User Information

The user icon is available in the title bar only, if more users than the default "Admin" user are defined. To open the "User Information" dialog, click the icon.

The dialog displays the "Login" (= user name, see [User login](#)) together with your "Name", "Role" and all "Groups" assigned to you. You cannot edit this information here. Instead, only an administrator can edit it in the "User Admin" dialog, which is exclusively available to users with administration rights.

The "User Information" dialog also allows **changing your password**.

To do so, click the "Change Password" button to expand the dialog as in [Figure 4-2](#). Enter your current password in the field "Old Password". If an administrator has previously reset your old password, leave this field blank.

Then enter your new password in the field "New Password" and repeat it in the field "Confirm Password". No special rules and requirements apply to the length and complexity of your password or to the characters that you use. Complete the change of password by clicking "OK".

 A screenshot of the "User Information" dialog box. It contains several input fields: "Login" (Login-C), "Name" (Charlie), "Role" (Expert), and "Groups" (A1, B2, C3). Below these is a section titled "Change Password" with three sub-fields: "Old Password", "New Password", and "Confirm Password". At the bottom are "OK" and "Cancel" buttons.

Figure 4-2: User information dialog with some example data

If you have forgotten your password, ask an administrator to reset it.

4.2 Dashboard



Access: "Home" > "Dashboard"

The user-configurable "Dashboard" dialog (see [Graphical user interface](#)) displays the icons of **pinned** items. Use these icons like a jump list for one-click access to your favorite items. The configuration of this dialog is described in the section ["Handling pinned items"](#) on page 55.

To pin an item, select "Pin to Dashboard" . The pin icon changes to .

Access, for example: "Home" > "Test Templates"

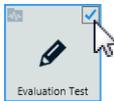
This function is available in many dialogs (such as "Tests" or "Test Templates"), but *not* in the "Home" > "Dashboard" dialog. For an example, see [Figure 4-3](#).



Figure 4-3: Pinning a component (here: a report template) to the "Dashboard" dialog

Once a component is pinned, it can be opened directly from the "Dashboard" dialog by clicking the item there.

Handling pinned items



To see [Details](#) of a pinned item and get access to the [Common action buttons](#) available for this item, check the checkbox in its top right corner.

Checking more than one item reduces the displayed details and action buttons to those details and buttons, which are commonly valid for the checked items.



You can limit the categories of pinned items to be displayed in the "Dashboard" dialog, see ["Dashboard: Show ..."](#) on page 182.

4.3 Tests

Tests are used to measure the electromagnetic interference of EUTs. Each test is based on a single [Test Template](#), which must be configured before running the test.

The [software structure](#) shows that a test contains one test template.

By creating a test and selecting a test template for it, all settings of this test template are copied into a newly generated [Test container](#). If the original test template is modified later on, its changes do not influence any previously created tests.



See [Chapter 7, "Running tests"](#), on page 209 for information on how to run tests and how to work with the [test control elements](#) in an opened test.

Handling test items



Access: "Home" > "Tests"

Depending on the selection of one or several tests, different action buttons are available in the actions bar. Most of them are common action buttons, described in [Chapter 3.3 on page 39](#). The dialog-specific action buttons for tests are:



"Delete" removes the selected one or more tests from the database. But if a test is associated with an EUT, deleting the test also removes it from the test plan of this EUT.

Deletion is protected with a confirmation warning.

For information on how to proceed from **"Create: Test"**, see [Chapter 4.3.1, "Configuring tests"](#), on page 56.

Use the "Open" button to view or configure selected tests (see [Configuring test charts](#) and [Configuring test tables](#)) or to evaluate the [Test results](#).

The following chapters describe how to configure tests, test charts and test tables.

- [Configuring tests](#)..... 56
- [Configuring test charts](#)..... 58
- [Configuring test tables](#)..... 68

4.3.1 Configuring tests

Access: "Home" > "Tests"

- ✚ Click "Create: Test" to generate a new test as described below.

Figure 4-4: New Test configuration dialog for EMI tests

Test Name

Specifies a test name. R&S ELEKTRA suggests a default name.

Specifying a test name is a prerequisite for creating a test.

Test Template

Selects a test template from a list of preconfigured items.

The configuration of test templates for EMI tests is described in [Chapter 4.4, "Test Templates "](#), on page 73.

Selecting a test template is a prerequisite for creating a test.

Limit Line

The limit line is *automatically* entered in this field by R&S ELEKTRA, when the test template is selected (which is obligatory), but *only*, if the test template contains exactly

one limit line. Afterwards, you can optionally select a different limit line from the list of preconfigured items. But if you do so and then select a test template *after* that, your limit line selection is overwritten by the setting in the test template.

If *no limit line is suggested* by the software upon selecting a test template, this lack of a suggestion can have two different reasons:

- The test template contains no limit line, which is indicated by a placeholder "<none>" in the empty "Limit Line" field
- The test template contains more than one limit line (for various frequency ranges), which is indicated by a placeholder "<Multiple Selection>" in the empty "Limit Line" field

In either case, you can decide:

- Leave this field blank. In this case, R&S ELEKTRA does not overwrite anything.
- Select any limit line. In this case, if different limit lines have been specified in the test template, R&S ELEKTRA *overwrites them all* with the limit line that you have selected.

Therefore, unless you are sure, we recommend leaving a blank limit line field blank in this instance, to avoid overwriting different limit lines in the test template's frequency ranges.

Instead of selecting a limit line in this field, we recommend to first create the test and then open the test template inside the test. This way, you can better decide, if a limit line (or different ones) needs to be selected.

The configuration of limit lines is described in [Chapter 4.7.1, "Limit Lines"](#), on page 163.

Selecting a limit line is optional for creating a test.

Report Template

Selects a report template from a list of preconfigured items.

The configuration of report templates is described in [Chapter 4.5, "Report Templates"](#), on page 124.

Selecting a report template is optional for creating a test.

Test Information

Allows specifying test information, especially such information that is valid for every test based on this template.

Click "Add Information"  to create more lines of information. Edit the "Title" and "Content" of each line as required.

To move a line up or down, first double-click it to highlight the whole line. You can also click once inside the line, but this click must be anywhere outside of the editable fields, hence the dark blue area in the following figure:



Once the line is highlighted, click the enabled up or down arrows to move the line.

To remove a line that you do not need, click the "Delete Information" button .

You can add individual, test-specific information per measurement in the [Test Components](#) dialog.

Specifying test information is optional for creating a test.

New Test



Click "New Test" to run an [EMI test](#) or "Cancel" to quit the test configuration immediately.

4.3.2 Configuring test charts

Access: "Home" > "Tests" > "Open" "... test"

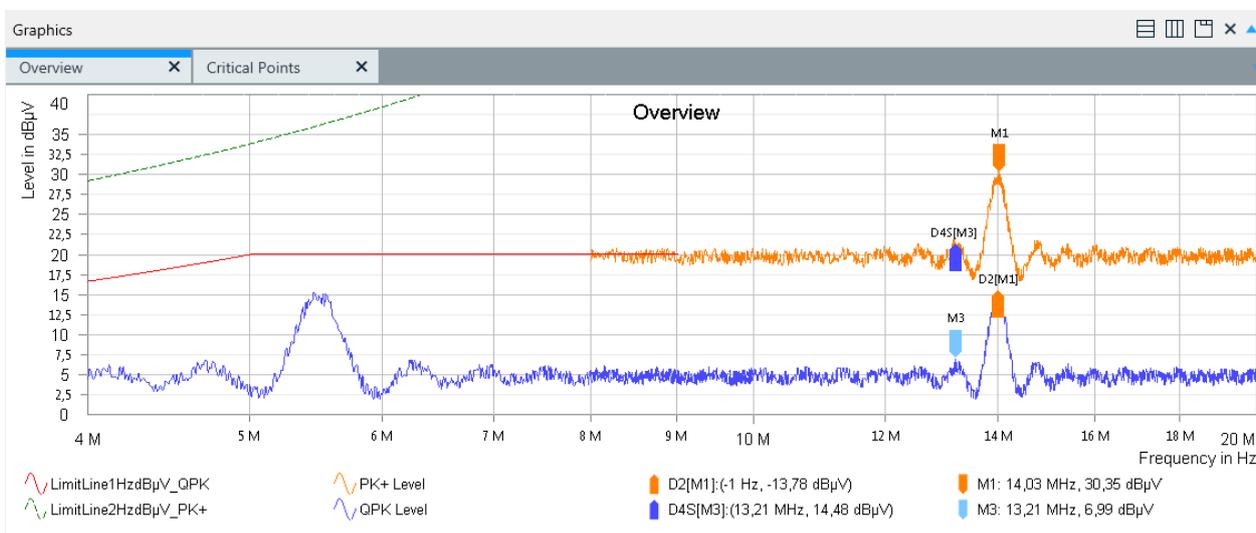


Figure 4-5: Example of an EMI test chart

PK+ Level = Trace of "Max Peak" detector measurements

QPK Level = Trace of "Quasi Peak" detector measurements (here: two frequency ranges, overlapping at 8 MHz to 10 MHz)

M1 = Marker 1 (in color of its own trace), see [Marker](#)

D2[M1] = Delta marker 2 (referenced to M1, in color of reference trace), see [Set Reference](#)

M3 = Unreferenced marker 3 (light blue = selected)

D4S[M3] = Synchronized delta marker 4 (referenced to M3, in color of reference trace)

In an existing EMI test (which has previously been executed and saved, as described in [EMI tests](#)), you can configure the test results presentation as described in the following chapters.

- [Chart](#)..... 59
- [Trace](#)..... 63
- [Marker](#)..... 65

4.3.2.1 Chart



Access: "Home" > "Tests" > "Open" "... test" > "Chart Menu" button 

In the charts configuration, you can determine how one or more charts are displayed and how the axes are scaled. You can determine the graphic properties and make the content of charts available outside of R&S ELEKTRA.

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Close / Close all.....	59
Arrange charts.....	59
Chart.....	60
L Connect Charts.....	60
L Set Logarithmic x-Axis in all Graphics.....	60
L Set Linear x-Axis in all Graphics.....	60
L Axis X.....	60
L X Axis Logarithmic.....	60
L Change scale.....	60
L Manual frequency scaling.....	60
L Do Autoscale.....	61
L Autoscale to measurement result.....	61
L Axis Y.....	61
L Y Axis Logarithmic.....	61
L Change scale.....	61
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L Do Autoscale.....	62
Copy To Clipboard.....	62
Save Image to File.....	62
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Graphics Properties.....	62
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Hide / show charts

The top "Graphics" bar toggles between hiding and showing all charts. If both graphics and tables are visible (half screen, each), hiding the graphics shows the tables in full size. Hiding the tables, too, leaves the two top bars visible, only. Opening the graphics while the tables are hidden shows the charts in full size.



Close / Close all

Closes the selected chart or all charts that are shown. To reopen closed charts, double-click their names in the [Test Components](#) side panel.



Arrange charts

To arrange charts horizontally, vertically or cascade them behind each other, use the buttons   . Available only, if more than one chart is open.

Chart

Right-clicking the chart and selecting "Chart" (or clicking the "Chart Menu" button ) provides access to the chart configuration functions described below. If more than one chart is open, clicking the "Chart Menu" button also requires selecting the chart for which you want to access the chart configuration functions.

Connect Charts ← Chart

Right-clicking a chart and selecting "Chart" > "Connect Charts" allows moving markers jointly in different charts. The connect function is available only, if at least two charts are present and at least one marker is set in one of the charts. Setting or moving a marker in another chart moves the "active" marker (the one that was selected last) in each of the connected charts to the same frequency.

Synchronized markers within the same chart remain synchronized, even when connected to a marker in a different chart. A marker in a connected chart is no longer displayed, if it moves out of the frequency range of "its" trace, while following a marker in a different chart. When it is moved back into that frequency range, it is displayed again.

Note that markers cannot be *referenced* to markers in other charts. Instead, display the trace in question within the same chart by "Add Trace" on page 64.

The joint movement of connected markers can best be seen in charts that are displayed next to each other by "Arrange charts" on page 59.

To terminate the connect function, click "Chart" > "Connect Charts" again. Deleting all markers in one chart also terminates the connect function.

Set Logarithmic x-Axis in all Graphics ← Chart

Right-clicking the chart and selecting "Chart" allows enabling "Set Logarithmic x-Axis in all Graphics".

Set Linear x-Axis in all Graphics ← Chart

Right-clicking the chart and selecting "Chart" allows enabling "Set Linear x-Axis in all Graphics".

Axis X ← Chart

Right-clicking the chart and selecting "Chart" > "Axis X" provides access to the X-axis configuration functions described below.

X Axis Logarithmic ← Axis X ← Chart

Toggles between logarithmic and linear X-axis. Alternatively, right-clicking the X-axis allows enabling or disabling the logarithmic scale.

Note: Logarithmic scale is not available, if zero or negative values are shown on the axis.

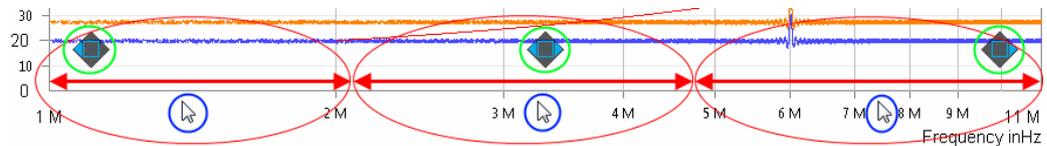
Change scale ← Axis X ← Chart

Opens a dialog to set the frequency range limits for the X-axis. Alternatively, right-clicking the X-axis and selecting "Change scale" opens the same dialog.

Manual frequency scaling ← Change scale ← Axis X ← Chart

Clicking, holding and horizontally drawing the mouse pointer in the left, center or right third of the X-axis allows a manual frequency scale adjustment:

- In the **left** third, the lower (left) end of the frequency scale is manipulated.
- In the **center** third, the whole frequency scale is shifted up or down.
- In the **right** third, the upper (right) end of the frequency scale is manipulated.



- Green circles = Direction indicators for manual scale adjustment of the frequency axis (only one indicator visible at a time)
- Red arrows in red ovals = Left 1/3, center 1/3 and right 1/3 of the frequency axis
- Blue circles = Mouse pointer positions in the left, center and right third of the axis

Do Autoscale ← Axis X ← Chart

Automatically adjusts the scale of the X-axis to the frequency range used for measurements. Alternatively, right-click the X-axis and select "Do Autoscale" or hit the [Shift] + [x] keys to do the same.

Autoscale to measurement result ← Axis X ← Chart

Truncates frequencies outside the measured range: R&S ELEKTRA adjusts the boundaries on the X-axis to the values displayed in the chart. Alternatively, right-clicking the X-axis and selecting "Autoscale to measurement result" allows doing the same.

Axis Y ← Chart

Right-clicking the chart and selecting "Chart" > "Axis Y" provides access to the Y-axis configuration functions described below.

Y Axis Logarithmic ← Axis Y ← Chart

Toggles between logarithmic and linear Y-axis. Alternatively, right-clicking the Y-axis allows enabling or disabling the logarithmic scale.

Note: Logarithmic scale is not available, if zero or negative values are shown on the axis.

Logarithmic Y-axis is not available for dB levels, because dB levels are logarithmic already.

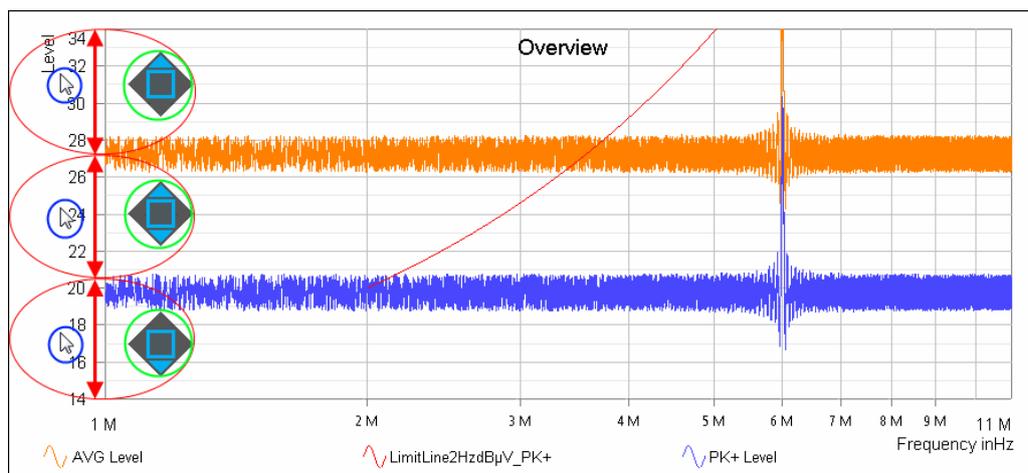
Change scale ← Axis Y ← Chart

Opens a dialog to set the level range limits for the Y-axis. Alternatively, right-clicking the Y-axis and selecting "Change scale" opens the same dialog.

Manual level scaling ← Change scale ← Axis Y ← Chart

Clicking, holding and vertically drawing the mouse pointer in the upper, middle or lower third of the Y-axis allows a manual level scale adjustment:

- In the **upper** third, the upper end of the level scale is manipulated.
- In the **middle** third, the whole level scale is shifted up or down.
- In the **lower** third, the lower end of the level scale is manipulated.



- Green circles = Direction indicators for manual scale adjustment of the level axis (only one indicator visible at a time)
- Red arrows in red ovals = Upper 1/3, middle 1/3 and lower 1/3 of the level axis
- Blue circles = Mouse pointer positions in the upper, middle and lower third of the axis

Do Autoscale ← Axis Y ← Chart

Automatically adjusts the scale of the Y-axis to a range that is a bit wider than the measured levels. Alternatively, right-click the Y-axis and select "Do Autoscale" or hit the [Shift] + [y] keys to do the same.

Copy To Clipboard

Right-clicking the chart and selecting "Copy To Clipboard" captures a screenshot bitmap of the active chart and copy it to the clipboard. Outside of R&S ELEKTRA, this bitmap chart can then be entered into any application that allows pasting graphics.

Save Image to File

Right-clicking the chart and selecting "Save to Image File" saves a screenshot bitmap of the active chart outside of R&S ELEKTRA in portable network graphics (PNG) format.

Store Zoom Settings

Saves the current view, when you have **zoomed** into a chart. The saved view with its individual zoom settings is available in the "Test Content" > "Graphics" section of the **Test Components** dialog, where you can rename it by a right-click. Double-clicking a saved view opens this chart with the stored zoom settings. Double-clicking a different saved view of the same graphic changes the view of the displayed chart accordingly. Double-clicking the basic node of the same graphic returns the displayed chart to its full view.

You can integrate the saved views directly into your **test reports**, see [Chapter 4.5.1, "Configuring report templates"](#), on page 125.

Graphics Properties

Right-clicking the chart and selecting "Graphics Properties" opens the "Chart Options" dialog to define the settings for **Graphics**, **Marker**, **Grid** and **Traces**.

While these settings are local for the currently opened graphic chart, the same settings can also be defined globally as a default for all new graphics, as described in [Chapter 4.9.3.3, "Graphics"](#), on page 184. However, the global settings do not influence tests that have already been created.

Note:

- The parameter "Show Pixel Mode" in the tab "Marker" > "Pixel Mode" specifies how markers are moved along traces (especially noticeable, if only a few frequency points are visible). If "Show Pixel Mode" is enabled, markers move from pixel to pixel between frequency (measurement) points. If disabled, markers can only jump from one frequency point to the next (see [Graphics > Marker > "Pixel Mode"](#)).
- The parameter "Peak Excursion" in the tab "Marker" > "Search" determines, whether local maxima qualify as peaks. For a definition of "Peak Excursion", refer to [Graphics > Marker > "Search"](#).

Print

Opens a dialog for printing the chart.

Zoom

Right-clicking the chart and selecting "Zoom" allows viewing enlarged sections of a chart ("zoom into a chart"). Zooming is done by drawing a rectangle with the left mouse button, to specify the area to be zoomed. In this way, multiple zooming into the same chart is possible. The first zoom can also be done by just drawing a rectangle, as long as the mouse pointer's origin does not collide with any object in the chart. A small copy of the whole chart, superimposed in the upper right corner, provides an overview of the zoomed area (dark rectangle) in relation to the whole chart area.

Using a tablet computer with [touch-sensitive display](#), test charts can be zoomed by stretching or shrinking them with two fingers ("pinch to zoom"): Zooming is done by touching and holding two opposite corners of the rectangular area that you want to zoom, then drawing your fingers apart or bringing them closer together.

Once zoomed, clicking and holding the chart's visible fraction allows dragging it to a different area of the full chart at the same zoom factor. Alternatively, the dark rectangle mentioned above can be dragged by clicking and holding it. However, avoid clicking the chart in a place that is occupied by a trace, line or marker, as this click would call up other functions.

The zoomed view is disabled by double-clicking the chart or by right-clicking the chart and selecting "Undo Zoom".

4.3.2.2 Trace

In the trace configuration, you can add or delete traces, move a trace to the front and set its properties.

Right-clicking the chart and selecting "Trace" provides access to the trace functions described below.

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L Constant Trace	64
L Result Trace from current Test	64
L Global Limit Line	64

L Global Attenuation / Transducer Corr.....	64
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Move Trace To Front.....	64
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L Line.....	64
L Symbol.....	64
L Vertical Line To the Bottom.....	65

Add Trace

Right-clicking the chart and selecting "Trace" > "Add Trace" allows selecting the kind of trace to be added as described below.

Constant Trace ← Add Trace

Adds a horizontal line in the chart with a user-defined trace name and a constant level (Y) value.

Result Trace from current Test ← Add Trace

Adds a trace from another column selected in the result table of the current test.

Use this option for comparing this trace of the current test with other traces from the same test.

Global Limit Line ← Add Trace

Adds a trace from a column in "Tables" > "Limit Lines".

Global Attenuation / Transducer Corr. ← Add Trace

Adds a trace from "Tables" > "Attenuation" or from "Tables" > "Transducer Correction".

Delete Trace

Right-clicking the chart and selecting "Trace" > "Delete Trace" allows selecting a trace and deleting it.

Move Trace To Front

Right-clicking the chart and selecting "Trace" > "Move Trace To Front" allows selecting a trace and moving it to the front.

Trace Properties

Right-clicking the chart and selecting "Trace" > "Trace Properties" opens a dialog that defines the following trace settings. Alternatively, this dialog can be accessed by right-clicking a *trace* and selecting "Trace Properties".

Traces ← Trace Properties

Selects the trace, limit line or symbol trace to be configured.

Line ← Trace Properties

Specifies "Color", "Thickness" and "Style" of the selected trace.

Symbol ← Trace Properties

Specifies "Color", "Size" and "Shape" of symbols on the selected trace.

Vertical Line To the Bottom ← Trace Properties

Specifies "Color", "Thickness" and "Style" of lines that connect symbols on the selected trace to the lower edge of the chart.

4.3.2.3 Marker



Access: "Home" > "Tests" > "Open" "... test" > "Marker Menu" button 

In the marker configuration, you can add or delete markers, reference markers to each other or move them to specific positions. The [Pixel Mode](#) determines the step size for moving markers. To specify default marker properties such as flag colors and "Peak Excursion", use the "Home" > [Administration](#) > [Settings](#) > [Graphics](#) > [Marker](#) dialog.

All markers have a name label and, by default, a flag with the same color as "their" trace or as the trace of the referenced [Delta](#) marker.

To select a marker, click it directly or click its legend entry. The selected marker (or selected last, if multiple markers are present) is identified by a light blue flag, if color is enabled in the [Graphics Properties](#). This blue "highlighting" color temporarily overrides the original flag color.

Moving markers manually

Click and hold a marker to drag it to any position on the same trace. Alternatively, you can use the left and right arrows on the keyboard or the mouse wheel to move the selected marker. (In [Pixel Mode](#), these steps can be too small to see them without zooming.)

Moving markers automatically

Right-click a marker to select one of the following marker positioning functions:

- "Marker" > [To Peak](#)
- "Marker" > [To Next Peak](#)
- "Marker" > [To Min](#)
- "Marker" > [To Next Min](#)
- "Marker" > [To Position](#)
- "Marker" > [To Trace](#)

Alternatively, right-click the *chart* to select one of these functions for positioning the selected (highlighted) marker.



Be aware of the following:

- Synchronized markers always move jointly.
- Selected markers in other charts also move, if [Connect Charts](#) is activated.
- The moving behavior of markers is influenced by the [Pixel Mode](#) setting.

Right-clicking the chart and selecting "Marker" (or clicking the "Marker Menu" button ) provides access to the marker functions described below. If more than one chart is

open, clicking the "Marker Menu" button also requires selecting the chart for which you want to access the marker configuration functions.

Add To Trace.....	66
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└ To Next Peak.....	67
To Min.....	67
└ To Next Min.....	67
To Position.....	67
To Trace.....	68
Delete Marker.....	68

Add To Trace

Allows selecting the trace, to which a new marker is to be set, and adds the marker to this trace.

- If the marker that you set is the first one in this chart, it is immediately set to the peak of the selected trace.
- If one or more other markers are already present in the chart, R&S ELEKTRA opens a context dialog that offers three selections:
 - "Trace" - allows changing the trace that you have selected for the marker
 - "Reference Mode" - specifies if and how the marker is referenced to another marker, see [Set Reference](#)
 - "Reference Marker" - specifies to which other marker the new marker is referenced (not available for "Reference Mode" = "None")

If the [Reference Mode](#) is set to "None", R&S ELEKTRA places the new marker at the trace's peak.

Alternatively, directly double-clicking a *trace* and confirming the defaults in the "Add New Marker" dialog allows placing a new marker on the trace. Unless you have selected to [synchronize](#) the marker, it is placed at or near the mouse click position.

Note: If you double-click a trace to add a new marker, but the chart is [zoomed](#), your double-click first disables the zoom. To add the new marker, double-click the trace again.

Set Reference

Opens a dialog for specifying a "Reference Mode" for any two markers.

Alternatively, directly right-clicking a *marker* and selecting "Set Reference" opens the same dialog, with this marker preselected.

To set a reference, first select a "Marker" (or keep the preselected marker), then select one of the following options for the "Reference Mode":

- **"Delta"** shows the level difference value of the two referenced markers in the legend
- **"Synchronized"** locks the two markers to the same frequency (available only for markers on different traces)
- **"SynchronizedDelta"** locks two markers on different traces to the same frequency *and* calculates their delta
- **"None"** leaves the selected marker unreferenced with any other marker (= default)

Finally, select the "Reference Marker" from a list of markers that are available for referencing (not available for "Reference Mode" = "None").

Pixel Mode

Opens a dialog for activating or deactivating the "Pixel Mode" function.

- If enabled, a marker can move from pixel to pixel on the display between the frequency (measurement) points.
- If disabled, the marker can only jump from one frequency point to the next. The effect of this setting becomes especially noticeable, if only a few frequency points are visible, for example when zooming deeply into a trace.

Alternatively, the setting can be accessed by right-clicking a *marker* and selecting "Pixel Mode", or by right-clicking the chart and selecting [Graphics Properties](#) > "Marker" > "Pixel Mode" > "Show Pixel Mode".

The global setting for "Show Pixel Mode" can be altered at "Home" > [Administration](#) > [Settings](#) > [Graphics](#) > [Marker](#) > "Pixel Mode". However, **this setting does not influence any test** that has already been created.

To Peak

[Automatically moves](#) a marker to the peak value of a trace.

To Next Peak ← To Peak

[Automatically moves](#) a marker to the next peak value of a trace, if it has previously been set to the overall peak ("To Peak"). Moving a marker to the next peak can be repeated until the limit is reached that is specified by the parameter "Peak Excursion". This parameter is defined by clicking the chart and selecting "Graphics Properties" > "Marker". Defaults are defined at "Home" > [Administration](#) > [Settings](#) > [Graphics](#) > [Marker](#).

Note: Specifying the "Peak Excursion" in the [Graphics Properties](#) menu does not influence a test that has already been created.

To Min

[Automatically moves](#) a marker to the minimum value of a trace.

To Next Min ← To Min

[Automatically moves](#) a marker to the next minimum value of a trace, if it has previously been set to the overall minimum ("To Min").

Moving a marker to the next minimum can be repeated until the limit is reached that is specified by the parameter "Peak Excursion". This parameter is defined by clicking the chart and selecting "Graphics Properties" > "Marker". Defaults are defined at "Home" > [Administration](#) > [Settings](#) > [Graphics](#) > [Marker](#).

Note: Specifying the "Peak Excursion" in the [Graphics Properties](#) menu does not influence a test that has already been created.

To Position

[Automatically moves](#) a marker to a user-defined frequency. If this marker is synchronized with another marker, both are moved jointly to the new frequency position.

To Trace

Automatically transfers a marker to another trace or limit line. Note that a marker cannot be transferred to a trace or limit line where the same frequency position is already occupied by a synchronized marker. R&S ELEKTRA only offers the appropriate choice of targets.

Delete Marker

Allows selecting one specific marker or "All Markers" to be deleted.

Alternatively, right-clicking a marker and selecting "Delete Marker" offers the same choice.

4.3.3 Configuring test tables

Access: "Home" > "Tests" > "Open" "... test"

Name	Rg	Frequency	QPK Level	QPK Limit	QPK Margin	CAV Level	CAV: AVG Limit	CAV Margin	Correction	Meas. BW	Meas. Time	Time of Meas.	Source	Comment
Unit		MHz	dBμA	dBμA	dB	dBμA	dBμA	dB	dB	kHz	ms			
9	1	3.728	20.10	30.00	9.90				-8.84	9.000	2.000.000	10:48:24	Critical Points	
10	1	3.730				10.21	20.00	9.79	-8.84	9.000	2.000.000	10:48:24	Critical Points	
11	1	11.227	29.84	30.00	0.16				-8.73	9.000	2.000.000	10:48:24	Critical Points	
12	1	11.263				20.00	20.00	0.00	-8.73	9.000	2.000.000	10:48:24	Critical Points	
13	1	18.780	39.55	30.00	-9.55				-8.88	9.000	2.000.000	10:48:24	Critical Points	
14	1	18.809				29.70	20.00	-9.70	-8.88	9.000	2.000.000	10:48:24	Critical Points	
15	1	26.306	49.78	30.00	-19.78				-8.90	9.000	2.000.000	10:48:24	Critical Points	

Figure 4-6: Example of a final results table in an EMI test

EMI test tables contain the following columns:

- "Rg" - the frequency range number
- "Frequency" - the frequency points
- The "Level", "Limit" and "Margin" values for each **detector** selected in the **test template** (with **Margin** = "Limit" minus "Level")
- "Correction" - the accumulated amount of "Attenuation" and "Measurement Correction" specified for the **Signal Path** and **LISN** or **Transducer** used in this measurement
- **Meas BW** - available only in "Critical Points" tables and "Final Results" tables
- "Meas. Time" - **per point**, available only in "Critical Points" tables and "Final Results" tables
- "Time of Meas." - available only in "Final Results" tables: R&S ELEKTRA automatically enters the date and time of the measurement. To toggle between a display of time only, or date and time, use the **Show / Hide Column Headers** button  to activate the "Accuracy" header. This header lets you select either "Date/Time" or just "Time".
- "Source" - available only in "Final Results" and "Critical Points" tables:
 - In the "Critical Points" table: The frequencies in the critical points table and in the final measurement can originate, for example, from steps in the **Data Reduction** or from **interactive measurements**.
 - In the "Final Results" table: The measured values originate from the "Critical Points" or from "Interactive" measurements (individually **recorded**).

- "Comment" - content (which you can edit) depends on the kind of table:
 - In the "Overview" table: You can enter arbitrary comments in any cell of the "Comment" column.
 - In the "Critical Points" table: R&S ELEKTRA automatically enters the names of detectors, with which a critical level value was detected in the overview measurement at this frequency point.
 - In the "Final Results" table: During an [Interactive measurement](#) , your comments from the [Measurements](#) dialog are automatically entered in the new rows that are generated in this table.

If your test uses [Loop Parameters](#), the EMI test table can have the following additional columns:

- "Polarization"
Axis X/Y/Z of DUT orientation if there is a GTEM cell.
- "Line"
Label of the LISN line, if available, for example "N" or "L1". See also [Chapter 7.4, "Test result graphics"](#), on page 231.



To sort the table rows by any of the columns, click the column's name header. Click the name header again for reverse order.

For the default and optional headers of test tables, see [Table Headers](#).

For information on how to work with tables, see [Test result tables](#).

You can configure tables by the following functions:

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Select cells	70
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Paste	71
Add new row	71
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Set default sorting	72
Auto Scroll	72
Sort table	72
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L Accuracy	72
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L Base Unit	73



Hide / show tables

The top "Graphics" bar toggles between hide and show all tables. If both graphics and tables are visible (half screen, each), hiding the tables shows the graphics in full size. Hiding the graphics, too, leaves the two top bars visible, only. Opening the tables while the graphics are hidden shows the tables in full size.



Close / Close all

Closes the selected table or all tables that are shown. To reopen closed tables, double-click their names in the [Test Components](#) side panel.



Arrange tables

To arrange multiple tables horizontally, vertically or cascade them behind each other, use the buttons .

Select cells

A single cell is selected by clicking it directly. Selected cells are marked by bold content.

Multiple individual cells (not necessarily adjacent) are selected by pressing [Ctrl] while clicking the cells to be selected. You can also unselect previously selected cells by this combination of pressing [Ctrl] and clicking the cells. In tablet operation, selecting multiple cells requires to bring up the on-screen keyboard, tap [Ctrl] and then tap the cells to be selected.

A single row of cells is selected by clicking the row header. Selecting all cells in a row is equivalent with selecting the whole row. Selected rows are highlighted by a blue background color together with bold cell content.

Multiple adjacent rows of cells are selected by clicking the first row header, then pressing [Shift] and clicking the last row header. In tablet operation, bring up the on-screen keyboard, tap the first row header, then tap [Shift] and tap the last row header.

A rectangular range of cells is selected by clicking a cell in one corner of the rectangle, then pressing [Shift] and clicking the cell in the opposite corner of the rectangle. This procedure is also used to select one single or multiple columns. Note that the scrollbars can be used between clicking the two corner cells. In tablet operation, selecting multiple rows requires the following steps: Bring up the on-screen keyboard, tap a cell in one corner of the rectangle, tap [Shift] and tap the cell in the opposite corner of the rectangle. If you want to use the scrollbars between tapping the two corner cells, proceed as follows: First tap one corner cell, then scroll to the opposite corner cell, tap [Shift] and tap the opposite corner cell. If a relevant part of the table is hidden by the on-screen keyboard, undock it. Once the on-screen keyboard floats, it can be moved out of the way.

An alternative for selecting a rectangular range of cells is clicking a cell and using the [Shift] + [Arrow] keys to define the selection. The [Ctrl] key can be used in combination with the [Arrow] keys to jump to the first or last row or column.

You can select also [the whole table](#).



Delete rows

Deleting is available only in tables that are not controlled by a test template, for example the "Critical Points" table. Thus, it is not permitted in the "Overview" and "Final Result" table.

To delete values of selected cells from a table, right-click any selected cells and select "Delete rows", or click the "Delete rows" button .



Copy

To copy values from selected cells into the clipboard, right-click the cells and select "Copy", or click the "Copy" button , or press [Ctrl] + [C]. The copied values can be inserted in a new position by [Paste](#).



Paste

To paste [cut](#) or [copied](#) values from the clipboard into a table, right-click the new (first) cell position and select "Paste", or click the "Paste" button , or press [Ctrl] + [V].



Add new row

Adding rows is available only in tables that are not controlled by a test template, for example the "Critical Points" table. It is not permitted in the "Overview" and "Final Result" table.

To insert a new row, right-click a row header or a cell and select "Insert new row before". The new row is then inserted above the row that has been clicked.

To add a new row at the end of the table, click the button  and select "Add new row".

To delete selected rows, click the button  while the rows are highlighted and select "Delete rows".



Show / Hide Columns

To show or hide [columns](#) of a table selectively, right-click any column header and select "Show / hide columns". In the list of available columns, tick the columns to be shown and untick the columns to be hidden. Alternatively, click the "Show / hide columns" button  and activate or deactivate the individual columns in the list accordingly. You cannot hide the columns "Rg" (frequency range number) and "Frequency" (frequency points).

If you enable the checkbox "Use Report Relevant Column" for this table in the report template, the hidden columns are not shown in the report, either. Instead of the column selection in the report template, the report shows and hides the columns as selected in the "Show / Hide Columns" dialog. You can show a column in the GUI but hide it in the report by deactivating it using . See [Chapter 4.5.1, "Configuring report templates"](#), on page 125. Saving the test also saves the selection of columns.



Show / Hide Column Headers

To show or hide individual column headers described below, right-click any column header and activate or deactivate either of them. Alternatively, click the "Show / Hide Column Headers" button .

- [Detector](#) shows the selected [Detector types](#) in level, limit and margin columns, but does not allow modifying the selection.
- [Accuracy](#) adjusts the decimal fraction of the values in the selected column.
- [Base Unit](#) shows the selected base units, but does not allow modifying them.



Select Table

Selects all cells of a table. Alternatively, click any header of the first column or press [Ctrl] + [A] or right-click any cell in the table and select "Select Table".



Show Graphic Display

Generates a graphic representation of selected table contents. Alternatively, right-click any cell and select "Graphic Display". A dialog opens up to select the columns to be displayed. The dialog allows also selecting either the generation of a new chart or the integration of the selected column's data into an existing chart.



Export to CSV file format

Exports a table's contents to a file in `.csv` format (comma-separated values). A dialog opens up to specify the target folder and filename.

For importing such files, see ["Importing tables"](#) on page 161. For exporting table contents to an Excel file, use [copy and paste](#).



Set default sorting

Re-establishes a table's original order. Typically, a table is sorted per default by increasing frequency values.



Auto Scroll

Auto Scroll

Facilitates reading the "Final Results" or "Critical Points" table during a measurement: Enabling the checkbox keeps the row that shows the currently measured frequency point within the display area.

Sort table

To sort the table's rows by the values in the "Rg" (frequency range number) or "Frequency" column, click this "Name" header. Click this header again for reverse order.

Table Headers

The [Name](#) and [Unit](#) headers are always visible, the optional [Detector](#) header is enabled per default. You can also enable [Accuracy](#) and [Base Unit](#).

Name ← Table Headers

Shows the name of the column, as in [Figure 4-6](#). You can change the order of rows by clicking the "Rg" or "Frequency" header. In detector columns, the name consists of an abbreviation for the [Detector](#) name and the type of trace, which can be "Level", "Limit" or [Margin](#).

Unit ← Table Headers

To select one of the optional units for an individual column, click its "Unit" header. The software automatically converts the displayed values.

Example:

If the unit is "kHz" and the displayed value is "2,000", changing the unit to "MHz" changes the displayed value to "2".

If the unit is "dBV" and the displayed value is "-137", changing the unit to "dBμV" changes the displayed value to "-17".

Accuracy ← Table Headers

Specifies the number of decimal places of the values displayed in the selected column. You can set this parameter from 0 to 8 decimal places.

"Accuracy" is available only, if it is enabled at [Show / Hide Column Headers](#).

Detector ← Table Headers

Displays the full name of the [measurement detector](#), which is abbreviated in the "Name" header. The detector cannot be changed in this column, which is available only, if it is enabled at [Show / Hide Column Headers](#).

Base Unit ← Table Headers

Displays the base unit of the column. The base unit cannot be edited in this column, which is available only, if it is enabled at [Show / Hide Column Headers](#).

4.4 Test Templates

Test templates are used to **configure EMI Tests**. The [software structure](#) shows that a test contains one test template, which contains hardware setups along with [Limit Lines](#) and user-definable configuration settings.



Types of test templates

- 1) A test template that you create and save with your settings can be considered as a **"global" test template**.
- 2) When you create a test based on a test template, a **copy** of this test template is **integrated** into the [Test container](#).

The differences between these two types of test templates are:

- **Global** test template
 - Is available at "Home" > "Test Templates"
 - Allows creating tests
 - Allows modifying device properties from within the test template dialog
 - Changing settings in a global test template has no influence on existing tests
- **Copy** of a test template in a test container
 - Is available only within the test, into which it is integrated
 - Exclusively controls the test, into which it is integrated and cannot be used for creating other tests
 - Does not allow modifying device properties from within the test template dialog
 - Changing settings in this copy in an executed test requires clearing the test to keep its results consistent with the test settings, see ["Clear Results"](#) on page 214

Handling test template items



Access: "Home" > "Test Templates"

Depending on the selection of one or several test templates, different action buttons are available in the actions bar. Most of them are common action buttons, described in [Chapter 3.3, "Common action buttons"](#), on page 39. (For information on how to pro-

ceed with **"Create: Template"**, see ["Configuring test templates"](#) on page 74.) The dialog-specific action buttons for test templates are:

 "Pin to Dashboard (Create Test)" adds the selected test templates to the "Dashboard" with the function of directly creating a test (see "Create test from template" .

 "Unpin from Dashboard (Create Test)" removes the selected test templates from the "Dashboard" with the function of directly creating a test (described above).

 "Create test from template" applies the selected test template for directly creating a test. From here, you can continue with [step 2](#) of the procedure [Creating and running tests](#).

Note that this action button is available in the actions bar only, if one single test template is selected in the "Test Templates" dialog.

 Clicking the  button and then clicking the pop-up "Open test configuration" applies the selected test template for configuring a test.

The "New Test" dialog opens, see [Configuring tests](#).

 "New Test" creates a test based on the selected test template. Hence, using "New Test" in the "Test Templates" dialog is an abbreviation of the procedure described in [Chapter 4.3.1, "Configuring tests"](#), on page 56: Now, you do not have to first select a test type. Instead, the test type of the selected test template is used. Therefore, the new test configuration dialog (for example [Figure 4-4](#)) is preconfigured. Note that the "New Test" action button is available only in the "Test Templates" dialog, if one single test template is selected.

Configuring test templates

Access: "Home" > "Test Templates"

 Click "Create: Template" to generate a new [EMI test template](#). The following chapter explains how to configure a test template.

 In a new EMI test template, the "General Settings", the "Measurement Flow" settings and the "Actions" are available only, when you have selected a test receiver. If the [Receiver](#) in your [Device List](#) is [Set as Favorite Device](#), R&S ELEKTRA automatically preselects it in new EMI test templates.

A default EMI test template is partly preconfigured by R&S ELEKTRA as in [Figure 4-7](#).

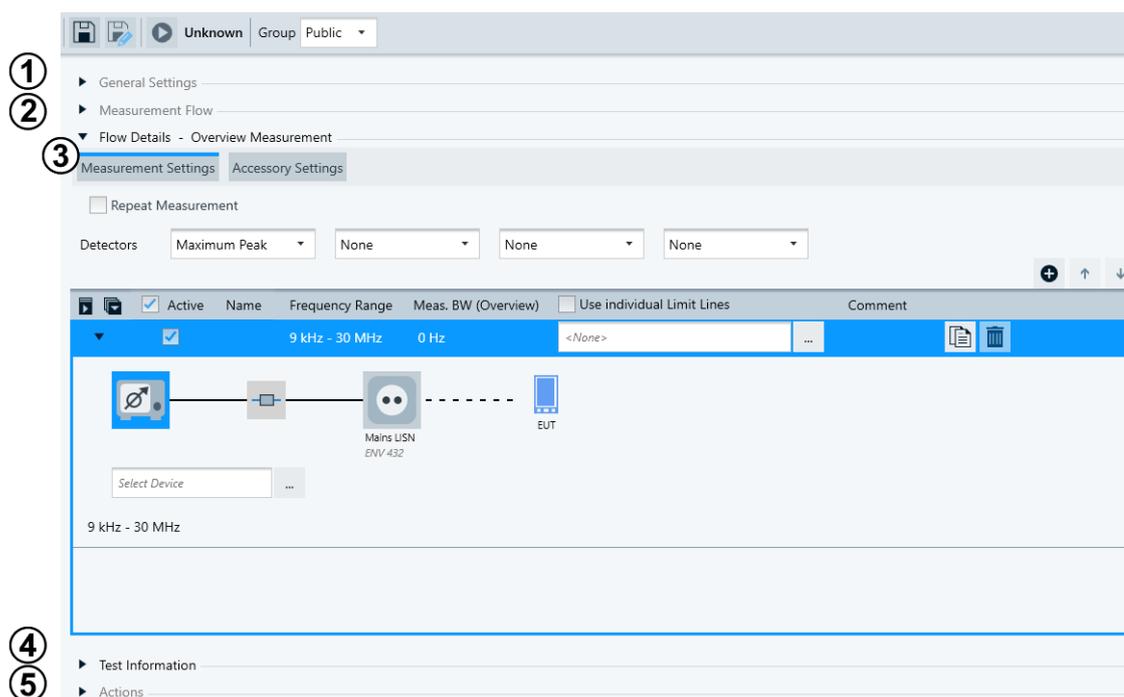


Figure 4-7: Default test template for EMI tests

- 1 = [General Settings](#) globally relevant for the test execution
- 2 = [Measurement Flow](#) settings for overview measurement, data reduction and final measurement
- 3 = [Flow Details](#) (here: one frequency range, only)
- 4 = [Test Information](#) (can be edited also in a [test components dialog](#))
- 5 = [Actions](#) with settings relevant for user interaction during tests

For a configuration example, see [Figure 4-8](#).

The screenshot displays the configuration interface for an EMI test template. The top section, 'General Settings', includes tabs for 'Setup', 'Optional Settings', and 'Report'. Under 'Setup', the 'Operating Mode' is set to 'Test Receiver', 'Scan Mode' is 'Stepped Scan', 'Audio Demodulation Type' is 'OFF', and 'Level Range (Graphics)' is '0 - 80 dBµA/m'. The 'Measurement Flow' section shows a sequence of steps: 'Overview Measurement', 'Spectrum Overview', 'Data Reduction', 'Critical Points', 'Final Measurement', and 'Final Results'. The 'Flow Details - Overview Measurement' section shows 'Repeat Measurement' set to 'By Software' and 'Repetition Mode' set to 'Time Interval' with a value of '10 s'. The bottom section is a table of measurement settings for two frequency ranges: '9 kHz - 150 kHz' and '150 kHz - 30 MHz'. The first row has 'Meas. BW (Overview)' set to '200 Hz', 'CISPR BW' set to 'Auto', 'Input Selection' set to '1 DC', 'RF Attenuation' set to 'Auto', 'Min. Attenuation' set to '0 dB', and 'Preamplifier' set to '0 dB'. The second row has 'Meas. BW' set to '9 kHz', 'CISPR BW' set to 'Auto', 'Input Selection' set to '1 DC', 'RF Attenuation' set to 'Auto', 'Min. Attenuation' set to '0 dB', and 'Preamplifier' set to '0 dB'.

Figure 4-8: Example of a fully configured EMI test template with radiative transducer

In [Figure 4-8](#), the EMI test template example is configured with the following settings:

General Settings

- **Setup** provides the following settings:
 - **Operating Mode** = "Test Receiver"
 - **Scan Mode** = "Stepped Scan"
 - **Audio Demodulation Type** = "OFF" (which leaves the **Volume** setting idle)
 - **Level Range (Graphics)** from 0 dBµA/m to 80 dBµA/m

- LOG X-Axis is enabled.
- [Graphics Settings](#) allows selecting additional limit lines to be displayed.
- [Report](#) allows selecting a default report template.

Measurement Flow allows selecting the test phase to be configured:

- The [Overview Measurement](#) test phase is highlighted, therefore its settings are available in the [Flow Details](#) section.
- The [Data Reduction](#) test phase is not highlighted, its settings are summarized in brief below the icon.
- The [Final Measurement](#) phase is enabled but not highlighted, its settings are summarized in brief below the icon, for example the [detectors](#) "Quasi Peak", "Minimum Peak", "CISPR Average" and "RMS Average".

Flow Details, here for the "Overview Measurement" test phase highlighted above:

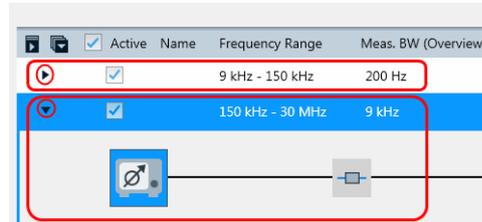
- The [Measurement settings](#) dialog is selected.
The available dialogs are either [Measurement Settings](#) and [Trigger](#) or [Data Reduction Settings](#), depending on the test phase in the "Measurement Flow".
- The [Repeat Measurement](#) option is enabled.
- Four [Detectors](#) for the overview measurement, here "Maximum Peak", "Minimum Peak", "Average" and "RMS"
- A first [Frequency Range](#), here *9 kHz to 150 kHz*.
See section [Various frequency range statements in the dialog](#) for more details.
- The "Meas. BW (Overview)", here *200 Hz*, is displayed next to the frequency boundaries. You can specify it in the [settings for the overview measurement](#).
- A [Limit Line](#) with the name "EN 55011 M Field 3m QP Group 2 Class B" is selected from the list of limit lines.
- The checkbox for [individual limit lines](#) is activated, enabling different limit lines for different frequency ranges.
- No [Offset](#) for the limit line is specified.
- Some arbitrary [Comment](#) text is entered, here "*Customer xyz*".
- For the highlighted receiver device icon, the [settings for the overview measurement](#) are configured, including, for example, the [Meas. BW = 200 Hz](#), the [Step Size = 50 Hz](#), "Auto" ranging for the [RF Attenuation](#) and the [Preamplifier = 0 dB](#).
For the same selected (highlighted) receiver icon, the dialog also provides access to the [Settings \(Final\)](#).
- The [Signal Path](#) Receiver - LoopAntenna and the [Transducing Device](#) Magnetic Loop Antenna are selected.
Note that there is a "Select Device" field and a  button available below each device icon for selecting this device. Instead of an antenna, you can select other types of transducers, including LISNs and TEM waveguides.
- The [Properties](#) of the hardware setup's devices as specified in the [Device List](#) are not shown in this figure.
- An additional second frequency range, here *150 kHz to 30 MHz* (not expanded in this figure), with the same limit line
- The [Test Information](#) dialog is not shown in this figure.

- The **Actions** settings dialog is not shown in this figure (see [Figure 4-28](#)).



Minimize frequency ranges

For best access to all frequency ranges within a limited display area, each of the frequency ranges can be minimized like the first frequency range in this example:



Or use the scrollbar, to shift the frequency range that you want to edit into the display area.

The following chapters explain how to configure an EMI test template.



For information on how to execute a test, see [Chapter 7, "Running tests"](#), on page 209.

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4.4.1 General Settings

General Settings

This dialog provides access to several settings that are relevant independent of the type of measurement.

In a new test template, the "General Settings" are available only, when you have selected the **Receiver** in the **Hardware Setup**. To have the **Receiver** selected automatically in each new test template, set it as your favorite in the device list. See [Set as Favorite Device](#).

The software automatically configures several settings in the background, for example the **"Filter Type"**:



"Filter Type"

The "Filter Type" defines the bandwidth of the measuring filter (IF filter). R&S ELEKTRA automatically sets the IF filter bandwidth to 6 dB, if the [Receiver](#) supports this filter type. If it does not support 6-dB filters, R&S ELEKTRA automatically sets the IF filter bandwidth to 3 dB.

- A normal Gaussian filter with a 3-dB filter bandwidth approximately matches the noise bandwidth.
- EMI filters with a 6-dB filter bandwidth comply with CISPR and MIL standards. In the context of EMI tests, the 6-dB definition is more common, since it approximately matches the *equivalent pulse bandwidth* of broadband signals.

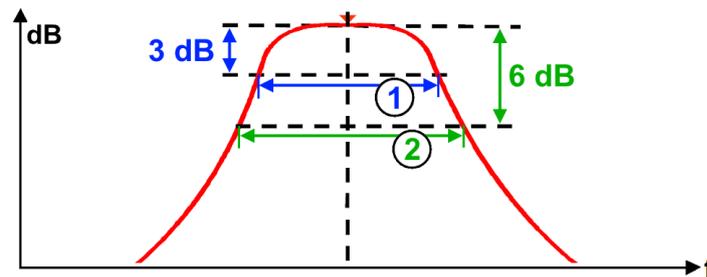


Figure 4-9: Definition of filter bandwidths

- dB = Level in decibels
 f = Frequency
 3 dB = Signal level 3 dB down from peak
 6 dB = Signal level 6 dB down from peak
 1 = Bandwidth at a level 3 dB down from peak
 2 = Bandwidth at a level 6 dB down from peak

The selected filter type is shown in the test report, if you configure the [Report Template](#) to include the "EMI Test Template" and to "Show Details" of this template.

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Setup

Specifies some basic settings for the test template.

Operating Mode ← Setup

Specifies the type of [Receiver](#):

- "Test Receiver" Operate your measuring device in test receiver mode to perform scan measurements. This mode also enables selecting a [Scan Mode](#), if the receiver offers both "Stepped Scan" and "Time Domain Scan".
- "Spectrum Analyzer" Operate your measuring device in spectrum analyzer mode to perform sweep measurements. During final measurements, the device performs sweeps in zero span mode.

Scan Mode ← Setup

[Scan](#) modes are available only, if the [Operating Mode](#) is "Test Receiver" (not "Spectrum Analyzer"), and if the test receiver is capable of both "Stepped Scan" and "Time Domain Scan". For a Rohde & Schwarz test receiver, make sure that software option "Time Domain Scan" is available, for example R&S ESR-K53, and that "K53" is enabled in the [Receiver](#) properties. See "Options" in [Chapter 4.6.3, "General properties"](#), on page 143.

- "Stepped Scan" With this selection, R&S ELEKTRA performs conventional scans.

"Time Domain" With this selection, R&S ELEKTRA enables fast scans with support of fast Fourier transform (FFT) algorithms. As this scanning mode is faster than stepped scans, "Time Domain" is typically the preferred selection, if available.

As a special feature only with an R&S ESW [Receiver](#) and only with firmware version 1.70 or later, R&S ELEKTRA offers the following time-domain scan modes:

- "TD Automatic" ensures compliance with CISPR 16-1-1. With CISPR detectors, it makes the R&S ESW receiver optimize the measurement as in "TD Max Dynamic" mode, with non-CISPR detectors, the automatic mode is identical to "TD Max Speed".
- "TD Max Dynamic" ensures compliance with CISPR 16-1-1. It uses a capability of R&S ESW receivers for optimizing the time domain scan with a small analysis bandwidth in favor of a high dynamic range, regardless of the detector. Consider selecting this mode, for example, if your signal requires enhanced measurement sensitivity for narrowband interferers in the presence of continuous-wave signal components.
- "TD Max Speed" uses a capability of R&S ESW receivers for optimizing the time domain scan with a large analysis bandwidth towards enhanced speed, reducing the dynamic range and sensitivity for pulses with frequencies below 10 Hz. Consider selecting this mode, if you know that your signal has no low-frequency pulsed interferers. However, this mode (in contrast to the other TD modes) does not ensure fully compliant testing according to the standards under all circumstances.

For more information on "TD Max Dynamic" and "TD Max Speed" modes, refer to "Selecting the mode for time domain scans" ("TDS Optimization") in the [R&S ESW user manual](#).

If an existing test template is defined with "TD Max Dynamic" or "TD Max Speed" mode while the referenced receiver does not support that mode, R&S ELEKTRA automatically changes it to "Time Domain" mode. If this mode also is not possible, it is automatically changed to "Stepped Scan".

Sweep Type ← Setup

[Sweep](#) types are available only, if the [Operating Mode](#) is "Spectrum Analyzer" (not "Test Receiver"), and if the spectrum analyzer is one of the following device [types](#):

- R&S ESR
- R&S ESRP
- R&S ESW
- R&S FSV
- R&S FSV30xx
- R&S FSVA30xx
- R&S FSW
- R&S FSWT

For these devices, the following "Sweep Type" settings are available:

"Auto" With this selection, R&S ELEKTRA automatically selects "Sweep" or "FFT", which ever is faster.

"Sweep"	With this selection (= default), R&S ELEKTRA performs conventional quasi-analog sweeps from the start to the stop frequency.
"FFT"	With this selection, R&S ELEKTRA lets the spectrum analyzer sample on defined frequency values and transforms the sampled data to the spectrum by fast Fourier transformation (FFT). "FFT" is not available in the following cases: <ul style="list-style-type: none"> • When using 5-Pole filters or RRC filters • When using one of the CISPR detectors • When an external generator is active (via hardware option) • When the preselector is on and the span covers frequencies below 8 GHz

If an existing test template is defined with "FFT" or "Auto" sweep type while the referenced spectrum analyzer does not support "FFT", R&S ELEKTRA automatically corrects it to "Sweep".

For more information on the "Sweep Type", refer to the [R&S FSW user manual](#), section "Common Measurement Settings" > "Bandwidth, Filter and Sweep Configuration" > "Bandwidth, Filter and Sweep Settings".

Audio Demodulation Type ← Setup

Available only, if the receiver supports audio demodulation (option R&S FSV-B3) and if "FSV-B3" is enabled at "Home" > "Device List" > "Receiver" > [General](#) > "Options".

Audio demodulation can improve the identification of signals in the [Interactive measurement](#) mode. For example, if an FM broadcasting radio signal acts as interferer, FM demodulation can make the original audio signal audible.

Available audio demodulation types are:

"OFF"	Disables audio signal demodulation.
"AM"	Enables audio demodulation of amplitude modulated RF signals.
"FM"	Enables audio demodulation of frequency modulated RF signals.

Volume ← Audio Demodulation Type ← Setup

Sets the audio volume level, if [Audio Demodulation Type](#) is available. Use this feature for a receiver that is suited for controlling the audio demodulation volume (option "B3").

Output 1 ← Setup

Available only, if the [Receiver](#) type is "FSWT26", which has 2 [IF/VIDEO/DEMODO] ports [OUTPUT1] and [OUTPUT2] on its rear panel.

"Off"	Turns off the output.
"IF Output"	<ul style="list-style-type: none"> • The intermediate frequency (IF) is the signal of the downconverted received frequency (resolution bandwidth, RBW) after the IF filter. Downconversion is done by the local-oscillator and mixer hardware. Select one of the following "Output Voltage" ranges for IF output: <ul style="list-style-type: none"> – ±0.5 V – ±1.0 V – ±1.5 V

"I & Q"

Automatically sets **Output 2** to "I & Q", too. "I & Q" is available only for both outputs or none.

Select one of the following "Output Voltage" ranges for in-phase and quadrature components (I & Q):

- ± 0.5 V
- ± 1.0 V
- ± 1.5 V

"Video"

The video signal is the "IF Output" with an additional video bandwidth filter in the signal path.

Specify the following settings for video output:

- Select the "Mode" as either linear or logarithmic.
 - For "LIN" mode, also select the coupling (see below)
 - For "LOG" mode, R&S ELEKTRA automatically selects "DC" coupling
- Select the "Coupling" (for "LIN" mode) as either alternating or direct current:
 - For "AC" coupling, also select the output gain and AC cutoff (see below)
 - For "DC" coupling, no gain and no AC cutoff settings are available

When you change the coupling, note that the "Output Voltage" ranges also change (see below).

- Select the "Output Gain" (for "AC" coupling, only) as automatic, linear or logarithmic.
 - For "AUTO" output gain, no manual gain setting is available
 - For "LIN" output gain, enter a factor in the range of 0.1 to 100000
 - For "LOG" output gain, enter a gain in the range of -2 dB to 100 dB
- Specify the "AC Cutoff" (for "AC" coupling, only) in the range of 1 Hz to 900 Hz
- Enabling "Lowpass" allows specifying a limit frequency for the lowpass filter
- Select the "Output Voltage"
 - For "AC" coupling (see below), select one of the following ranges:
 - ± 0.5 V
 - ± 1.0 V
 - ± 1.5 V
 - For "DC" coupling (see below), select one of the following ranges:
 - 0 V to 0.5 V
 - 0 V to 1.0 V
 - 0 V to 3.0 V
- The "Phones" option allows sending the signal also as an audio output to the headphone jack on the receiver's front panel.
 - "Off" disables the audio output
 - "Overview" enables the audio output during the overview measurement
 - "Final" enables the audio output during the final measurement
 - "Both" enables the audio output during the overview and final measurements

- "FM"
 - Select one of the following "Output Voltage" ranges for frequency modulation (FM):
 - ± 0.5 V
 - ± 1.0 V
 - ± 1.5 V
 - Select the "Coupling" (for "LIN" mode) as either alternating current "AC" or direct current "DC".
- "PM"
 - Select one of the following "Output Voltage" ranges for phase modulation (PM):
 - ± 0.5 V
 - ± 1.0 V
 - ± 1.5 V
- "AM"
 - Select one of the following "Output Voltage" ranges for amplitude modulation (AM):
 - ± 0.5 V
 - ± 1.0 V
 - ± 1.5 V
 - Select the "Coupling" (for "LIN" mode) as either alternating current "AC" or direct current "DC".

Output 2 ← Setup

Available only, if the [Receiver](#) type is "FSWT26".

For a description of these settings, see [Output 1](#).

Level Range (Graphics) ← Setup

Specifies the lower and upper level range limits to be displayed on the y-axis of the test chart.

The software automatically assigns the unit of the level values depending on the [Transducing Device](#).

You can edit the unit by entering it together with the level value, for example:

- "ma" for mA
- "w" for W
- "dbm" for dBm
- "mv" for mV
- "dbµv" for dBµV

LOG X-Axis ← Setup

Enables or disables logarithmic scaling of the test chart's x-axis.

Site Correction Factors (C2) for the GTEM Correlation ← Setup

Available only, if you have selected a [TEM Waveguide](#) as the [Transducing Device](#).

Specifies two [attenuation tables](#) with dB values for the correlation between measurements in an open area test site (OATS) and in the GTEM waveguide.

R&S ELEKTRA uses these tables for a correlation algorithm. It converts the results of a measurement in a GTEM cell into equivalent results that would be measured in a true OATS with an antenna in horizontal or vertical polarization.

You can either select existing attenuation tables or let the software compute correction factors to create tables automatically.

"Horizontal" Name of the attenuation table that represents horizontal antenna polarization in the OATS. Use the  button to select a table.

"Vertical" Name of the attenuation table that represents vertical antenna polarization in the OATS. Use the  button to select a table.

Create new factors ← Site Correction Factors (C2) for the GTEM Correlation ← Setup

Uses a set of input parameters to let R&S ELEKTRA calculate attenuation tables for GTEM correlation. The software automatically creates these tables for the frequency range 10 MHz to 30 GHz.

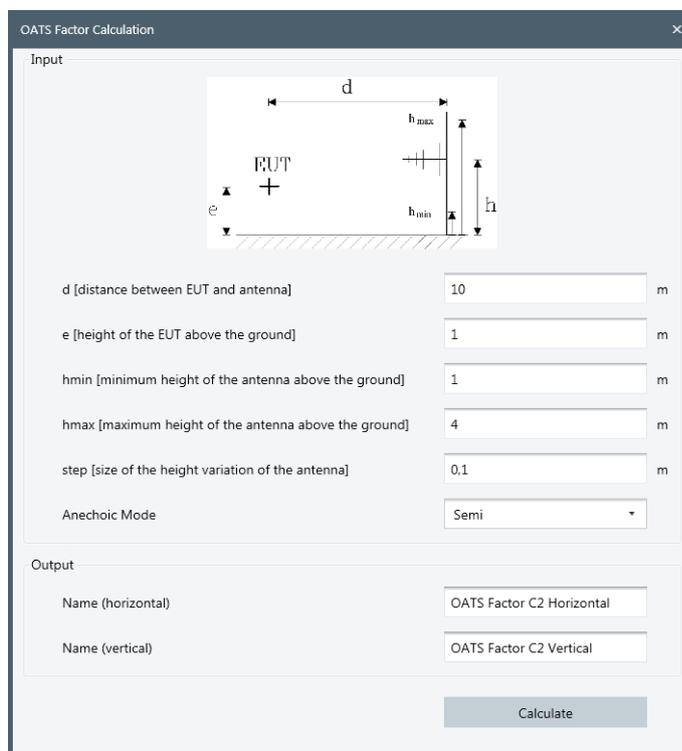


Figure 4-10: OATS (open area test site) factor calculation

Use the following "Input" parameters:

- "d" = horizontal distance between EUT and antenna
- "e" = vertical height of the EUT above the ground
- "hmin" = minimum vertical height of the antenna above the ground
- "hmax" = maximum vertical height of the antenna above the ground
- "step" = step size of the vertical height variation of the antenna
- "Anechoic Mode" = either "Semi" anechoic or "Fully" anechoic

Note: Do not consider the default values suggested in the dialog as recommended by Rohde & Schwarz.

For the "Output", specify names for the attenuation tables for horizontal and vertical polarization, respectively.

Click "Calculate" to let R&S ELEKTRA automatically create and save these tables.

If you try to save a GTEM test template, which requires defining the C2 factors, but you have not yet done so, the following message comes up: "Select Horizontal and Vertical Correction Factors (C2)". In this case, open the [General Settings](#) > [Setup](#) dialog to select or create the "Site Correction Factors (C2) for the GTEM Correlation".

Note: For the GTEM conversion factor C1, see ["GTEM Correction"](#) on page 155.

Graphics Settings

Selects an arbitrary number of [Limit Lines](#) to be shown additionally in the test charts that are based on this test template. The limit lines in this table are not used for any test evaluation, but for display only.

The **"Add a limit line table"** button  allows selecting limit line tables to be added to the list of limit lines.

Optionally, enter an "Offset" to shift the limit line up ("+", positive dB values) or down ("-", negative dB values).

The "Delete the Table" button  removes a selected limit line table from the list.

"Auto-connect adjacent frequency range sections in a trace" is relevant only, if the test template has more than one frequency range. Use the checkbox to decide, how R&S ELEKTRA draws the trace segments between adjacent frequency ranges.

The auto-connection rules for traces are as follows:

- If a frequency range has a frequency point at its stop, and the next frequency range has a frequency point at its start:
 - If these frequency points are the same, but have different test levels:
 - With enabled checkbox, the software connects these points with a vertical trace segment
 - With disabled checkbox, the software leaves a gap in the trace between these points
 - If these frequency points differ, but have the same test level:
 - The software always connects these points with a horizontal trace segment
 - If these frequency points differ and have different test levels, the software always leaves a gap in the trace between these points
- If a frequency range has no frequency points at its start and stop, the software always connects the trace between this frequency range and its neighbors
- If a frequency range contains one frequency point, only, the software always connects the trace between this frequency range and the next frequency range

Report

"Default Report Template" optionally selects an existing (predefined) [report template](#) to be used as a default for each test based on this test template.

4.4.2 Measurement Flow

▼ Measurement Flow

This dialog provides access to various settings for the overview measurement, for the data reduction and for the final measurement. These settings are valid across all frequency ranges specified in the test template.

In a new test template, the "Measurement Flow" settings are available only, when you have selected the [Receiver](#) in the [Hardware Setup](#). To have the [Receiver](#) selected automatically in each new test template, set it as your favorite in the device list. See [Set as Favorite Device](#).

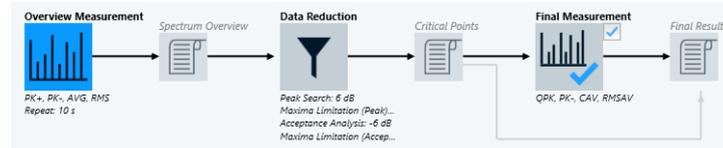
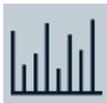


Figure 4-11: Phases in the measurement flow

To access the [Flow Details](#) settings of any individual phase in the measurement flow, click the icon of this phase. If the icon has a checkbox, you must enable it before you can select the icon.

- [Overview Measurement](#)
- [Data Reduction](#)
- [Final Measurement](#)

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Overview Measurement

The intention of the overview measurement is finding signals and frequencies that deserve being examined in more detail. This measurement is a scan or sweep, according to the [Operating Mode](#), the [Scan Mode](#) and the [Settings \(Overview\)](#). The overview measurement is executed across the full [spectral range](#) defined in the test template.

The overview measurement can be more coarse than the [Final Measurement](#), and if there is a LISN, it typically ignores some of the LISN lines. However, it must be fine enough to find all interference signals. Therefore, in the [Settings \(Overview\)](#), select a good balance of [Meas. BW](#) and [Step Size](#).

Click the "Overview Measurement" icon to access the "Flow Details - Overview Measurement" settings:

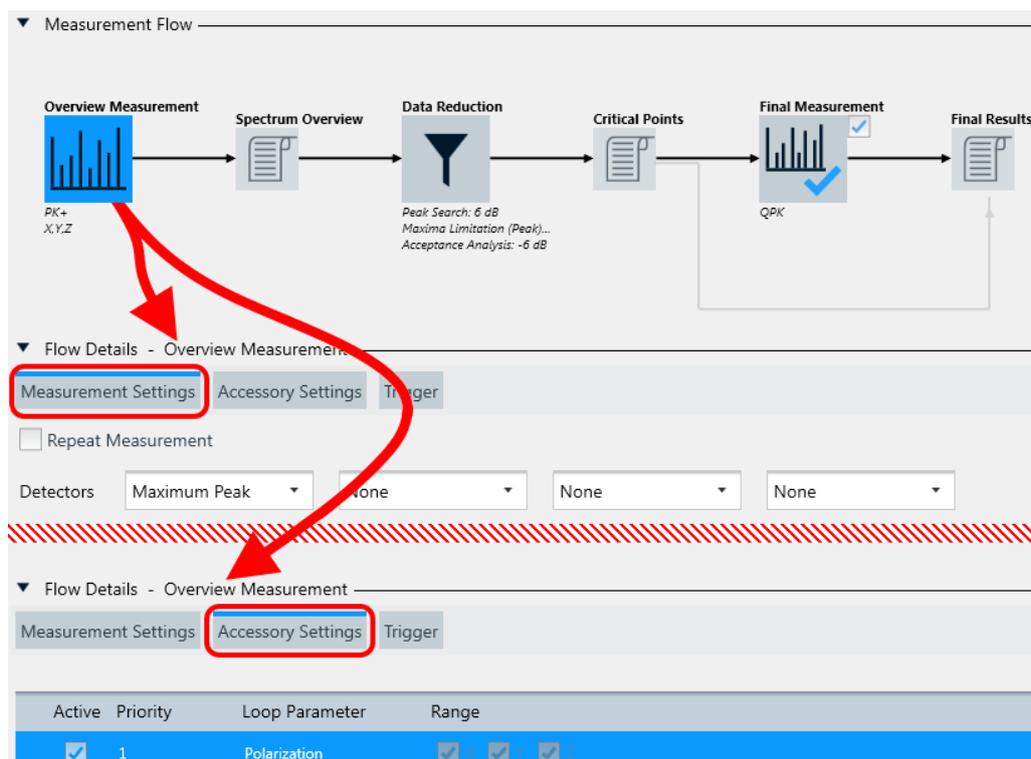


Figure 4-12: The Overview Measurement icon gives access to dialogs under Flow Details - Overview Measurement

The "Flow Details - Overview Measurement" section (Figure 4-12) offers a comprehensive "Measurement Settings" dialog and two brief "Accessory Settings" and **Trigger** dialogs.

- The **"Measurement Settings"** dialog comprises the following settings:
 - [Repeat Measurement](#)
 - [Detectors](#)
 - [Trace Mode](#) and [Averaging Mode](#)
 - [Graphics per Range](#)
 - [Add Spectrogram Graphic](#)
 - Below these settings, find the [frequency range list](#) with the comprehensive [Settings \(Overview\)](#), which are described in [Chapter 4.4.3, "Flow Details"](#), on page 101.
- The **"Accessory Settings"** dialog can comprise various "Loop Parameters".

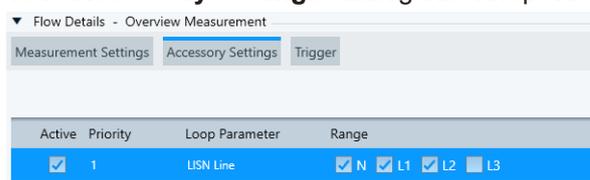


Figure 4-13: Example of Loop Parameters in the Accessory Settings dialog

EMI tests always run through all frequencies defined in the [frequency range list](#). But depending on the accessories in the test setup, some tests must repeat this run with varying accessory settings. By enabling "Graphics per Position" for an

"Active" loop parameter, you can enable R&S ELEKTRA to create separate charts for the test results of each position of this parameter, similar to [Graphics per Range](#). The software reduces some large result tables of such separate charts to a maximum of 1000 rows. This reduction does not apply to pure H/V and LISN-line charts, which keep their full resolution.

For example, in a conducted EMI test setup with a LISN, you typically repeat the frequency run for each selected LISN line. Such a repetition is called a **loop**.

The availability of "Loop Parameter" types depends on the [Transducing Device](#):

– **Absent**

If the transducing device is a simple transducer or probe, for example a current clamp, a coupling network, a single-line LISN or a near-field probe, the "Accessory Settings" dialog and any loop parameters are absent.

– **"LISN Line"**

If the transducing device is a [LISN](#) (but not a "Single Line LISN"), the "Accessory Settings" offers a line selection. Select the LISN lines that you want to include into the measurement. The following settings apply:

- In a hardware setup with a 2-line LISN, you can select or deselect "N" and "L1".
- In a hardware setup with a 4-line LISN, you can select or deselect "N", "L1", "L2" and "L3".

Select at least one line for the overview measurement. During the test, the software automatically measures the selected lines one by one and stores the results both in combined and in separate result tables.

For the settings in each frequency range, see also ["Settings"](#) on page 117.

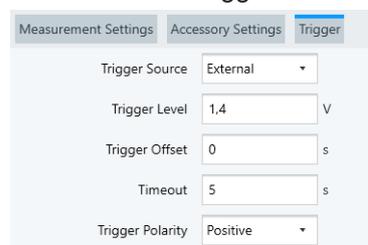
– **"Polarization"**

If the transducing device is a [TEM Waveguide](#), hence, a GTEM cell, R&S ELEKTRA enables measuring on all 3 orthogonal EUT axes (X, Y, Z), as shown at the lower edge of [Figure 4-12](#).

You can activate or deactivate this polarization loop, but you cannot change the preselected setting for the x-axis, y-axis and z-axis. Thus, if activated, you must run three overview measurements with the EUT in three different orthogonal orientations. During the test, the software prompts you to switch (hence, rotate) the EUT axis to the three orthogonal orientations X, Y or Z, respectively. The three measurements are stored in separate result tables.

Note that TEM waveguides such as GTEM cells are not suited for [interactive measurements](#).

- **"Trigger"** functions can control your receiver or spectrum analyzer during EMI measurements. Using these functions, R&S ELEKTRA can start or stop data acquisition based on trigger events.



Measurement Settings	Accessory Settings	Trigger
Trigger Source	External	External
Trigger Level	1.4	1.4 V
Trigger Offset	0	0 s
Timeout	5	5 s
Trigger Polarity	Positive	Positive

Figure 4-14: Example of settings in the Trigger dialog

The "Trigger" dialog is available only, if each frequency range uses one of the following receiver or spectrum analyzer [device types](#):

- R&S ESCI
- R&S ESPI
- R&S ESR
- R&S ESRP
- R&S ESU
- R&S ESW
- R&S FSV
- R&S FSVA
- R&S FSW
- R&S FSWT

The "Trigger" dialog provides the following parameters:

- "Trigger Source"
 - "Free Run" selects non-triggered operation.
 - "External" gives access to the following settings:
 - "Trigger Level" specifies the voltage threshold for detecting a trigger event.
 - "Trigger Offset", available only in the "Final Measurement", and only if "Gate Mode" is "Off", defines the time offset between the trigger event and the start of the sweep.
 - "Timeout" defines the maximum time to wait for a trigger event to occur.
 - "Trigger Polarity" selects a "Positive" voltage change (rising edge) or "Negative" voltage change (falling edge) for the trigger event.
 - "Drop-Out Time" is available only in the "Final Measurement", and only if the [Operating Mode](#) is "Spectrum Analyzer", while also "Gate Mode" is "Off" or "Edge" with positive "Trigger Polarity". Availability depends also on the device, for example it is available with the R&S FSW, but not with the R&S FSV. It defines the time that the input signal must stay below the "Trigger Level" before triggering again. Hence, if the input signal has a brief instability (drop out) and crosses the threshold during the "Drop-Out Time", it is ignored and not considered as a trigger event.
 - "Hold Off" is available only in the "Final Measurement", and only if the [Operating Mode](#) is "Spectrum Analyzer". Availability depends also on the device, for example it is available with the R&S FSW, but not with the R&S FSV. It specifies a time lapse, during which no subsequent trigger event can occur. If the next trigger signal is detected before the "Hold Off" time has passed, this signal is ignored.
 - **"Gate Mode"** is available only, if the [Operating Mode](#) is "Spectrum Analyzer", or if the mode is "Test Receiver" with [Scan Mode](#) = "Stepped Scan". Setting "Gate Mode" to "Level" or "Edge" enables trigger gating, which defines conditions for letting an input signal act as a trigger.

A gated sweep is a spectral measurement that captures data only, while a signal from the trigger source, which is also the gate source, "opens" a channel for data acquisition. Typically, gated sweeps are used for measuring only during selected relevant test situations. For example, the gate signal can be a 5V TTL signal that is generated externally in the EUT's environment. The gate signal must be fed into a control port of the receiver or spectrum analyzer.

The following "Gate Mode" options are available:

- "Level": The gate opens and the measurement starts when the trigger source signal exceeds the "Trigger Level". The gate closes and the measurement stops when the trigger source signal drops below the "Trigger Level". You can specify a "Gate Delay", hence a time to wait after the opening of the gate, before the measurement starts.
- "Edge": In addition to the "Level" functions, "Edge" limits the measurement's duration: It terminates the measurement after the specified "Gate Length" or upon the closing of the gate, whichever event happens first.
- "Continuous Gate": available only, if in all frequency ranges, the hardware setup's [Receiver](#) is an R&S FSW spectrum analyzer or an R&S ESW receiver with firmware 3.0 or later. Enables specifying a "Gate Period Length" and a "Gate Period Count". The gate period length defines how long the gate is open when it is triggered. The gate period count determines, how many bursts are included into the current acquisition.

Repeat Measurement ← Overview Measurement

Specifies that the overview measurement is cyclically repeated in a test, until you manually terminate the repetition. This mode is useful for observing changes in the measurement results, if you modify any test conditions during test execution.

The following settings are available (see [Figure 4-8](#)):

- "By Software" or "By Device":
 - "By Software" is enabled by default, hence R&S ELEKTRA controls the repetitions.
 - "By Device" is available only, if the [Operating Mode](#) is "Spectrum Analyzer" (not "Test Receiver"), and if the selected spectrum analyzer supports repetitions. Selecting "By Device" enables specifying the [Trace Mode](#) and the [Averaging Mode](#).
- "Repetition Mode"
 - "Count" specifies the number of repetitions between 1 and 100,000, how often the measurement is repeated.
 - "Time Interval" is available only, if measurements are repeated "By Software". The time interval specifies a duration between 1 s and 100,000 s, how long the measurement is repeated.

Note: During repeated measurements, R&S ELEKTRA compares the currently measured level values with the previously measured level values and keeps the maximum. Lower values in the still varying level measurements are thus ignored. Over time, this algorithm leads to a trace that approaches the maximum of the measured level values at each frequency point, with a continuously reduced variation along the trace.

To terminate the continuously repeating overview measurement while the test is running, click "End Repetition" in the test's [Measurement Flow Control](#) side panel.

If you disable "Repeat Measurement", the overview measurement is executed in a single scan or sweep, only.

See also the "Repeat Measurement" setting in the [Final Measurement](#).

Detectors ← Overview Measurement

Selects the detector types for up to four detectors used in the [overview measurement](#) of a test.

Select at least the 1st detector.

Your selection of detectors for the overview measurement also determines the automatic preselection of corresponding default detectors in the **final** measurement settings, according to [Table 4-1](#).

Note: Typically, we recommend using a single fast detector in the 1st detector position, for example "MaxPeak". More and other detectors are permitted and can be a good choice, too, depending on the test situation. For a list of all available detector types, see [Chapter 5.3, "Detectors"](#), on page 196.

Trace Mode ← Overview Measurement

Available only, if [Repeat Measurement](#) = "By Device" is enabled.

Selects one of the following update modes for subsequent traces in each enabled detector:

- "Clear Write" overwrites the previous trace with the levels measured last at each point. See ["Clear Write"](#) on page 227.
- "Max Hold" uses the highest level measured at each point. See ["Max Hold"](#) on page 227.
- "Min Hold" uses the lowest level measured at each point.
- "Average" determines the average level over all measurements at each point.

Averaging Mode ← Overview Measurement

Available only, if [Repeat Measurement](#) = "By Device" is enabled.

Defines the mode with which the trace is averaged over all measurements:

- "Logarithmic" (called "Video" in some instruments) activates logarithmic averaging. Hence, typical measurement levels are labeled "dBμV" or "dBm".
- "Linear" converts the level values into linear units before averaging
- "Power" converts the level values into watt units before averaging

After averaging, the software converts the data back to the original unit.

The selected "Averaging Mode" applies to each detector, for which ["Trace Mode"](#) on page 93 is set to "Average".

Graphics per Range ← Overview Measurement

Enabling this graphics option has the following consequences:

- R&S ELEKTRA creates separate charts for the test results of each frequency range
- The [Name](#) field becomes available for specifying name labels for each frequency range

Add Spectrogram Graphic ← Overview Measurement

Enables R&S ELEKTRA to generate a spectrogram table and a "waterfall" spectrogram graphic for the 1st selected [detector](#) of the overview measurement. Upon test completion, the software stores the table and graphic in the [Test container](#), with a name as "PK+@Spectrogram", for example, where "PK+" represents the [detector type](#) used for this result. See also [Chapter 7.4, "Test result graphics"](#), on page 231.



Data Reduction

Specifies various parameters for algorithms that reduce the number of measurement results from the overview measurement.

To identify the most critical results, you can decide whether the software performs either a "Peak Search" or a "Subrange Maxima" evaluation. Then R&S ELEKTRA subjects the outcome to an "Acceptance Analysis". To select an option, activate the check-box next to it.

The following diagram shows the interrelation of the data reduction options:

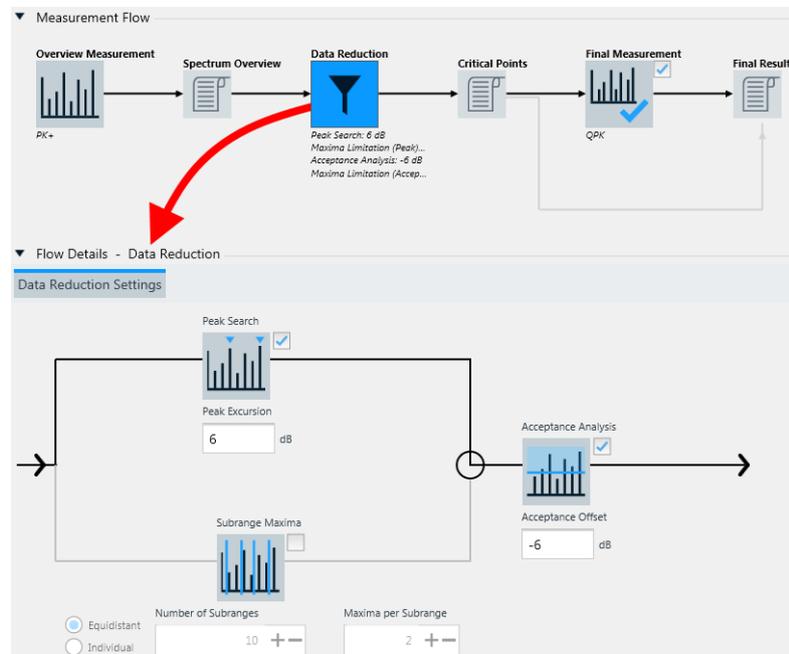


Figure 4-15: Options in the data reduction procedure

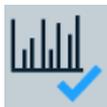
As a result of the data reduction procedure, R&S ELEKTRA stores the reduced number of critical data points (frequencies and measured levels) in the "Critical Points" table.

The data reduction algorithm is based on the "Overview" results table, which contains all maximized results of the partial measurement, for example, "Overview L1" (if there is a LISN with corresponding settings). If the test template uses a LISN, the software stores the results together with the information, which individual LISN line delivered which individual critical result.

"Peak Search" Activates a peak search evaluation. This data reduction mode finds the highest narrowband signals in the measured frequency range. The setting specifies the "Peak Excursion" (default: 6 dB), which determines, whether local maxima qualify as peaks. For a definition of "Peak Excursion", refer to ["Marker"](#) on page 185.

"Subrange Maxima" Activates a subrange maxima evaluation. This data reduction mode finds critical broadband signals in the measured frequency range. You can specify the "Number of Subranges" and the "Maxima per Subrange". If you change the default "Equidistant" setting of subranges to "Individual", you can select your own [Frequency List](#) instead of entering several equidistant subranges.

"Acceptance Analysis" You can let R&S ELEKTRA apply the limit line in a stricter form by specifying an "Acceptance Offset" (default = -6 dB). The specified offset shifts the limit lines of each frequency range: adding a negative dB value lowers the limit line. Frequency points with level values that fall below the shifted limit line are then discarded.



Final Measurement

Specifies the settings for the final measurements, which are performed as single measurements and must comply with EMI standard requirements regarding detectors, measurement bandwidth, accessory settings and measurement time.

Note: Skip "Final Measurement"?

Under certain conditions, you can use the results of the "Overview Measurement" as final results, instead of actually running the "Final Measurement". The conditions include making sure, that the "Overview Measurement" was performed at the correct critical frequencies and with the correct accessory settings. In this case, R&S ELEKTRA can copy the frequencies from the critical points table and the corresponding overview measurement results to the final results table.

To let the software do so, disable the "Final Measurements" checkbox as in [Figure 4-17](#).

Click the previously enabled "Final Measurement" icon (or enable the checkbox next to it) to access the "Flow Details - Final Measurement" settings:

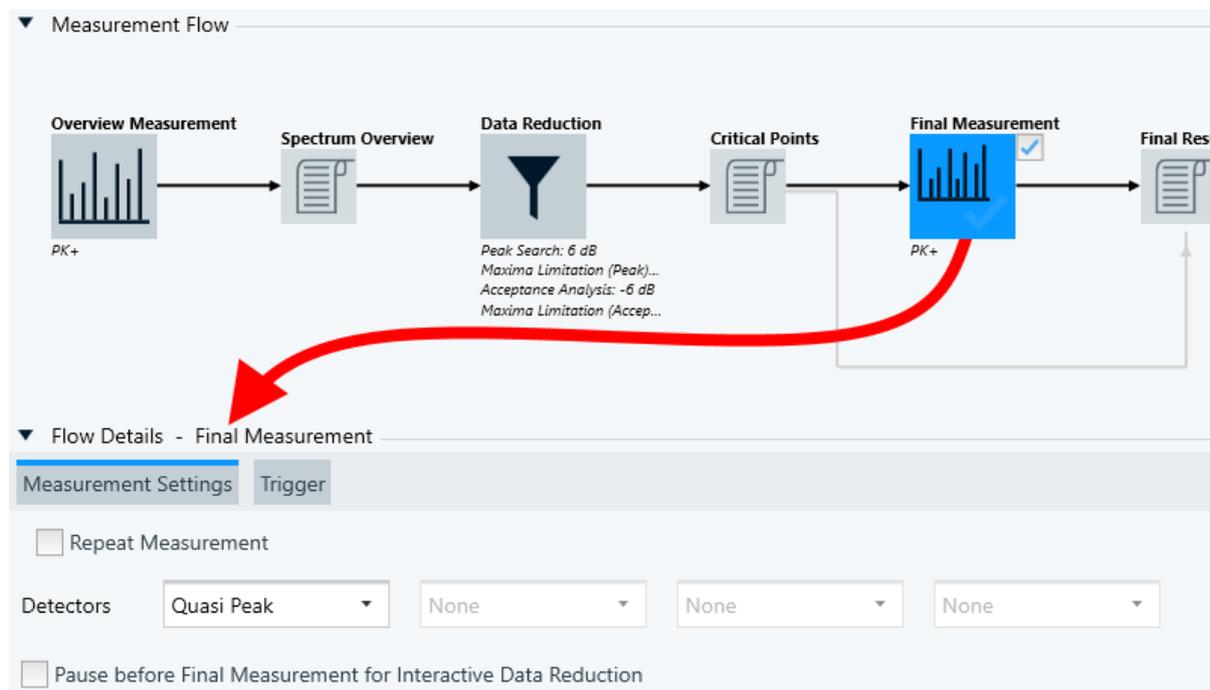


Figure 4-16: The Final Measurement icon opens Flow Details - Final Measurement

Here is an overview of all "Measurement Settings" for the "Final Measurement":

"Repeat Measurement"

Specifies that the final measurement is cyclically repeated in a test, until you manually terminate the repetition. This mode is useful for observing changes in the measurement results, if you modify any test conditions during test execution.

The following settings are available:

- "By Software" or "By Device":
 - "By Software" is enabled by default, hence R&S ELEKTRA controls the repetitions.
 - "By Device" is available only, if the [Operating Mode](#) is "Spectrum Analyzer" (not "Test Receiver"), and if the selected spectrum analyzer supports repetitions. Selecting "By Device" enables specifying the "Trace Mode" and the "Averaging Mode". For a description of these modes, refer to the "Overview Measurement", see ["Trace Mode"](#) on page 93 and ["Averaging Mode"](#) on page 93.
- "Repetition Mode"
 - "Count" specifies the number of repetitions between 1 and 100,000, how often the measurement is repeated.
 - "Time Interval" is available only, if measurements are repeated "By Software". The time interval specifies a duration between 1 s and 100,000 s, how long the measurement is repeated.

Note: During repeated measurements, R&S ELEKTRA compares the currently measured level values with the previously measured level values and keeps the maximum. Lower values in the still varying level measurements are thus ignored. Over time, this algorithm leads to a trace that approaches the maximum of the measured level values at each frequency point, with a continuously reduced variation along the trace.

To terminate the continuously repeating final measurement while the test is running, click "End Repetition" in the test's [Measurement Flow Control](#) side panel.

If you disable "Repeat Measurement", the final measurement is executed in a single scan or sweep, only.

See also the [Repeat Measurement](#) setting in the [Overview Measurement](#).

- "Detectors" Selects the detector types for up to four detectors used in the [final measurement](#) of a test.
- The following rules apply for the selection of final measurement detectors:
- Select at least the 1st detector.
 - For the optional 2nd, 3rd and 4th detector, you can select any detector type, even if it is already selected for other detector positions. Hence, there is no mutual exclusiveness, in contrast with the [Detectors](#) for the [overview measurement](#).
 - You can select only as many detectors as for the overview measurement.
 - R&S ELEKTRA observes a **one-to-one relation** of detector positions. Hence, the overview measurement made with the overview detector set in the 1st position is finalized with the final detector that is also set in the 1st position. If any position is set to "None" in the overview measurement settings, it remains deactivated in the final measurement.
 - The automatic preselection of the default final measurement detectors depends on your selection of the [overview measurement detectors](#) and on the mapping in [Table 4-1](#).
 - The default preselection is not binding, you can select an arbitrary detector on any position that is specified for an overview detector.
 - Changing final detectors does not change (overwrite) any detector selection in the overview measurement settings.
 - The selection of the final measurement detectors is independent of the [Transducing Device](#).

Table 4-1: Mapping of overview and final detectors

Selected detector in overview measurement	Suggested default detector in final measurement
Average (AVG)	CISPR Average (CAV)
CISPR Average (CAV)	CISPR Average (CAV)
Maximum Peak (PK+)	Quasi Peak (QPK)
Minimum Peak (PK-)	Minimum Peak (PK-)
Quasi Peak (QPK)	Quasi Peak (QPK)
RMS	RMS Average (RMSAV)
RMS Average (RMSAV)	RMS Average (RMSAV)

For a list of all available detector types, see [Chapter 5.3, "Detectors"](#), on page 196.

- "Trace Mode" Same function as described for the "Overview Measurement", see ["Trace Mode"](#) on page 93.
- "Averaging Mode" Same function as described for the "Overview Measurement", see ["Averaging Mode"](#) on page 93.

"Pause before Final Measurement for Interactive Data Reduction"

Interrupts the test before the final measurement for an interactive data reduction. You can use this pause during a test to manipulate the measured levels. This manipulation influences the critical results considered for further evaluation. Note that you are allowed to manipulate the measured results, but you are responsible for this manipulation.

"Use Critical Points as Final Results" Per default, the checkbox next to the "Final Measurement" icon is enabled, as in [Figure 4-16](#), and R&S ELEKTRA performs final mea-

measurements at the frequencies of the previously identified critical points.

However, you can apply a "skip" mode and use the critical points results as final results. To apply this mode, disable the checkbox as in [Figure 4-17](#).

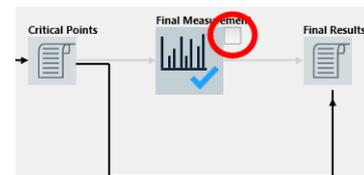


Figure 4-17: Skipping the final measurements uses the critical points as final result

This deselection lets R&S ELEKTRA skip the final measurements.

Instead, the software copies the previously identified critical frequencies and their levels from the overview measurement into the final results table.

- If you use a TEM waveguide, the software copies the field-strength overview values (dB μ V/m) calculated from the measured overview X / Y / Z levels (dB μ V) in the result tables. Doing so, it uses the same H/V polarizations that were found to have critical points.
- If you use a LISN, the software copies the overview levels from the same LISN lines that were found to have critical points.

Note: Double-check final detectors. When you disable the "Final Measurement", the software also overwrites the final measurement "Detectors" with the detectors selected for the overview measurement. For example, it replaces the "Quasi Peak" detector by the "Maximum Peak" detector. The updated final detectors remain selected when you enable the "Final Measurement" again. You can edit the overwritten selection.

However, if you miss this potential change of detectors for the "Final Measurement", disabling and enabling the "Final Measurement" can cause an **unintended misconfiguration** of your test template.

Also note that without a final measurement, you must configure the overview measurement according to the standard requirements, such that the measured values qualify as final results.

Disabling the "Final Measurement" also disables additional measurement settings (repeat / pause measurement), if available.

Note: Consider TD scan. We recommend using the time domain (TD) option for the final measurement, if the overview measurement data is sufficient for a standard-compliant characterization of the RF emission. This option is typically reasonable, if you operate the receiver in [Scan Mode](#) "Time Domain Scan" with a compliant detector, for example [QuasiPeak](#). Even with this slow detector, a "Time Domain Scan" is often faster than a "Stepped Scan" with a fast noncompliant detector, for example "MaxPeak". This speed effect is especially relevant within the relatively small frequency ranges of conducted measure-

ments. Because the detector is standard-compliant, you can skip the final measurement and use the levels at the critical points of the overview measurement as the final results.

Also, using the fast TD scan with a "slow" compliant detector helps to avoid missing sporadic interferers or strongly drifting interferers.

However, in some special cases of a TD scan, it can be an advantage to run the overview measurement with a fast noncompliant detector, for example "MaxPeak". An example is a broad frequency range that requires measurements in many frequency segments. In this case, using the "MaxPeak" detector for the overview measurement and the compliant "QuasiPeak" detector for the final measurement on critical points, only, can be faster. For this procedure, enable the checkbox for the final measurements.

"Perform Final Measurement on Critical Points" Available only if the following criteria are all met:

- The [license](#) "ELEMI-S" is deactivated
- The EMI test template uses a [LISN](#) (not a different transducer) as the [Transducing Device](#)

If selected, the software runs the final measurement on the critical points. At each critical point, it measures at the same LISN line that was found to have a critical level at this frequency in the overview measurement.

"Measure Critical Points on these LISN Lines" Available only, if the following criteria are all met:

- The [license](#) "ELEMI-S" is deactivated
- The EMI test template uses a [LISN](#) (not a different transducer) as the [Transducing Device](#)

If selected, this setting specifies the LISN lines, across which the measurements are to be repeated at the previously identified critical frequencies: "N" and "L1" for a 2-line LISN, or "N", "L1", "L2" or "L3" for a 4-line LISN.

Select at least one LISN line for the final measurement. The selection is independent from the selection in the [Overview Measurement](#).

The "**Trigger**" dialog is the same as described for the "Overview Measurement".

4.4.3 Flow Details

▼ Flow Details - ...

This dialog provides settings for the different phases of the measurement flow and for all frequency ranges.



All settings that are located **above** the list of frequency ranges are described in [Chapter 4.4.2, "Measurement Flow"](#), on page 87, because the availability of these settings greatly changes with the selected (highlighted) measurement phase.

- For "Measurement Settings", "Accessory Settings" and "Trigger", see [Figure 4-12](#)

The following sections describe these functions:

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Shift Frequency Range Up / Down.....	103
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Name.....	103
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Meas. BW (Overview).....	104
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Hardware Setup.....	106
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Settings (Overview).....	108
L Meas. BW.....	108
L CISPR BW.....	109
L Step Size.....	109
L Points.....	110
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L Meas. Time.....	111
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L Video BW.....	112
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L Auto ID Threshold.....	114
L RF Attenuation.....	114
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Add Frequency Range

Creates an additional frequency range in the same test template and with the following default settings:

- The lower limit of the new frequency range is automatically set equal to the upper limit of the highest existing frequency range in this test template.
- The upper limit of the new frequency range is automatically set 10 MHz above its lower limit, if permitted by the selected devices.
- The following settings and selections are copied, if available, from the frequency range that was previously selected (highlighted in blue).
 - All selected devices in the hardware setup
 - The limit line
 - All measurement settings in the dialogs [Settings \(Overview\)](#) and [Settings \(Final\)](#)



Shift Frequency Range Up / Down

Available only, if at least one other frequency range is displayed above / below the selected frequency range. The buttons swap the position of the selected frequency range with the one above / below it.

Frequency ranges are typically arranged in an order of increasing frequency, but different arrangements are permitted, too.



Active

Activates or deactivates measurements in selected frequency ranges.

The global checkbox next to the "Active" headline activates or deactivates the measurements in all frequency ranges.

Name

You can specify arbitrary names for the frequency ranges. These names appear instead of the range number in the "EMI Test Template" component of your test reports. If you activate [Graphics per Range](#), the names appear also in the headers of the range charts.

Frequency Range

Specifies the lower and upper limits of the frequency range. To edit the frequency values, click them.

You can also edit the units. Permissible units are *Hz*, *kHz*, *MHz* and *GHz*. For *kHz*, *MHz* and *GHz*, it is sufficient to enter *k*, *M* and *G*. For example, enter *10M* for *10 MHz*.

If you exchange any [Transducing Device](#) in the test template's hardware setup, the frequency values of new frequency ranges can change according to the device properties. If the device is incompatible with the existing frequency ranges, you must change them, too, before you can save the test template.

Note: Various frequency range statements in the dialog.

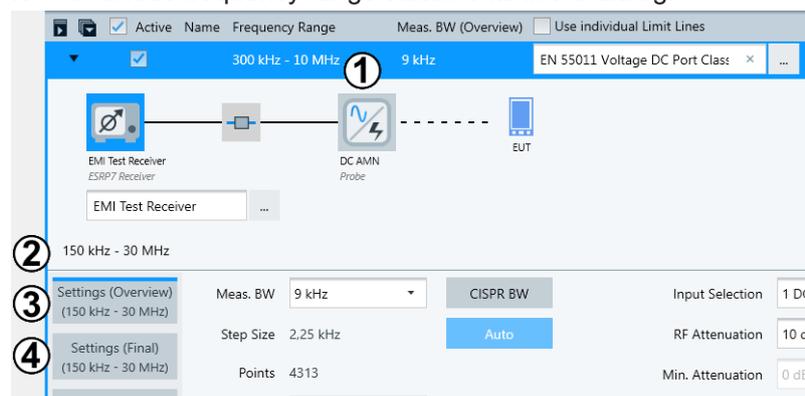


Figure 4-18: Example of frequency ranges shown in the settings dialog

- 1 = Specified lower and upper limit of the frequency range (here: 300 kHz to 10 MHz).
Mouse-over text: "Set Start and Stop Frequency"
- 2 = Frequency range, in which the combined receiver, signal path and transducer (here: an artificial mains network) can be used. This frequency range can be limited, for example, by the transducing device's correction table.

Note that (2) is the largest common range of (3) and (4), where (2) can be reduced also by invisible setting details.

Mouse-over text: "The Frequency Range of the Hardware Setup"

- 3 = Usable frequency range of the receiver with the current [overview measurement settings](#). This frequency range can be reduced by various properties and settings of your receiver, for example, the [selected input](#). R&S ELEKTRA computes this reduction in a complex algorithm.
- 4 = Usable frequency range of the receiver with the current [final measurement settings](#).

The frequency range (1) is an interactive setting, while the other frequency range statements are for your information, only.

The measurement settings and their frequency range statements are only shown, if the receiver icon is selected (highlighted).

Meas. BW (Overview)

Displays the measurement bandwidth as specified in the [Settings \(Overview\)](#).

...

Limit Line

Selects a [limit line](#) table.

Note: In each frequency range, you can select **one limit line table**, only. However, each limit line table can be defined with up to **four limit line columns**, each for an individual detector.

If no limit line is defined for the current detector, but there is a limit line for an alternative detector according to [Table 4-2](#), R&S ELEKTRA automatically replaces the missing limit line. R&S ELEKTRA uses the alternative limit line for calculating the [Margin](#) values in the result table and the [Verdict](#).

Table 4-2: Alternative limit line detectors

Test template detector	Limit line detector alternative
Average (AVG)	CISPR Average (CAV)
CISPR Average (CAV)	AVG
Maximum Peak (PK+)	Quasi Peak (QPK)
Minimum Peak (PK-)	none (no detector alternative)
Quasi Peak (QPK)	none (no detector alternative)
RMS	RMS Average (RMSAV)
RMS Average (RMSAV)	RMS
Sample	none (no detector alternative)

For more information on detectors, see also [Chapter 5.3, "Detectors"](#), on page 196.

If the selected limit line table does not contain a limit line specification for the alternative detector, either, a "Validation Warning" comes up when you save the test template: "Selected limit line does not match the configured detector in this frequency range" (or several warnings, one for each frequency range). Saving is still possible, but as the test misses a required limit line, R&S ELEKTRA cannot calculate the margin values and the verdict. To solve this issue, we recommend using the detectors as specified in a limit line table that conforms with the applicable standard.

Use individual Limit Lines ← Limit Line

To allow different limit lines for different frequency ranges, activate the checkbox. Otherwise, if this checkbox is not activated, the same (global) limit line is used for all frequency ranges.

If different limit lines are specified for different frequency ranges, deactivating this checkbox copies the limit line selection of the currently highlighted frequency range (blue) to all other frequency ranges. This copying of settings is protected by a warning: "The individual Limit Line settings of the frequency range(s) will be lost when disabling "Use individual Limit Lines"." The "OK" button confirms the disabling, "Cancel" returns to the dialog without deactivating the checkbox.

Offset

Specifies an offset value and its unit, for example "dB μ V/m", to add to the frequency range a limit line that is shifted by this offset. Specifying a negative offset lowers the limit line, a positive offset raises it. If the offset value is 0, R&S ELEKTRA adds no shifted limit line.

The test chart displays the original limit line dashed, and the shifted limit line bold, with its offset value in the legend. This feature facilitates seeing clearly whether measurement results exceed a given dB distance from the original limit line.

Note: The *offset* limit line is relevant for the test results, hence the [Margin](#) values and the test's [Verdict](#) depend on it.

When you add a frequency range, per default R&S ELEKTRA copies a specified offset from the existing frequency range to the new one.

Comment

Per frequency range, you can enter arbitrary text below the headline "Comment", as shown in [Figure 4-8](#). These comments appear in the "EMI Test Template" component of your test reports.



Copy

Creates a copy of this frequency range. Hence, the button works like [Add Frequency Range](#), but also enters the settings of the copied frequency range into the new frequency range.



Delete Frequency Range

Available only, if at least two frequency ranges are present. Deletes the selected frequency range without additional warning and without the possibility to restore a deleted frequency range with its settings.

Hardware Setup

A hardware setup, represented by a diagram as in [Figure 4-19](#), is part of each frequency range in a test template and defines the physical measurement.

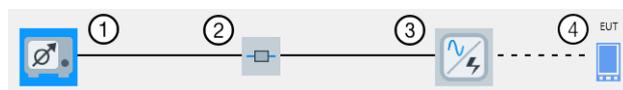


Figure 4-19: Example of a hardware setup diagram

- 1 = Receiver (here selected, hence highlighted in blue)
- 2 = Signal Path
- 3 = Transducing Device
- 4 = Representation of the EUT

The transducing device can be a "Transducer", "LISN" or "TEM Waveguide". Note that the EUT is not a device in R&S ELEKTRA.

The hardware setup diagram is displayed along with the receiver's [overview measurement settings](#), its [final measurement settings](#) (if available) and the [properties](#) of all devices.

To select a device or change the selection in the hardware setup diagram, proceed as follows:

- If the device has not been selected before, click its icon to open the selection dialog.
- If the device has already been selected, click the  button to open the selection dialog, and optionally change the device.

Except for the receiver, which is fixed, you can specify different signal paths and transducers for hardware setups in different frequency ranges, if the devices are compatible with each other. To be compatible, the devices must have the same [device type](#), such as "Transducer" > "Probe".

Note: To access the [device properties](#) of the receiver, signal path or transducing device, select (highlight) its icon. However, be careful with changing these properties, as any change affects all test templates that use this device.

For example, using a current clamp in one frequency range is compatible with using a voltage probe or a power absorbing clamp in another frequency range. All these transducers are probes. On the contrary, multi-line LISNs and GTEM cells are not compatible with any other devices. If you select a LISN or TEM waveguide for the first frequency range, you cannot select any other, incompatible type of device in additional frequency ranges.

According to the LISN or GTEM (selected for all frequency ranges) or the transducer (selected for the first frequency range), R&S ELEKTRA defines the unit for the [level range](#). The definition is valid and binding for all frequency ranges to be created later. Therefore, in additional frequency ranges, R&S ELEKTRA only permits the selection of transducers with the same result unit. The software compares the level unit of your selected [Limit Line](#) with the level unit of the transducing devices. If the units do not match, you cannot save the test template.

To edit the [measurement settings](#), select (highlight) the receiver icon as in [Figure 4-19](#).

Select (highlight) the icon of any device or signal path to edit their [Properties](#) as defined in the [Device List](#).

Note: Modifications in a hardware setup. You can modify and save any [device](#) used even for a test template that is open. When you return to the dialog of such an affected test template after a device modification, R&S ELEKTRA validates it, adjusts the settings and notifies you of this adjustment.



Figure 4-20: Notification of adjusted measurement settings due to a replaced receiver

For example, consider replacing a receiver that can perform *time domain scans* (option "K53") by a different receiver that does not feature this [Scan Mode](#), but only *stepped scans*. In this case, the scan mode in a test template that uses this receiver for "Time Domain Scan" is changed to "Stepped Scan".

This change requires that in a test, which is based on this template, R&S ELEKTRA automatically deletes all existing test results from the [Test container](#), when you save or rerun the test. The reason is the requirement to preserve consistency between measurement settings and measurement results.

To keep results that you have saved earlier, close the test without saving it and [create](#) a new test based on the test template. Alternatively, you can make a [copy](#) of your test and rerun this copy.



Receiver ← Hardware Setup

The measurement instrument is the [Receiver](#) (test receiver or spectrum analyzer), which is automatically entered by R&S ELEKTRA as a reference from the [Device List](#).

In the device list, you can specify to use a different receiver. However, consider that this change affects all test templates, as the same receiver is referenced in each test template. Just as well, be careful with changing the [Device properties](#) of the receiver, as these properties settings also affect all test templates.

If the measurement instrument is a test receiver (not a spectrum analyzer), you can select the [Operating Mode](#) "Test Receiver" for *scan* measurements or "Spectrum Analyzer" for *sweep* measurements. This setting only affects the test template in which you specify it.

Select (highlight) the receiver icon to access the [Settings \(Overview\)](#), the [Settings \(Final\)](#) (if available) and the [receiver properties](#).



Signal Path ← Hardware Setup

Selects the [Signal Path](#) for this frequency range as a reference from the [Device List](#).



Transducing Device ← Hardware Setup

Selects the [Transducer](#) (current clamp, antenna, etc.), [LISN](#) or [TEM Waveguide](#) for this frequency range as a reference from the [Device List](#). The type of selected transducing device determines the icon that is displayed in the hardware setup diagram.



For different frequency ranges, you can specify *different transducers* of the same [Type](#) ("Probe"), but R&S ELEKTRA allows only *one LISN* or *one TEM waveguide* for all frequency ranges.

In the first frequency range, you can change the transducing device to any type. If the newly selected device is not compatible with devices in already existing subsequent frequency ranges, R&S ELEKTRA deletes these other frequency ranges. This feature is a specialty of the first frequency range. In all other frequency ranges, you can select only devices that are compatible with the transducing device in the first frequency range.

Note: If the test template is new, your selection of the transducing device can interactively change the [frequency range values](#) of the first frequency range.

Settings (Overview)

Settings (Overview)

Specifies the receiver settings for the [Overview Measurement](#).

Note: If the hardware setup uses the LISN "ENV 216", this specific LISN is the only one that also has a [Settings](#) dialog for its "High Pass" filter.

The receiver settings are available only, if you have selected (highlighted) the [Receiver](#) icon in the [hardware setup diagram](#).



Figure 4-21: Prerequisite: select (highlight) the receiver icon

Note: Be aware of the difference: *Settings* define the individual behavior of a device during a test that is controlled by this test template. On the contrary, *Properties* define the global characteristics of a device as specified in the [Device List](#).

Settings (Overview) (10 kHz - 30 MHz)	Meas. BW	200 Hz	CISPR BW	Input Selection	1 DC
Settings (Final) (10 kHz - 30 MHz)	Step Size	50 Hz	Auto	RF Attenuation	Auto
Properties	Points	2821		Min. Attenuation	0 dB
	Time Per Point	50 ms		Preamplifier	0 dB
	Total Time	141,05 s			

Figure 4-22: Settings dialog for the overview measurement

Note: After the measurement, R&S ELEKTRA can transfer the scan settings, the limit lines and the transducer correction data (as specified in the test template) into the test receiver's internal scan table. You can instantly use these settings at the test receiver (depending on the receiver model).

To let R&S ELEKTRA use this transfer feature, enable the "EMI: Download ..." checkboxes in the [General](#).

Note that the availability of some elements in the "Settings (Overview)" dialog varies with several settings in other dialogs. The details are described in the following sections.

Meas. BW ← Settings (Overview)

Selects from a list of suggested bandwidths for the measuring filter. As this filter is also called the intermediate frequency filter, the "Meas. BW" is also referred to as intermediate frequency filter bandwidth, IF filter BW or IF bandwidth.

The range and content of this list of bandwidths depends on your receiver, for example 10 Hz to 1 MHz with most receivers, or 1 Hz to 80 MHz, if you use an R&S ESW receiver with option "ESW-B8" enabled.

If you select a "Meas. BW" value that does not comply with CISPR standard specifications, R&S ELEKTRA brings up a warning message, and you cannot save the test template.

The measurement bandwidth that you set here is also displayed in the headline of the [Frequency Range](#).

CISPR BW ← Meas. BW ← Settings (Overview)

Automatically sets the measuring filter bandwidth according to CISPR specifications, depending on the width of the selected [frequency range](#).

The button "CISPR BW" is available only, if the following conditions are all met:

- The required CISPR bandwidth of the measuring filter is available in the receiver.
- R&S ELEKTRA can select the "Filter Type" "6 dB" in the receiver.
- The frequency limits of the user-defined frequency range are **within the boundaries of a CISPR band** as defined in the standard, see [Table 4-3](#).

Table 4-3: CISPR frequency bands

CISPR band	Frequency range	CISPR bandwidth
A	9 kHz to 150 kHz	200 Hz
B	150 kHz to 30 MHz	9 kHz
C/D	30 MHz to 1 GHz	120 kHz
E and above	1 GHz and higher	1 MHz

Step Size ← Settings (Overview)

The input field for entering a measurement frequency step size is available only, if the following conditions are all met:

- The [Operating Mode](#) is "Test Receiver"
- The [Scan Mode](#) is "Stepped Scan"
- The "Auto" button next to the "Step Size" input field is not enabled

In this constellation, R&S ELEKTRA automatically suggests the half [Meas. BW](#) (BW/2) as a default value for the frequency step size.

The screenshot shows a configuration panel with three rows: 'Meas BW' with a dropdown menu set to '200 Hz' and a 'CISPR BW' button; 'Step Size' with an input field containing '100' and 'Hz' and an 'Auto' button; and 'Points' with an input field containing '1411'.

Figure 4-23: Step size in operating mode "Test Receiver"

You can edit this value and specify an arbitrary step size for the test. We recommend using at most the half "Meas. BW" value, to avoid erroneous measurements.

If you specify a step size value that is greater than BW/2, a warning comes up next to the "Step Size" input field. You can still save and use the test template, but R&S ELEKTRA shows the same warning next to the [Verdict](#) in the test:



The "Auto" button next to the "Step Size" input field resets the step size to half the "Meas. BW" and disables editing this field.

The resulting number of **Points**, which is the **frequency range** divided by the step size, is automatically calculated and displayed for your information.

Note: A typical setting for an overview measurement is a step size of half the **Meas. BW** ("Auto" button) with a 6-dB **"Filter Type"**. However, as the measurement filter is not flat, the accuracy is limited. Narrow bandwidth (CW) signals could be measured up to 1.5 dB lower than their actual level. Manually setting the step size to a third or fourth of the measurement bandwidth (BW/3 or BW/4) improves the accuracy, but at the cost of a longer measurement time.

In the **Scan Mode** "Time Domain Scan", R&S ELEKTRA automatically fixes the "Step Size" at a quarter of the **Meas. BW** (BW/4). You cannot change this setting, and the "Auto" button is disabled.

As opposed to "Test Receiver" mode, in operating mode "Spectrum Analyzer" the step size is automatically calculated from the **frequency range** divided by the number of **Points**. In this case, the step size just serves for your information.

Points ← Settings (Overview)

- In the **Operating Mode** "Test Receiver", "Points" displays the number of frequency points for the overview measurement, resulting from the **frequency range** divided by the "Step Size". You cannot change the number of points, it just serves for your information.
- In the operating mode "Spectrum Analyzer", R&S ELEKTRA automatically suggests a default number of measurement points in such a way that the automatically calculated "Step Size" is equal to or close below the half **Meas. BW**.
If the "Auto" button next to the **Step Size** input field is disabled, you can change the number of measurement points and select from a list of suggested numbers. We recommend selecting the number of points in such a way that the resulting "Step Size" is not more than the half "Meas. BW" value, to avoid erroneous measurements. Use the "Auto" button to reset the number of points to meet the recommended "Step Size".

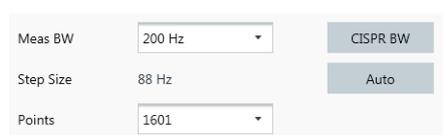


Figure 4-24: Measurement points in operating mode "Spectrum Analyzer"

The step size is displayed, too, for your information.

Note: For selecting a suitable number of measurement points, see the recommendations at **Step Size**.

Measurement time ← Settings (Overview)

Specifies the measurement time (total or per point) in the overview measurement, depending on the **Operating Mode**:

- In operating mode "Test Receiver", you can specify the **Meas. Time** per point. In **Scan Mode** "Stepped Scan", the total measurement time results from this setting by multiplying it with the number of frequency points.

- In operating mode "Spectrum Analyzer", you can specify the [Total Time](#) of the measurement. The measurement time per frequency point results from this setting by dividing it by the number of frequency points.
Note the following features in [Sweep Type "FFT"](#):
 - In this sweep type, the total time is the measurement time per FFT segment. The number of FFT segments depends on the performance of your receiver or analyzer.
 - The time required for data processing can be considerably longer than the time required for data capturing. Thus, if you consider only the defined sweep time for data capturing, the measurement can take longer than expected, because it includes also the time for data processing.

The shortest required measurement time depends on the type of EUT and on various conditions, including the [Scan Mode](#) or [Sweep Type](#) settings.

To determine the shortest required measurement time, run a continuous measurement with "Max Hold" function enabled directly on the test receiver (or a sweep in [spectrum analyzer mode](#)). We recommend observing the measurement results directly on the receiver's display, as this procedure allows the best judgment of short-term instabilities. When you observe the measurement results in R&S ELEKTRA, the delay of data transfer to your computer and of graphics generation can impede the correct estimation of the required measurement time.

Use the "Maximum Peak" detector across the whole frequency range of the limit line. Observe the displayed "Max Hold" level. We recommend considering the time that it takes, until the "Max Hold" spectrum looks "stable", as the minimum measurement time for final measurements at critical frequencies. The measurement time determined by this approach is also recommended for the overview measurement, but the best selection also depends on the type of the disturbance.

- If you use a test receiver that supports [Time Domain Scan](#), this fast scan mode is helpful, as you can better observe a wide frequency range. Generally, in each [Scan Mode](#), if you set your measurement time too short, you risk missing sporadic disturbances.
- However, you can afford more easily a longer [measurement time per frequency point](#) in "Time Domain Scan" mode, because it is faster than the "Stepped Scan". At similar total measurement times, a longer time per point permits observing the EUT more intensively.
If the EUT does not require enhanced observation, the total measurement time in "Time Domain Scan" mode can be much shorter than in "Stepped Scan" mode.

Note: If the disturbances generated by the EUT are occasional short pulses ("clicks"), evaluate the characteristics of such a device and the required measurement time by a click rate analysis. For a description of this procedure, refer to the user documentation of your test receiver.

Meas. Time ← Measurement time ← Settings (Overview)

Available only, if the [Operating Mode](#) is "Test Receiver": Selects the measurement time per point from a list of predefined values.

Depending on this setting, the total measurement time is displayed, too, if the [Scan Mode](#) is "Stepped Scan". The "Total" is automatically calculated from the measurement time per point multiplied by the number of [Points](#).

If the "Scan Mode" is "Time Domain Scan", the total measurement time (which is typically much shorter than in "Stepped Scan" mode) is not displayed. This time cannot be computed, because it depends on internal parameters and hardware capabilities of your receiver model.

Total Time ← Measurement time ← Settings (Overview)

Available only, if the [Operating Mode](#) is "Spectrum Analyzer": Selects the total measurement time from a list of predefined values or lets R&S ELEKTRA set this time automatically, if you click "Auto".

Time Per Point	936.9144 ms
Total Time	1.500 s
Video BW	10 MHz

Depending on this setting, the measurement time per point is displayed. It is automatically calculated from the total time divided by the number of [Points](#).

If you select "Auto" for "Total Time", R&S ELEKTRA hides the measurement time per point.

Video BW ← Measurement time ← Settings (Overview)

Available only, if the [Operating Mode](#) is "Spectrum Analyzer": Selects from a list of suggested video bandwidths.

- Fixed values 1 Hz to 10 MHz (or up to 80 MHz, if you use an R&S ESW receiver with option "ESW-B8" enabled)
- "Auto" enables an algorithm that automatically selects the widest possible video bandwidth, in any case wider than the [Meas. BW](#)

The "Video BW" is the bandwidth of the lowpass filter directly after the envelope detector. This downstream filter is used to remove noise from the signal envelope.

Typically, the "Video BW" must be wider than the [Meas. BW](#). Exceptions apply, if standards require that the video bandwidth filter cuts away part of the signal that has passed the measuring filter (IF selection filter). If you select a "Video BW" that is smaller than the "Meas. BW", R&S ELEKTRA shows a warning.

Input Selection ← Settings (Overview)

Selects the test receiver's or spectrum analyzer's port number, hence the physical RF input connector. If more than one port is available, the selected port is used for the measurement.

If you use a two-port [test receiver](#) that offers the coupling modes "AC" or "DC", you can select as follows:

"1AC" or "2AC" Port 1 or 2 with alternating current coupling mode. AC coupling is typically limited to signals that alternate with a few kHz, at least. Therefore, you cannot use this mode for lower frequency ranges, but the receiver is better protected against signal overload than in DC coupling mode.

"1DC" or "2DC" Port 1 or 2 with direct current coupling mode. You can use this mode to measure signals down to 0 Hz, but it leaves the receiver sensitive to overlaid DC voltage, which can damage the receiver input.

External harmonic mixers

As a special case, if your receiver or spectrum analyzer is in "Spectrum Analyzer" mode and supports using external harmonic mixers (see note on [Compatible instruments](#)), the "Input Selection" is extended with the following series of:

- External mixers, see [Table 4-8](#)
R&S ELEKTRA loads and displays the parameter values defined in the external mixer settings.
You can edit the parameter values at "Administration" > [External Mixer](#).
- Frequency bands, see [Frequency bands when using external harmonic mixers](#)

Table 4-4: Frequency bands when using external harmonic mixers

Band ID	Start frequency [GHz]	Stop frequency [GHz]
K	26	40
Q	33	50
U	40	60
V	50	75
E	60	90
W	75	110
F	90	140
D	110	170
G	140	220
J	220	325
Y	325	500
X	User-defined	

Selecting one of the external mixers or frequency bands has the following consequences:

- In the background, R&S ELEKTRA sets the "Input Selection" to DC input coupling.
- It sets the [Frequency Range](#) to the start and stop frequencies of the external mixer or band.
- It disables the [RF Attenuation](#) and [Preamplifier](#) fields, while in the background setting both parameters to 0 dB.
- It enables the [Auto ID Threshold](#) input field.
- R&S ELEKTRA loads and activates a corresponding "SaveSet" of settings in the receiver or analyzer, specific for the selected band. It identifies the appropriate "SaveSet" by the naming convention "EXTMIX_<band>", where <band> represents the band ID. If the frequency band is configured correctly in the receiver or analyzer, the instrument driver can recall and use it.
- If an external mixer is selected, by default, the conversion loss is always set to 0 dB.
To define conversion losses, use a separate attenuation correction table that is associated either to a signal path (side by side with any cable loss corrections) or to an antenna.

Note: Compatible instruments. The harmonic-mixers feature is supported by the following [receivers and spectrum analyzers](#) with option B21:

- R&S FSW26 to R&S FSW85
- R&S FSV30, R&S FSV40
- R&S ESW44

To perform a measurement with external mixers, we recommend proceeding as follows:

- Start at the front panel of your test receiver or spectrum analyzer:
 - Push [Preset].
 - Go to the "Home" menu.
 - Set the instrument to "Spectrum" mode.
 - Push the "External Mixer" softkey.
The settings dialog for the external mixer opens.
 - Activate the external mixer.
 - Apply all settings related to a specific waveguide band or an external mixer, for example its conversion loss.
 - Store the instrument settings as a data set with a name like "EXTMIX_<band>", where <band> represents the band ID.
- All other settings are available in the test template editor of R&S ELEKTRA:
 - Set **Operating Mode** = "Spectrum Analyzer"
 - Select one of the external mixers or waveguide bands from "Input Selection" drop-down list

Auto ID Threshold ← Input Selection ← Settings (Overview)

Available only, if the **Input Selection** uses a frequency band or external mixer (no conventional AC or DC port).

Specifies the maximum permissible level difference between test sweep and reference sweep to be corrected in the receiver's firmware during automatic comparison.

We recommend using a threshold between 0.1 dB and 100 dB, where 10 dB typically yields satisfactory results.

If **Auto Signal Identification** is disabled in the **External Mixer**, R&S ELEKTRA ignores the "Auto ID Threshold".

For more information on signal identification with auto ID, refer to your instrument's user manual.

RF Attenuation ← Settings (Overview)

Available only, if **Input Selection** uses a conventional AC or DC port (no frequency bands, no external mixers).

Selects a fixed input attenuation (in dB) from a list of predefined attenuation values. Alternatively, you can select "Auto" ranging, which has the following effects:

- "Auto" enables an algorithm that automatically selects the appropriate input RF attenuation (higher than the manual selection, if necessary). The algorithm depends on various settings and on the test situation.
- If the **Operating Mode** is "Test Receiver", "Auto" enables the selection of a **Min Attenuation**.

RF Attenuation	10 dB	▼	RF Attenuation	Auto	▼
Min. Attenuation	0 dB	▼	Min. Attenuation	0 dB	▼

If you use a test receiver in measurements with potentially strong signal pulses, you must protect the receiver's RF input port by selecting a sufficiently high "RF Attenuation" value.

Note: Setting the attenuation too high reduces the sensitivity of the measurement.

We recommend protecting the receiver input by using "Auto" ranging.

- If the [Operating Mode](#) is "Test Receiver", we recommend combining "Auto" with a [Min Attenuation](#) of 10 dB.
- If the [Operating Mode](#) is "Spectrum Analyzer", and if after completing the sweep across the current subrange R&S ELEKTRA detects an overload condition, it proceeds as follows, trying to solve the overload condition automatically:
 - a) The software increases both the RF attenuation and the reference level by 10 dB.
 - b) The driver triggers another sweep and waits for completion.
 - c) R&S ELEKTRA checks the measurement results for an overload condition again.
 - d) If it still detects an overload condition and the current RF attenuation is < 40 dB (or < 30 dB for R&S FSL or R&S ESL), it repeats the procedure.

Note: Automatic receiver protection. Between measurement steps, there is an increased risk of overloading the receiver's RF input port with [ESD](#) voltage peaks. This risk is especially prevalent during changes in the hardware setup, for example when you touch a connected measurement antenna while exchanging it.

To protect the receiver against possible voltage peaks, the software selects high input attenuation at the beginning and end of a test. It selects high input attenuation also between measurement steps, hence when the measurement is interrupted for user interaction. Typically, such interaction is accompanied by a notification that instructs you to do a change in the hardware setup. When your interaction is completed, the software sets the receiver input back to the correct attenuation that is assigned to the next measurement step and proceeds with the measurement.

Min Attenuation ← **RF Attenuation** ← **Settings (Overview)**

Available only in [Operating Mode](#) "Test Receiver", if [RF Attenuation](#) is set to "Auto" (not to a fixed value), and if [Input Selection](#) uses a conventional AC or DC port (no frequency bands, no external mixers).

Specifies either no minimum attenuation (0 dB = default) or a minimum attenuation of 10 dB, as described in [RF Attenuation](#).

Preamplifier ← **Settings (Overview)**

Available only, if [Input Selection](#) uses a conventional AC or DC port (no frequency bands, no external mixers).

Specifies the receiver's preamplification (in dB) for each frequency range.

We recommend disabling the preamplifier (= 0 dB) and using an [RF Attenuation](#) of at least 10 dB, to protect the receiver from damage due to input overload. This protection is especially important, if high disturbance pulses could occur, for example in conducted measurements. Another scenario that imposes an overload risk is the generation of electrostatic discharge pulses, caused by touching the antenna during manual antenna changes.

The following settings are available:

"0 dB"	Selects 0 dB preamplification (= default)
"20 dB"	Selects 20 dB preamplification. In the receiver R&S ESW, the preamplifier has a frequency range of 1 kHz to 8 GHz.
"30 dB"	Available only with a receiver like R&S ESW with option R&S ESW-B24. Selecting 30 dB preamplification activates the receiver's low-noise amplifier (LNA) instead of the preamplifier. In the R&S ESW, the preamplifier has a frequency range of 150 kHz to the maximum frequency of the device (8 GHz / 26.5 GHz / 44 GHz). The LNA is located in front of the preselector, hence it is <i>not</i> protected by it. With this selection, avoid high RF input levels, which can damage or even destroy the LNA.

IF Gain ← Settings (Overview)

Available only, if the [Receiver](#) type is "FSWT26", and if the [Operating Mode](#) is "Test Receiver".

Applies the selected gain after the signal has been mixed down to the intermediate frequency (IF), to improve measurement sensitivity.

- In "Auto" mode, the R&S FSWT automatically selects the best gain setting (up to 30 dB) for the measured signal
- Alternatively, you can manually select one of the predefined gain values

Reference Level ← Settings (Overview)

Available only, if the [Operating Mode](#) is "Spectrum Analyzer".

Specifies the value of the upmost line on the analyzer's display, to avoid an input overload.

The unit of the reference level is automatically adjusted to the [measurement unit](#) of the [transducing device](#), hence typically $dB\mu V$. The default value is 80 $dB\mu V$.

Settings (Final)

Settings (Final)

Specifies the settings for the [Final Measurement](#).

This dialog is available only, if you have both selected (chosen) a [Hardware Setup](#) and selected (highlighted) the [Receiver](#) icon in the [hardware setup diagram](#):



Figure 4-25: Select (highlight) the receiver icon

Note: Be aware of the difference: *Settings* define the individual behavior of a device during a test that is controlled by this test template. On the contrary, *Properties* define the global characteristics of a device as specified in the [Device List](#).

The rules for the settings in this dialog are all described in [Settings \(Overview\)](#).

Most of the settings (including the "Meas. BW") are **copied** from the overview measurement dialog.

Some settings are copied or calculated from overview settings, for example, the "Meas. BW", as the final measurement always uses identical "Meas. BW" setting as the overview measurement.

You can only edit the following final measurement settings:

- "Meas. BW" Selects the measurement bandwidth for the final measurement. Per default: set to the same [Meas. BW](#) as in the [Settings \(Overview\)](#). You can change the final measurement BW without influencing the BW settings in other measurement phases.
- "Meas. Time" Specifies the measurement time for the final measurement. The selection is independent of the [Measurement time](#) in the [Settings \(Overview\)](#) and independent of the [Operating Mode](#).
- "Video BW" Available only, if the [Operating Mode](#) is "Spectrum Analyzer". Per default: set to the same [Video BW](#) as in the [Settings \(Overview\)](#), if available there. However, you can change the setting and select from a list of suggested video bandwidths or "Auto".

Settings

Settings

Available only, if the hardware setup uses a LISN or an antenna device, *and* if you have selected (highlighted) the icon of this device.

This dialog specifies the settings of the selected LISN or antenna for each frequency range in the "Measurement Settings".

If you deactivate or deselect a parameter in the [Accessory Settings](#), the checkbox is unavailable in the "Flow Details" dialog.

See also details in [Accessory Settings](#).

Flow Details - Overview Measurement

Measurement Settings | Accessory Settings | Trigger

Use a table for the combined Height/Polarization setup

Active	Priority	Loop Parameter	Mode	Range	Step Size	Parameters
<input checked="" type="checkbox"/>	1	Azimuth	Stepped	0 deg - 360 deg	15 deg	Positioning Speed : 7
<input checked="" type="checkbox"/>	2	Height	Stepped	1 m - 4 m	50 cm	Positioning Speed : 7
<input checked="" type="checkbox"/>	3	Polarization	Stepped	<input checked="" type="checkbox"/> H <input type="checkbox"/> V		V → H
<input type="checkbox"/>	4	User Defined	Stepped			

Hardware Setup Diagram:

- EMI Test Receiver (ESI44 Receiver)
- Broadband Antenna (highlighted with callout 3)
- EUT
- Turntable (Matsuo FCU Turntable)

30 MHz - 6 GHz

Settings: H V

Figure 4-26: An example of an antenna with its V polarization parameter deselected

- 1 = Configuration in the "Accessory Settings" dialog
- 2 = Configuration in the "Flow Details" dialog for frequency between 30 MHz and 6 GHz
- 3 = Selected device, in this case, a broadband antenna

For the various devices, the options available for selection in the "Settings" dialog is limited by the options enabled in the [Accessory Settings](#) as follows:

- LISNs:
 - 2-Line LISN or 4-Line LISN, for example, "ENV 432": "N", "L1", "L2", or "L3"
 - "ENV 216": "High-Pass", which enables or disables remote switching of the LISN's internal 150-kHz highpass filter
 - "Single-Line": "IDLE" or the selected line
 - "Multi-Line": "Probe IDLE", "Probe Line A", "Probe Line B", "Probe Line C", "Probe Line D"
- Antenna: "H" or "V" polarization, as shown in [Figure 4-26](#)

Note: For a description of the receiver settings, refer to [Settings \(Overview\)](#).

Properties

Properties

Shows the properties of the device that you select (highlight) in the hardware setup diagram.

Note the difference: Properties define the global characteristics of a device as specified in the [Device List](#) (see [Device properties](#)). On the contrary, the [Settings](#) define the individual behavior of a device (the receiver) during a test that is controlled by this test template.

The "Properties" are shown as specified in the [Device List](#).

Note: Access to device properties depends on the type of test template.

- You can open a test template that is integrated into a test (as a "copy" of a "global" test template). However, you only can read but not modify any device properties from within this test template dialog. Hence, within the test, these properties settings document the states of the devices at the time when the measurement was executed.
- If you open a "global" test template outside of a test, you can modify the device properties from within the test template dialog.

4.4.4 Test Information

▼ Test Information

This dialog allows editing test information that is relevant for all (or most) of the tests that you run from this test template. By entering this information in the test template instead of in the test, you avoid having to enter the same information repeatedly for the same type of tests.

To edit your predefined titles and contents for an individual test, open the [test information dialog](#) within this test.

Title	Content	
Description		
Test Standard		
Test Site		
Operator Name		

Figure 4-27: Test information dialog

Add Information

- **"Add Information"**
Adds a new row in the test information table, below the default lines "Description", "Test Standard", "Test Site" and "Operator Name".
- **"Shift Row Up / Down"**
The buttons swap the position of the selected row with the one above or below it.
- **"Title"**
Enter a title for each row of test information.
Click the titles headline to sort the rows alphabetically by their titles.
- **"Content"**
Enter arbitrary content in each row of test information. You can also leave the content of a row blank and enter only the title, for entering the content later (within the tests).
Click the contents headline to sort the rows alphabetically by their contents.



Content history

For each category, R&S ELEKTRA memorizes previously stored text in the "Content" column. After saving the test template and deleting any text from the "Content" column, the software helps you in restoring that text by selecting it from a context dialog.



- **"Delete Row"**
Deletes the selected row without additional warning and without the possibility to restore the deleted title and content.

4.4.5 Actions

Actions

This dialog defines actions that are executed when a particular event occurs during a measurement.

In a new test template, the "Actions" settings are available only, when you have selected the [Receiver](#) in the [Hardware Setup](#). To have the [Receiver](#) selected automatically in each new test template, set it as your favorite in the device list. See [Set as Favorite Device](#).

Available Actions	Actions of the Test	Properties
<ul style="list-style-type: none"> ✉ E-mail i Notify ⌚ Wait 	<ul style="list-style-type: none"> ⏪ Test Start/Resume ⏪ Test Pause ▼ ⏪ Frequency range [9 kHz to 150 kHz] <ul style="list-style-type: none"> ⚡ Enter ⚡ Leave ▼ ⏪ Overview Measurement <ul style="list-style-type: none"> ⚡ Enter ⚡ Leave ▼ ⏪ Data Reduction <ul style="list-style-type: none"> ⚡ Enter ⚡ Leave ⏪ Test Stop ⏪ Test Error 	

Figure 4-28: Actions dialog

The available actions are:

- **Email** - sending an email message to alert the user
- **Notify** - sending a notification to alert the user
- **Wait** - waiting for a defined time before R&S ELEKTRA continues with the next step of a test. During this time, you can stop the test.

Typical events, for which actions can be assigned, are:

- "Test Start/Resume"
- "Test Pause"
- "At Every Frequency (Pre Dwell)"
- "At Every Frequency (Post Dwell)"
- "Frequency range" according to the test phases in the [Flow Details](#), where the event can be:
 - "Enter" the frequency range
 - "Leave" the frequency range
- "Overview Measurement", where the event can be:
 - "Enter" the measurement
 - "Leave" the measurement
- "Overview Sweep/Scan (all frequency ranges)", where the event can be:
 - "Enter" the overview sweep/scan frequency range
 - "Leave" the overview sweep/scan frequency range
- "Data Reduction", where the event can be:
 - "Enter" the data reduction
 - "Leave" the data reduction
- "Final Measurement", where the event can be:
 - "Enter" the measurement
 - "Leave" the measurement
- "Test Stop" (scan end or user interruption)
- "Test Error"

Assigning an action

To assign an action to an event, drag-&-drop the action icon from "Available Actions" (left tab) to the name of that specific event in "Actions of the Test" (center).

For example, click-and-hold "Notify", drag it to "Test Stop" and drop it there.

Click any assigned action item to edit it in the "Properties" tab.

If several action items are in one node, you can use the **short keys** [Alt]+[↑] and [Alt]+[↓] for moving a selected item up or down. Or right-click the item and use the functions "Move Up" and "Move Down" in the context menu.

To remove an action item from an event, select the item and click [Delete] on the keyboard. Or right-click the item and select [Delete] in the context menu. In **touch operation** on a tablet computer, tap and hold the icon of an action and select [Delete] in the context menu.

To include the details of your specified actions into test reports, open the **Report Templates** dialog, either in a general report template or embedded in a test template. In the selected "Test Template" component, enable the "Show Details" checkbox in the "Component Options" section.

The following actions are available in your tests:

Email..... 121
 Notify..... 123
 Wait..... 124

Email

Sends an email message when the event has occurred, for example, a test is started or stopped.

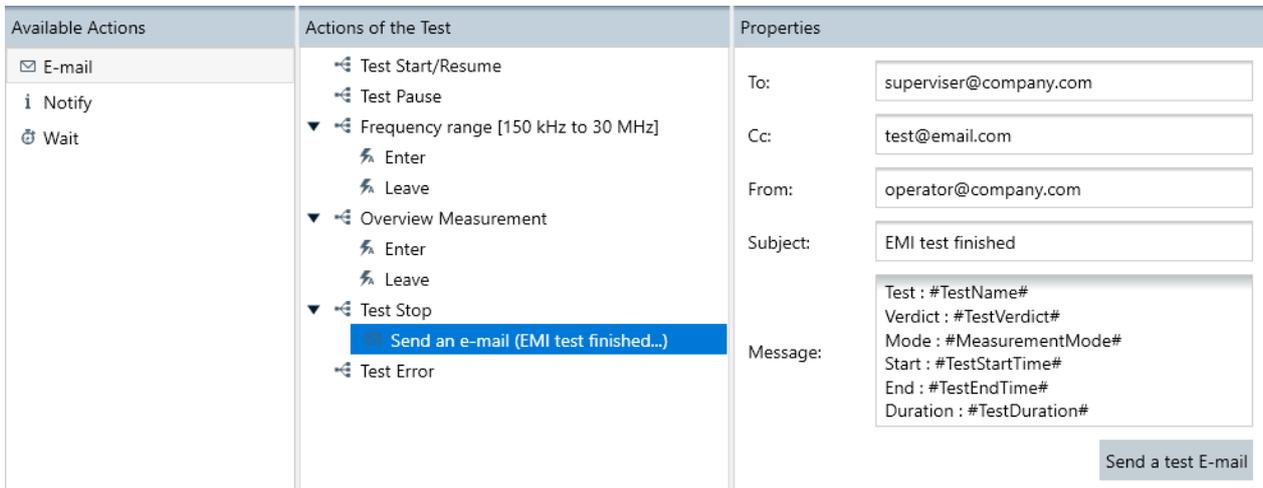


Figure 4-29: Action "Email" assigned to event "Test Stop"

- "To" Enter one or more recipient addresses.
- "Cc" Enter one or more copy addresses.
- "From" Enter the address of an email account that you have access to.

"Subject"	Enter a subject heading. R&S ELEKTRA suggests a default heading. For the pound keys, see the description at "Message".
"Message"	<p>Enter any arbitrary message text. R&S ELEKTRA suggests some default entries. The functional text items (tags between two pound keys, for example "#TestName#") are automatically replaced by the content that they represent. This replacement is executed only, if the message is issued out of a real test. The replacement cannot take effect when you use the button "Send Test Email" out of the test template. If no content is available for a tag, R&S ELEKTRA returns the tag itself.</p> <p>The functional text items (tags) that the software can replace automatically are:</p> <ul style="list-style-type: none"> • #TestName# Returns the name that you used to save the test. If the test is not yet saved, R&S ELEKTRA uses the default name of the test based on the name of the test template. • #TestVerdict# After the test is finished, output values are "Inconclusive", "Failed" or "Passed", otherwise it is "Unknown". • #MeasurementMode# Output values are "Overview" or "Final" measurement. Available only, if the measurement in the first frequency range has started. • #CurrentFrequency# Returns the current frequency that the measurement uses at this moment. • #CurrentFrequencyRange# Returns the start and stop frequencies of the frequency range that the measurement uses at this moment. • #CurrentMonitoringChannel# Returns the name and number of the "Monitoring Channel" that is active, together with its minimum and maximum values. • #TestStartTime# Returns both date and time in the format "yy-MMM-dd ddd HH:mm:ss". • #TestEndTime# Returns both date and time in the format "yy-MMM-dd ddd HH:mm:ss". Before the test is completed, the output value is "<Test not yet finished>". • #TestDuration# Returns the hours, minutes and seconds from the test start to the moment that the notification is generated. • #TestStatus# Can be started, stopped, completed, failed or unknown.
"Send Test Email"	<p>Sends an email to the specified "To" and "Cc" addresses. Note that in a test message, the text items between pound keys are not replaced by the content that they represent.</p>

Notify

Brings up a user-defined text and audio message on the computer, on which R&S ELEKTRA is running, when the event has occurred.

The audio feature requires that the computer has a sound card and that the computer's loudspeaker is not muted (volume > 0%).

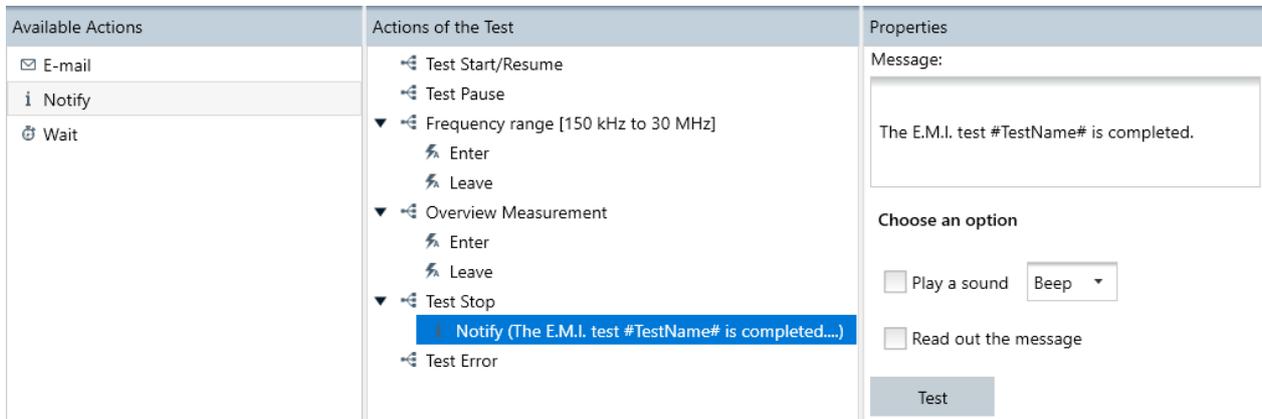


Figure 4-30: Action "Notify" assigned to event "Test Stop"

While the dialog box shows the text message, you can optionally stop the test or select "Continue" to proceed with the test execution.

- "Message" Enter any arbitrary notification text. R&S ELEKTRA suggests a default entry. The functional text items between two pound keys (for example "#TestName#") are automatically replaced by the content that they represent. This replacement is executed, if the notification is generated out of a real test, rather than out of the test template by using the button "Test".
For a list of functional text items that can be used between two pound keys, see [Email](#) > "Message".
- "Play a sound" Replays a Windows system sound according to your selection in the field "Select a sound".
The available Windows system sounds are called:
- "Beep"
 - "Exclamation"
 - "Asterisk"
 - "Hand"
- "Read out the message" This function displays the text from the "Message" field in a dialog box and also reads it out loud, when the event has occurred.
Note that acronyms such as "EMI" are better pronounced if written as "E.M.I.". The audio replay of the message is not stopped even if you continue or stop the test.
- "Test" Serves for testing the message output of the "Notify" feature.
Note that in this "Test" notification, the text items between pound keys are not replaced by the content that they represent.

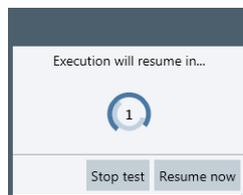
Wait

Makes R&S ELEKTRA pause the test for a user-defined time (number of seconds) before the next step of the test is executed.

Available Actions	Actions of the Test	Properties
<input checked="" type="checkbox"/> E-mail <input type="checkbox"/> Notify <input checked="" type="checkbox"/> Wait	<ul style="list-style-type: none"> ↳ Test Start/Resume ▼ Test Pause <ul style="list-style-type: none"> ⊙ Wait (10 sec) ▶ Frequency range [150 kHz to 30 MHz] ▶ Overview Measurement ↳ Test Stop ↳ Test Error 	Wait (sec): <input type="text" value="10"/> + -

Figure 4-31: Action "Wait" assigned to event "Test Pause"

While the test is paused, a dialog box shows a countdown of the remaining seconds to wait. During this time, you can optionally stop the test or select "Resume now" to skip the remaining waiting time.



4.5 Report Templates

Report templates are used for the configuration of [test reports](#). Report templates contain user-definable settings and are contained in [Tests](#), as shown in the [software structure](#).

Handling report template items



Access: "Home" > "Report Templates"

Depending on the selection of one or several report templates, different action buttons are available in the actions bar. All these buttons are common action buttons, described in [Chapter 3.3, "Common action buttons"](#), on page 39.



Specify general settings for report templates at "Home" > "Administration" > [Settings](#) > [Report](#).

With "Open" or "Create Report Template", proceed as described in [Chapter 4.5.1, "Configuring report templates"](#), on page 125.

4.5.1 Configuring report templates

Either start with an existing report template, or create a new one.

- To open an existing report template, use one of the following options:
 - Select it at "Home" > "Report Templates" and click "Open". Opening a report template from this menu allows saving it as a global report template, available for other tests, but you cannot configure all details.
 - Open it from within a test as described in [Chapter 3.9, "Reporting"](#), on page 50. Opening a report template inside a test allows configuring all details, but you cannot save it as a global report template, available for other tests.
- To create a report template, use one of the following options:
 - Select "Home" > "Report Templates" > "Create: Report Template". Creating a report template from this menu allows saving it as a global report template, available for any test, but you cannot configure all details.
 - Create a report template from within a test as described in [Chapter 3.9, "Reporting"](#), on page 50. Creating a report template inside a test allows configuring all details, which are not necessarily available in other tests.

Hence, typically create your report templates outside of tests and configure them with all contents that are not test-specific. Then save these report templates as global report templates. Inside a test, select one of your global report templates and refine it by configuring specific details. The detailed report template is saved (embedded) in the test container as a copy of the original global report template. Note that this embedded report template copy is not globally available. To make the copy globally available, right-click it to open its context menu and select "Export to Global Report Template".

In the "General" section of the report template, specify the report title and the left-hand, center and right-hand content of both the report header and footer.

All items that can be included into the report header or footer are self-explanatory, except for the [Verdict](#).

Below the "Header" and "Footer" dialogs, select from a list of "Available Components" in an arbitrary order. Double-click an item, or click the "Select Component" button  next to it, to add the item to the list of "Selected Components" (dialog below the "Available Components").

In this list, you can rearrange the "Selected Component": drag and drop them to the desired position. (If you use a tablet computer, touch and immediately drag the object you want to move, without holding it for long.)

Most of the "Selected Component" offer individual "Component Options", for which you can specify settings when you have highlighted that "Selected Component". For example, if you have selected "Generic Table", its "Component Options" include the selection of the "Table Type" (e.g., "Limit Line" and "Transducer Correction"). For each type, you can enable the checkbox "Include All Table(s) of Selected Type" to include into the report template a placeholder for all tables of this type.

In the global context, the software does not know column names and availability. So for tables and graphics, the "Available Columns" and "Available Graphics" lists present named placeholders, enclosed in square brackets. In the test context, the report template translates these placeholders into actual content. For example, the "Available

Columns" in the global context include "[Detector 1]". In the test context, it translates into a set of columns for detector 1, like "Level", "Limit", "Margin", and "Raw Level".

The "Component Options" also offer "User Defined Columns" for tables and "User Defined Graphics" for graphics. However, you cannot create your own columns and graphics. Instead, this field allows specifying in the global context the name of a column or graphic that you expect to be available in the test context. For example, if you want to report the "Detector 2 Limit", and you know that a test uses the RMS detector as detector 2, this field allows adding "RMS Limit" to the selected columns.

In the frequency column of result tables, R&S ELEKTRA automatically adjusts the unit (Hz, kHz, MHz) to the highest test frequency. For frequencies < 100 kHz, it uses Hz, for frequencies < 1 MHz, it uses kHz. It adjusts also the number of decimal places of the frequency values according to the [Accuracy](#) setting in the test.

In part, you can specify options only when the report template is opened (embedded) inside a real test. Outside of a test, hence in a non-embedded report template, placeholders for the selected components are inserted into the report preview.

Options of embedded report templates

The following options are available only for **embedded** report templates, opened inside a test:

- For the component "EMI Tables", select at least one of the "Available Tables" by clicking the "+" sign (⊕) to add it to the list of "Selected Tables". In the selected table, optionally select a subset of rows and optionally disable individual columns. In this context, the checkbox "Use Report Relevant Column" (available only in an embedded report template) provides two options for each table:
 - If unchecked, the report shows the columns of this table as selected here, in the report template.
 - If checked, the report ignores the selection in the report template. Instead, it shows the columns as selected with  in the [Show / Hide Columns](#) dialog  of that table's header, or in its context menu.
- For the component "Generic Graphics", select at least one of the "Available Graphics" by clicking the "+" sign (⊕) to add it to the list of "Selected Graphics".
- For the component "Generic Table", select at least one of the "Available Tables" by clicking the "+" sign (⊕) to add it to the list of "Selected Tables".

Action buttons in the report's top menu

To put any change into effect, click the small "Refresh" button  in the *top menu of the report*. If you edit an embedded report template inside a test, do **not** use the taller "Refresh" button  in the *top menu of the test*.

The placeholders shown for selected components in non-embedded report templates provide no details. Therefore, we recommend creating basic report templates from the report templates menu and refining them within your tests, as described above.



When you have finished configuring the report template, make sure to **save** the result by clicking  or  in the [Test control top menu](#).

Next to the "Refresh" button  in the top menu of the report, more functions are available for the following:

- Exporting the report in PDF  or DOCX  format. The default format is set in the [Administration > Report](#). When you click the export button, you can still switch to the non-default format.
- Attaching
The "Attach" button , which is only available for embedded report templates, saves a report in the R&S ELEKTRA database together with the test, see [Chapter 3.9, "Reporting"](#), on page 50.
- Toggling the display of miniature views of report pages in a sidebar
- Printing the report
- Searching for text in the report
- Zooming the report view
- Navigating the report's pages using the left and right arrow keys

Note that tables that do not fit on the length of one page are continued on the next page (or pages). Tables that do not fit on the width of one page are split to fit on the width of n pages. The table parts are labeled "(1/n)" on the first page and continued with labels "(2/n)", "(3/n)", ... until "(n/n)". To reduce the width of a table, deselect columns that are dispensable. This deselection can only be done in a report template that is embedded within a test.

Optionally enable "Landscape Display" for wide graphics or tables.

Zoom settings for selected graphics

With this feature, you can better visualize the chart in reports without creating and storing a new chart by zooming in to a specific area.

To render a specific region of an existing chart for reporting

1. Verify that one of the following is available in the "Selected Components":
 - "EMI Graphics"
 - "Generic Graphics"

Otherwise, add the component from the list of "Available Components" by clicking .

2. In the "Selected Components", select (highlight) the relevant component, for example "EMI Graphics".

The dialog displays the "Available Graphics".

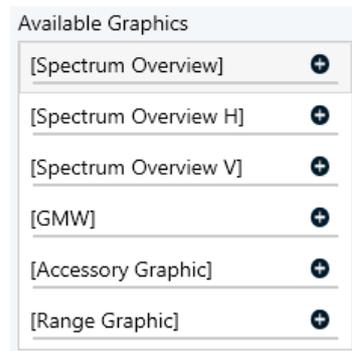


Figure 4-32: Available Graphics box

- For each chart that you want to add to the report, click the select button . This chart's entry appears in the list of "Selected Graphics".
- If you want to specify zoom settings for a selected graphic, expand its zoom-settings. To do so, click the expand button . The zoom-settings box opens.

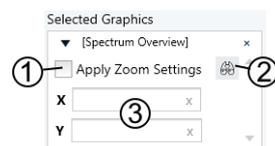


Figure 4-33: Zoom-settings box

- 1 = Checkbox applies zoom settings to report
 2 = Selects predefined camera views in spherical and cylindrical charts
 3 = [Zoom settings parameters](#)

Note: If a chart has stored zoom settings, you cannot edit these settings here in the zoom-settings box. See ["Store Zoom Settings"](#) on page 62.

- Enter the "X" and "Y" parameters (3 in [Figure 4-33](#)) with a syntax as in [Table 4-5](#). R&S ELEKTRA automatically applies the correct units from the chart.

Note: For spherical or cylindrical charts, you can select a predefined camera direction from a list. To open this list, click the "Select View" button (2 in [Figure 4-33](#)). For the view that you select, R&S ELEKTRA automatically enters the correct "X" and "Y" parameters.
- To let your settings take effect for the report, enable the "Apply Zoom Settings" checkbox (1 in [Figure 4-34](#)).
- To immediately execute your settings in the report, click the small refresh button . See ["Action buttons in the report's top menu"](#) on page 126.

Zoom settings parameters

The "X" and "Y" zoom parameters require different entries for different chart types. Also, take care to use correct syntax for these parameters.

Table 4-5: Syntax for X and Y parameters

Chart type	Designation	Description	Syntax	Examples
Cartesian, Heat map	Range	<p>"X" and "Y" depend on the chart type:</p> <ul style="list-style-type: none"> Cartesian chart of spectral measurement: "X" = frequency (Hz), "Y" = level (e.g. dBm) Heat map of spectrum-over-azimuth measurement: "X" = turntable azimuth (deg), "Y" = frequency (Hz) Heat map of cylindrical measurement: "X" = turntable azimuth (deg), "Y" = antenna height (m) 	<p>Enter value pairs "a;b" with semicolon (;) as separator.</p> <p>"a" is minimum value, "b" is maximum value.</p> <p>"a" (minimum) is smaller than "b" (maximum).</p> <p>Common unit prefixes and negative values are accepted, but frequency is always positive.</p>	<p>Frequency syntax</p> <ul style="list-style-type: none"> 200M;1G 200;1G 200;600 <p>Wrong syntax</p> <ul style="list-style-type: none"> 1G;200
Cartesian, Heat map	Center/span	<p>"X" and "Y" depend on the chart type:</p> <ul style="list-style-type: none"> Cartesian chart of spectral measurement: "X" = frequency (Hz), "Y" = level (e.g. dBm) Heat map of spectrum-over-azimuth measurement: "X" = turntable azimuth (deg), "Y" = frequency (Hz) Heat map of cylindrical measurement: "X" = turntable azimuth (deg), "Y" = antenna height (m) 	<p>Enter value pairs "a:b" with colon (:) as separator.</p> <p>"a" represents center, "b" represents span.</p> <p>The absolute value of "a" (center) is greater than the absolute value of "b" (span).</p> <p>Common unit prefixes and negative center values are accepted, but span is always positive.</p>	<p>Frequency syntax</p> <ul style="list-style-type: none"> 1G:200 600:200 <p>Wrong syntax</p> <ul style="list-style-type: none"> 200M:1G 200:1G
Spherical, Cylindrical	Absolute	<p>"X" represents elevation θ and "Y" represents azimuth ϕ of the viewing direction in angular degrees.</p>	<p>Enter single values between 0 and +360.</p>	<p>Degrees syntax</p> <ul style="list-style-type: none"> 90 45 <p>Wrong syntax</p> <ul style="list-style-type: none"> -10 362

Upon refreshing the report with correct zoom settings, the test report displays the zoomed chart.

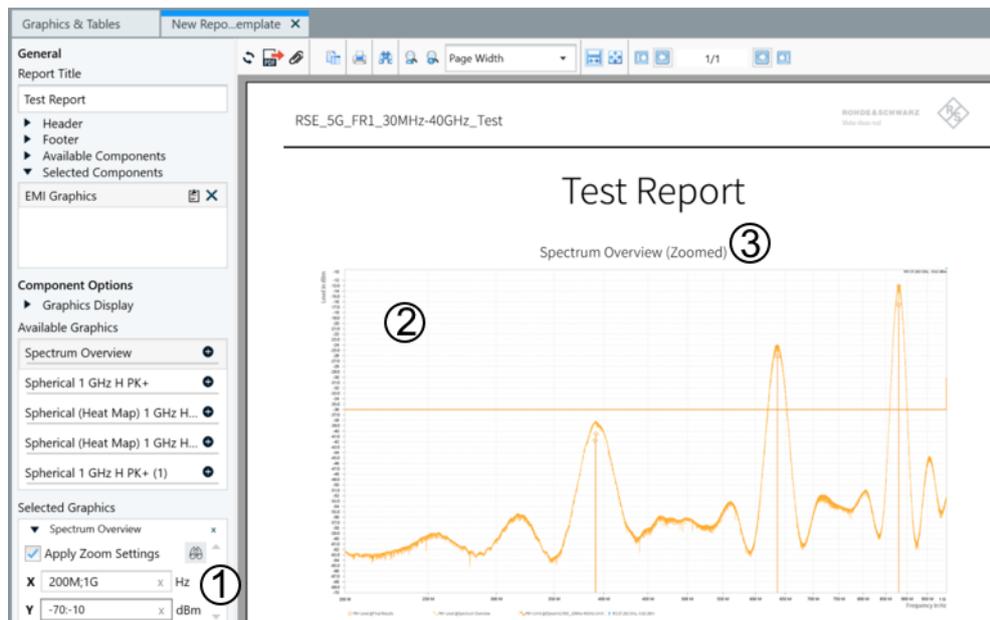


Figure 4-34: A test report with a chart that has correct zoom parameters configured

- 1 = "X" and "Y" parameters
- 2 = Zoomed-in chart
- 3 = Chart title with label "(Zoomed)", indicating that zoom configuration is applied

Otherwise, the report displays the original chart without zoom and error messages for the user to verify the error.

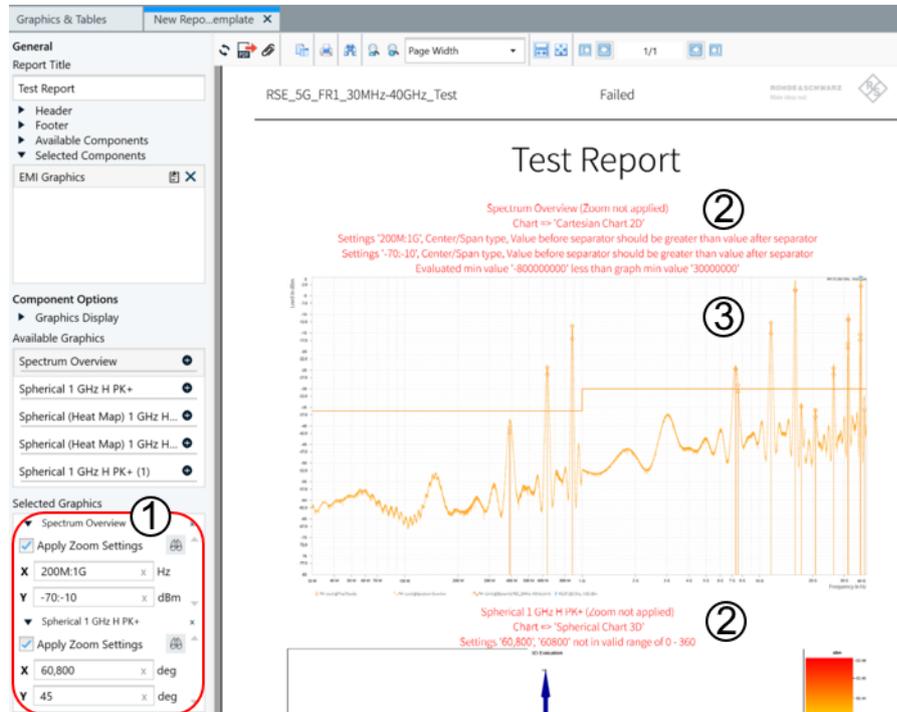


Figure 4-35: A test report with charts that have incorrect zoom parameters configured

- 1 = Zoom settings with incorrect parameters
- 2 = Error messages
- 3 = Original chart without zoom settings applied

4.6 Device List

The "Device List" comprises all measuring equipment in the test site. Devices from this list are part of [Test Templates](#), as shown in the [software structure](#).

R&S ELEKTRA is compatible with a comprehensive choice of Rohde & Schwarz devices. When you [add](#) a device to the "Device List", a device driver is implemented in the background. The software does not provide user access to these drivers, which cover all communication tasks between R&S ELEKTRA and the devices.

Each device entry contains [General properties](#). You can edit these properties. For the receiver, you can let R&S ELEKTRA automatically retrieve the properties by using the functions [Search Device](#) and [Recheck Devices](#). This feature requires that the receiver is connected to your computer, either directly via GPIB or remotely via LAN. Note that many [LISNs](#) can be remotely controlled by R&S ELEKTRA via an interface in the receiver.

Handling device list items

Access: "Home" > "Device List"

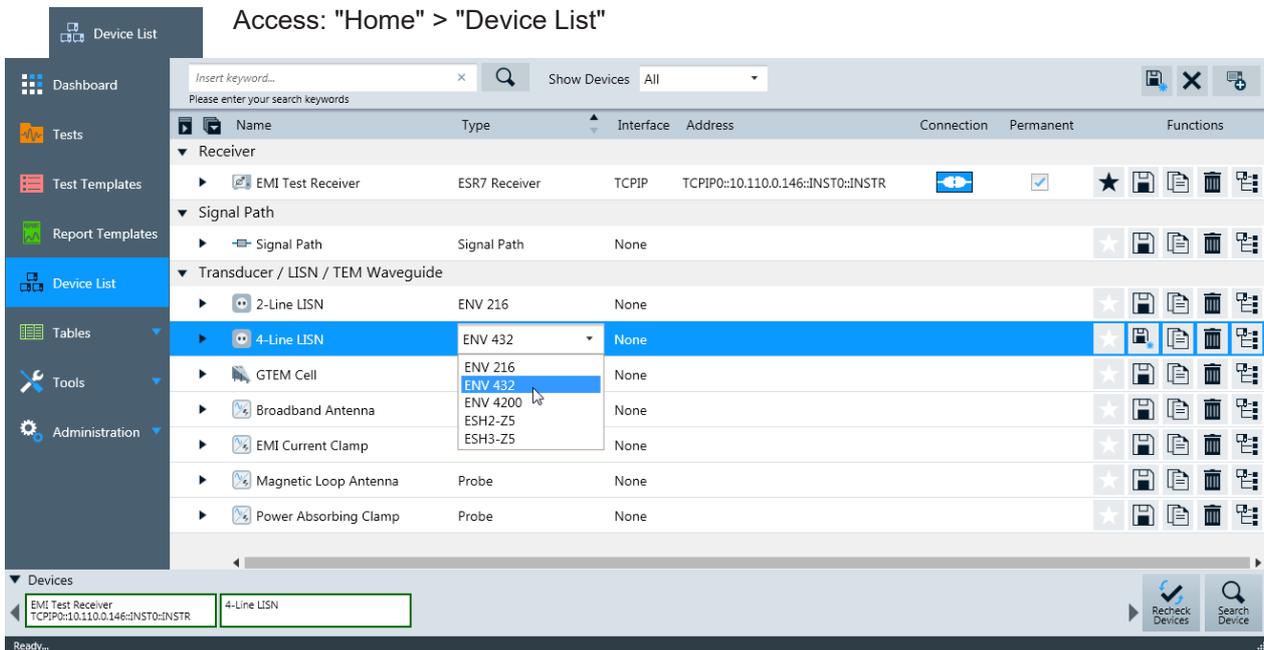


Figure 4-36: Device list dialog with an exemplary list of devices

The "Device List" dialog is largely different from the other "Home" dialogs ("Tests", "Report Templates", etc.). Differences are:

- All items in the "Device List" are grouped in **Device classes**, for example "Receiver" or "Transducer". (To sort the entries within each device class, click the column header. Click the header again for reverse order.)
- No item in the "Device List" can be selected for an action to be executed with it. Instead, you can set one device per device class to be the **Favorite Device** in this device class.
- No item in the "Device List" can be **pinned** to the "Dashboard".
- No search can be saved, but the "Device List" can be **filtered (Show Devices)** for referenced, unreferenced or modified devices.
- None of the familiar **Common action buttons** is available. Instead, there is a special set of **Action buttons in the Device List**.
- The device properties are not edited by opening them in a separate dialog tab. Instead, the device properties unfold in several tabs within the "Device List".
- Besides editing the device properties manually, they can also be automatically retrieved from existing physical equipment. This retrieval is implemented by the functions **Search Device** and **Recheck Devices**. To use these functions, the equipment must be connected to the computer, which runs R&S ELEKTRA.
- Changes in the settings or properties of *several* devices can jointly be **saved** or **discarded**.

Device classes

The "Device List" includes the following classes of devices, which are described in [Chapter 4.6.2, "Device properties"](#), on page 142:

- [Receiver](#)
- [Signal Path](#)
- Various transducing devices are combined in the group "**Transducer / LISN / TEM Waveguide**":
 - [LISN](#)
 - [TEM Waveguide](#)
 - [Transducer](#)



Devices are always *integrated into test templates* as **references** that link to the original data sets in the "Device List". They are not integrated as copies of those data sets. Therefore, if device properties are modified in the "Device List", these properties are changed in all instances, too: in each test template that uses this device, in each test that uses this test template, etc.



Signal paths are included in the "Device List". A signal path is not necessarily only a piece of cable but can include multiple cables, connectors, attenuators, etc.

• Action buttons in the Device List	132
• Device properties	142
• General properties	143
• LISN	145
• Receiver	150
• Signal Path	153
• TEM Waveguide	154
• Transducer	157

4.6.1 Action buttons in the Device List

Access: "Home" > "Device List"

In the "Device List", the familiar [Common action buttons](#) are not available. Instead, the dialog-specific action buttons for the "Device List" are:

Search	133
Show Devices	133
Save all changes	134
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Add a new device	134
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Expand All	134
Name	135
Type	135
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Address.....	135
Connection.....	136
Permanent.....	136
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L Set as Favorite Device.....	136
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Search

Searching for devices in the "Device List" works as described in [Chapter 6, "Special software features"](#), on page 199: Enter an arbitrary text string into the search field to *filter the "Device List"* for entries that contain this text.

Note:

- Other than conventional [Searches](#), a search in the "Device List" cannot be saved and [pinned](#) to the "Dashboard".
- Do not confuse this function for *searching (filtering) the "Device List"* with the function [Search Device](#), which allows finding devices in the network environment (LAN or GPIB).
- If there are unsaved device changes in the device list, the search results are not complete. To get complete search results, save the changed devices before doing a search.
If you wish to see exclusively the devices with unsaved changes, select [Show Devices](#) > "Modified".

Show Devices

Filters the devices that are displayed in the "Device List" by the following criteria:

- | | |
|----------------|--|
| "All" | All devices are displayed without being filtered. |
| "Referenced" | Only those devices are displayed, which are used ("referenced") elsewhere, for example in test templates or tests. |
| "Unreferenced" | Only those devices are displayed, which are not referenced. |

"Modified" Only those devices are displayed, which have been modified, with the changes still being unsaved.

Save all changes

Saves all changes in all devices that have not yet been saved after modifying them. Saving the changes is not protected by any alert, all changes are immediately saved.

R&S ELEKTRA supports the shortcut key "[Ctrl + Shift + s]" for the "Save All Changes" command.

Note: Instead of "Save All Changes", you can save the changes in each individual device: Click [Save](#) in the row of the device for which you want to save the changes. Alternatively, use the shortcut key "[Ctrl + s]" to save the selected (highlighted) device entry.

Note: If you change settings in the [Receiver](#) that is selected as the [Control](#) of a [LISN](#), R&S ELEKTRA considers this LISN as changed, too.

Discard all changes

Discards all changes in all modified devices that have not yet been saved. This loss of settings is protected by the following alert: "Do you really want to discard all changes? Total number of <n> device(s) changed:", followed by a list of the "n" modified devices. To discard the changes, confirm with "Yes", or select "No" to return to the device list without discarding the changes.

Note: To discard the changes in one or several devices, but not all that you have modified, proceed in two steps: First click the "Save" button in the row of each device for which you want to keep the changes. Then click "Discard All Changes" to discard the changes for the remaining modified devices.

Add a new device

Opens a dropdown menu for selecting a device that you want to add to the "Device List".

The dropdown menu consists of a tree of folders and sub-sub folders that branch out from "[Device Class](#)" to the individual "Device Type".

Note: You cannot add a receiver but only exchange the receiver specified in the "Device List" for a different one. To do so, connect the new receiver to your computer or network and select the correct receiver [Type](#) for it. Then use the [Search Device](#) dialog to assign the new receiver to the "EMI Test Receiver" entry in the "Device List".

For the properties of the various types of devices, see [Chapter 4.6.2, "Device properties"](#), on page 142.



Collapse All

Minimizes the details of all devices:

- The first click collapses any [expanded](#) sections of device properties, if available, and shows a minimized list of device names.
- A second click collapses the list of device names, too, and shows a minimized list of device class headlines, only.



Expand All

Fully unfolds all [collapsed](#) device classes, device entries and device properties.

Name

Lists the device names, grouped within [Device classes](#).

To sort the device classes and the entries within each device class by the device names, click the "Name" column header. Click the header again for reverse order.

Type

Selects the device type for the receiver and for one or more LISN entries in the device list.

To sort the device classes and the entries within each device class by the device type, click the "Type" column header. Click the header again for reverse order.

To select the type, highlight an entry and click the "Type" field to show the selection switch. In the pull-down list that opens, select any of the available device types, as in [Figure 4-37](#).

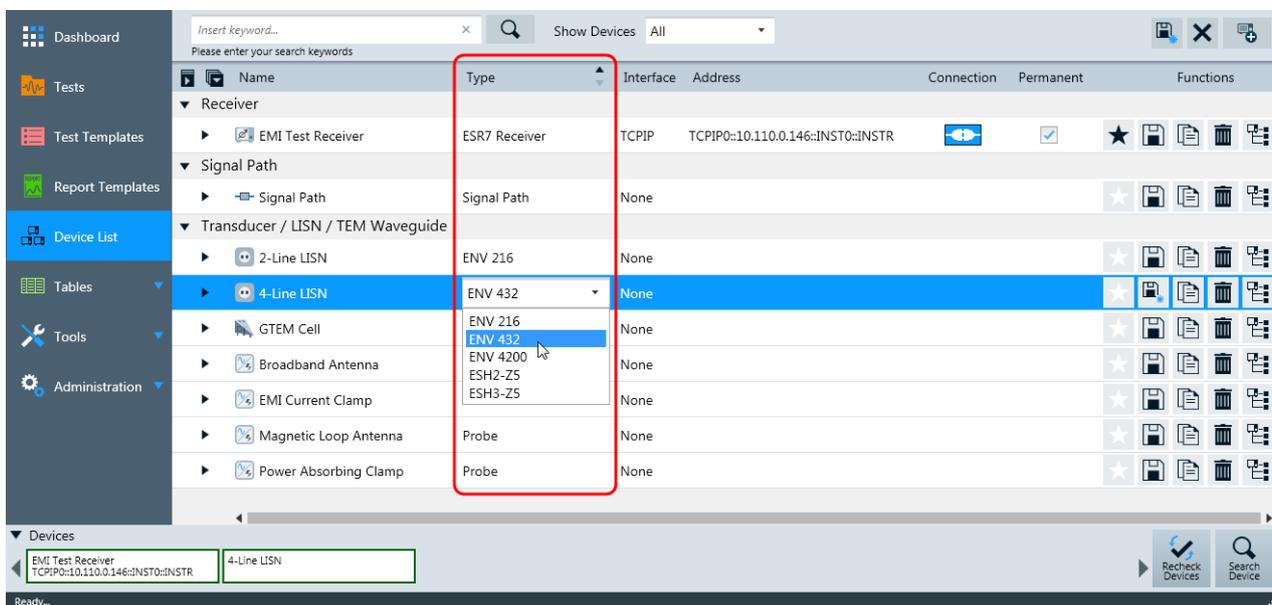


Figure 4-37: The Type selection in the Device List dialog

You can use the "Type" selection to exchange a device. If the device, which is replaced by this exchange (for example an ESR7 by an ESR26 [Receiver](#)), was referenced in a test, any existing test results data remain unchanged. However, when you rerun the test, the original test result data are discarded. The new device is then used for measurements in the rerun test.

Interface

Shows the [Interface Type](#) of the [Receiver](#) (the only device that can be [connected](#)). All other devices are labeled as "None" in the "Interface" column.

Address

Shows the [VISA resource string](#) of the [Receiver](#) (the only device that can be [connected](#)).

Connection

Toggles the connection state of the receiver and of LISNs.

-  - device not connected
-  - device connected

To be able to connect the receiver, first make sure to select your correct [Type](#) of receiver, for example the "ESR7 Receiver".

Note: Toggling the connection state is no criterion for R&S ELEKTRA to consider the receiver as "changed". Instead, the software checks, if the state of the [Permanent](#) switch has changed. Connecting or disconnecting the receiver does not alter the state of the "Permanent" switch.

You cannot edit the device properties of a connected receiver. Instead, the properties are automatically read from the receiver. The various properties tabs of a connected receiver show these properties in deactivated dialogs (grayed out).

Permanent

Activating this switch defines a permanent [Connection](#) to the receiver. After shutting down R&S ELEKTRA and starting it again, the receiver is automatically reconnected, if the network connection is available. If no connection is available, the receiver status is "red", see [Recheck Devices](#).

Functions

Comprises the following functions described below:

- [Set as Favorite Device](#)
- [Save](#)
- [Delete](#)
- [Show Reference](#)



Set as Favorite Device ← Functions

The set-as-favorite button is available in each individual device's row.

Per device class, you can select exactly one item to be "Set as Favorite Device" . This device is automatically used as the default, when R&S ELEKTRA requires a device of a specific [device class](#) for a test setup. All other devices in the same class are automatically assigned as non-favorite and hence non-default devices ().

Note: Clicking the "Set as Favorite Device" button of a newly [created](#) device also saves this device entry.

You can also remove the selection of one device as the favorite without assigning the favorite role to another device in the same class. To do so, toggle the state by clicking the button again.



Save ← Functions

The save button is available in each individual device's row.

Saves the changes in the selected device. Saving the changes is not protected by any alert, all changes are immediately saved.

Note: Instead of saving the changes in one individual device, you can use the [Save all changes](#) button to save all changes in all devices that have not yet been saved after modifying them.



Copy ← Functions

Duplicates a device (possibly a fully configured device) in the device list. Use this function, for example, in the following cases:

- Defining several similar devices with identical values for several properties
- Preparing several signal paths that reference the same switch unit
- Specifying multichannel devices (configured as separate devices), which all use the same connection settings

The new device has no [references](#) to the [test templates](#) and [tests](#), which the original device can have had.



Delete ← Functions

The delete button is available in each individual device's row.

You can delete only devices that are not used (hence, not "referenced") in [test templates](#). If a device has references, you must first remove these references as described below, to be allowed to delete the device entry.

Note:

Before you plan to delete a device entry, first consider the following use cases:

- If you wish to use a **different receiver model**, while only one receiver device entry is allowed in the device list, we recommend not to delete the receiver device entry. Instead, exchange the device type by a different receiver model, using the [Type](#) selection. This exchange preserves existing references, for example from test templates to the receiver device entry.
- If you wish to **replace** an old by a new device, and you are sure about using the old device never again, we recommend renaming the old device's entry. Overwrite the device's properties with the new information, which includes, for example, selecting new correction tables.
- If you **stop using** a certain device without replacing it, we recommend not to delete the existing entry, for example to maintain existing references to this device from test templates.

When you click the "Delete" button, R&S ELEKTRA first checks, if the item that you wish to delete is referenced.

- If the device is **not referenced**, the deletion process is merely protected by the following alert: "Are you sure you want to delete the selected item(s)?" Confirm with "OK" or "Cancel" the deletion process. This function is similar to the common action button [Delete](#), except that no multiple selections of items can be deleted simultaneously.
- If the device **is referenced**, R&S ELEKTRA warns you that deletion is not possible, since the software expects that you clear the references first:

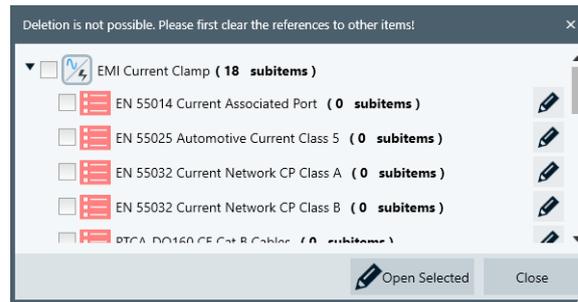


Figure 4-38: Dialog with subitems referenced by a device (here: a transducer)

If you wish to delete the receiver or a referenced LISN, **first consider to use the Type selection, instead.**

For all other devices, or if type selection is no option for your device, and if you still wish to delete the device despite the recommendations above, proceed as follows:

- To unfold a tree of all references, in which the device is used, click the triangles in front of all items that have subitems.
- Select the checkboxes of all items in the reference tree:

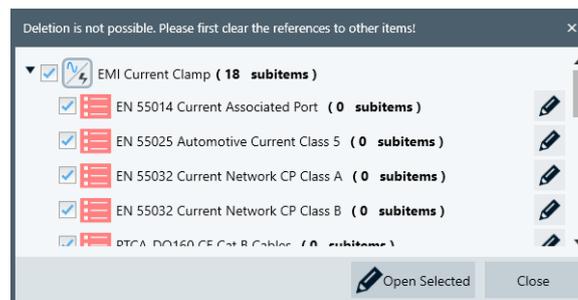


Figure 4-39: A transducer that is referenced by subitems down to tests templates

You can select all referenced items by selecting only the checkbox in front of the device icon itself.

- Click "Open Selected" to open a dialog tab for each selected item. This action closes the reference tree dialog and opens all selected subitems, but not the device itself.
- In the dialog tab of each test template, replace the referenced device by a different device. Then save this change and close the tab.

Proceed in the same way with all opened dialog tabs that contain a reference for the device you wish to delete.

Replacing a device can be difficult, since the new device must comply with several property requirements. For example, it must cover the frequency ranges required by the test templates.

Note that you cannot replace devices in the template section of existing tests, where the test template is embedded as a copy in the [test container](#). If you modify settings in an embedded template copy, any previous test results become invalid, because these results do not match the test conditions in the template. Therefore, R&S ELEKTRA does not permit saving a test with existing test results and a modified test template.

- In the "Device List" dialog, you can delete the now unreferenced device (which is still highlighted).



Show Reference ← Functions

The reference tree shows, in which [test template](#) and [test](#) a device is used ("referenced").

Hence, this button, which is also available in each individual device's row, brings up the same reference tree of a device as the [Delete](#) button. However, there are two differences:

- The button does not have the delete function
- The tree also includes the referenced tests



Search Device

The button "Search Device" in the lower right corner of the "[Device List](#)" window calls up a dialog for searching devices in the network environment, to which the computer is connected. Once the search is executed, the dialog looks as in [Figure 4-40](#):

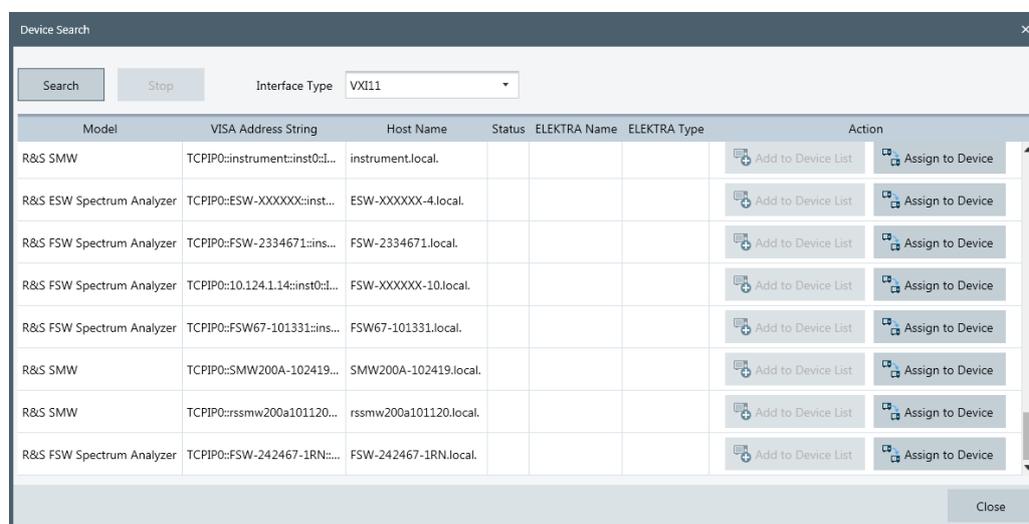


Figure 4-40: Device search dialog with an exemplary list of devices

Note:

- Do not confuse this function, which *searches devices in the network environment* (LAN or GPIB), with the function [Search](#), which allows for filtering the "Device List".

Search ← Search Device

Starts a search for devices by a broadcast command within the network, to which the computer is connected via the selected [Interface Type](#). The search stops automatically after a time that depends on the size of the connected network. (If it takes too long, you can [Stop](#) it.)

The dialog then presents a list of available devices, as shown in [Device search dialog with an exemplary list of devices](#). Use this list to select [Add to Device List](#) or [Assign to Device](#).

Stop ← Search Device

Stops the [Search](#). Use this function if you wish to terminate the search at some point, or if it does not stop automatically within a reasonable timeframe.

Interface Type ← Search Device

Selects the interface type for searching devices within the network, to which the computer is connected.

Changing the selected interface type immediately starts a search.

"VXI11"	VXI-11 is a protocol, specified by the VXIbus Consortium , for remote control of LAN-based test and measurement instruments. Use this "Interface Type" to search for devices connected via Ethernet (LAN).
"GPIB"	GPIB (General Purpose Interface Bus) is the common name for the 8-bit parallel communications interface specification IEEE-488. Use this "Interface Type" to search for devices connected over a short range via GPIB bus.

Model ← Search Device

States the model name, if it is contained in the network device's reply to the device search. You cannot edit this field, which remains empty, if the search algorithm cannot read the model name from the device.

VISA Address String ← Search Device

Displays the [VISA Address String](#) as originally found by the automatic device search. You cannot edit this string.

Host Name ← Search Device

Displays the host name of the device within the network. You cannot edit this string.

**Status ← Search Device**

Available only for the network device that is [assigned](#) to your receiver entry in the "Device List".

Shows and sets the connection state of this device, which you can toggle between connected and disconnected.

ELEKTRA Name ← Search Device

Available only for the network device that is [assigned](#) to your receiver entry in the "Device List".

Displays the receiver's [Name](#) in the "Device List".

You cannot edit the name in this column, but only in the [Name](#) field of the "Device List".

ELEKTRA Type ← Search Device

Displays the device class of the network devices. For all network devices that do not match with the "Device List", R&S ELEKTRA displays "unknown device category".

You cannot edit this field.

Action ← Search Device

Allows using results of the network device search for entries in the "Device List". Available only, if the search algorithm finds connectable devices in the network environment.

**Add to Device List** ← Action ← Search Device

"Add to Device List" is available for each network device that the [Search Device](#) function finds in the network environment.

When you click this button for an individual network device, R&S ELEKTRA offers the device types for which you can add the selected network device. If no device type is offered, you cannot add this entry to the "Device List".

**Assign to Device** ← Action ← Search Device

Assigns the connectivity parameters of an individual network device to the receiver device entry in the "Device List". "Assign to Device" is available for each device found by [Search Device](#) in your network environment.

To assign a specific network device from the "Search Device" dialog, first execute the [Search](#). If the search delivers results, browse the list of search results to find the network device that you wish to couple with your receiver entry in the "Device List". In this row of the search results list, click the "Assign to Device" button. The dialog opens a drop-down list for selecting the receiver.

When you select it, R&S ELEKTRA assigns the [VISA Address String](#) of the selected network device to your receiver entry in the "Device List" (hence, without adding a new entry).

Close the device search dialog either by "Save" or "Cancel". If you select "Cancel", you can decide later (in the "Device List" dialog) to either [save](#) or [discard](#) the modification of the receiver entry. Make sure to select the correct [receiver type](#).

Note: Avoid interfering with other people's devices. We recommend that you use "Assign to Device" only for devices, for which a control via R&S ELEKTRA is reasonable and desired. Note that this function allows connecting remotely to any available network resource. This connection can interfere with the work of other people, who use the same network device.

**Discard** ← Action ← Search Device

Available only for the network device that is [assigned](#) to your receiver entry in the "Device List".

Clicking "Discard" brings up a second button to confirm "Remove Device":

- If the device is **not referenced**, clicking "Remove Device" brings up the following warning: "Are you sure you want to delete the selected item(s)?" If you confirm your intention by clicking "OK", the "Device List" entry is deleted immediately.
- If the device is **referenced**, clicking "Remove Device" opens a dialog to inform you that deletion is not possible. As described in the section on the [Delete](#) function, you must first clear the references to other devices. However, this deletion is often not reasonable. Instead, if you only wish to break the relation between the receiver entry and a network device while keeping the entry in the "Device List", we recommend using the [Connection properties](#) dialog. After [disconnecting](#) the receiver, erase only the receiver's [address or host name](#).

Save (Ctrl+S) ← Search Device

Saves the settings of the [Search Device](#) dialog in the [Device List](#). Saving the settings within the [Search Device](#) dialog has the same effect as first canceling from this dialog and then selecting [Save all changes](#).

Cancel ← Search Device

Cancels the [Search Device](#) dialog without saving the device settings and returns to the [Device List](#). In this dialog, the changed settings are still available. They can be individually or globally [saved](#) or globally [discarded](#).

**Recheck Devices**

Available only, if at least one [permanent connection](#) was previously established.

The button "Recheck Devices" in the lower right corner of the "[Device List](#)" window launches a special checking algorithm for the permanent receiver connection. The algorithm checks this connection in the network environment, to which the computer has access via the specified [Interface Type](#).

Note: If the receiver's ID response differs from the selected [receiver type](#) setting, the checking algorithm is not executed.

The result of rechecking the receiver connection is shown in the device status bar at the lower edge of the "Dashboard" dialog (see [Graphical user interface](#)):

- A **green** box represents a permanently connected receiver that is available. If an available receiver - with a setting for permanent connection - is found to be currently disconnected, the algorithm reconnects it.
- A **red** box represents a permanently connected receiver that is not available.
- An **orange** box represents a connected receiver, which is found to be in a physical state that does not correspond with the defined settings.

Examples of receiver states represented by an orange box:

- A hardware or software option, which is enabled at "[General](#)" > "[Option](#)", is not available in the connected receiver.
- A hardware or software option, which is available in the connected receiver, is not enabled in the "[General](#)" > "[Option](#)" settings.

In either of these cases, clicking "Recheck Devices" adjusts the "Option" settings in the "General" tab and brings up a notification regarding this adjustment. Clicking "Recheck Devices" again finds the settings in agreement with the physical state and hence leads to a **green** box.

4.6.2 Device properties

The "Device List" specifies all device properties that are relevant for your EMI measurements.

Per device class, these properties are organized in sets of tabs, for example:

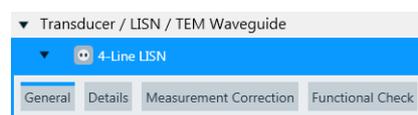


Figure 4-41: The device class "LISN" has the properties tabs *General*, *Details*, *Measurement Correction* and *Functional Check*

Other device classes have different sets of properties tabs.

Table 4-6 provides an overview of all tabs of all device classes.

- The **"General"** tab is **similar** for all devices. It is described in [Chapter 4.6.3, "General properties"](#), on page 143.
- All other tabs are individually **different** for the various device classes. These tabs are described in the chapters that are directly linked from the **X** characters in [Table 4-6](#). The table headline entries are linked to the individual device chapters.

Table 4-6: Properties tabs in the various device classes

Class → Tab ↴	Receiver	Signal Path	GTEM	LISN	Transducer
General	X	X	X	X	X
"Connection"	X				
"Details"	X		X	X	
"Transducer Type"					X
"Measurement Correction"		X	X	X	X
"Functional Check"	X		X	X	

4.6.3 General properties

This tab contains general properties of the devices. It includes the following parameters:

Description	143
Manufacturer	143
Serial Number	143
Cal. valid until	144
Options	144
Model	144
Firmware Version	144
L Minimum firmware version	144
Frequency Range	145

Description

Arbitrary text to describe the device.

Manufacturer

For LISNs and the receiver, this field displays the Rohde & Schwarz company logo.

For GTEM cells, transducers and signal paths, you can enter arbitrary text to describe the device manufacturer.

Serial Number

For the receiver, this field displays the serial number as read from the device, if the receiver is connected.

For GTEM cells, transducers and signal paths, you can enter arbitrary text to describe the device's serial number.

Cal. valid until

In this field, you can note the expiry date of the device's calibration validity. This note is intended to remind you when the next calibration is due.

If enabled in a report, the "Cal. valid until" date appears in its "Hardware Setup" details. However, the software does not act or alert you, if the expiry date is reached or exceeded.

To enable editing, activate the checkbox. Either directly edit the date field or click the calendar icon for date selection. To select a different month, click the calendar headline. To select a different year, click the calendar headline again.

Options

For the receiver, this field shows a predefined checkbox list of the receiver's hardware and software options. For a non-connected receiver, you can enable or disable individual options. This choice is useful, for example, for measurements with [device simulation](#).

If a remote connection to the receiver is established, R&S ELEKTRA automatically adjusts the options list to the actual configuration of the receiver. This adjustment is carried out when you execute one of the following actions:

- [Connect](#) the receiver
- Select [Recheck Devices](#).

While connected, the checkboxes are then no longer available for user interaction. Instead, the options list represents the physical receiver configuration.

For LISNs and GTEM cells, this field is blank. You can edit it, but it has no effect on any test execution.

For all other devices (signal paths included), this field is blank and cannot be edited.

Model

For the receiver, this field displays the model as read from the device, if the receiver is connected. For a non-connected receiver, this field is blank and cannot be edited.

For LISNs, GTEM cells, transducers and signal paths, you can enter arbitrary text to describe the device model.

Firmware Version

Available only for the receiver.

Displays the firmware version as read from a connected receiver. For a non-connected receiver, this field is blank and cannot be edited.

Minimum firmware version ← Firmware Version

Available only for the receiver.

Displays the number of the receiver's earliest firmware version that provides full compatibility with the current version of R&S ELEKTRA.

If the [Firmware Version](#) is lower than the "Minimum firmware version", R&S ELEKTRA does not [connect](#) with the receiver, or terminates a previously established connection. To connect again, update the receiver to a compatible firmware version.

Frequency Range

For the receiver, this field shows the start and stop frequencies according to the specifications of the selected [receiver type](#).

For LISNs, GTEM cells, transducers and signal paths, this field shows the start and stop frequencies as read from attenuation or correction tables, selected in the "Measurement Correction" tab. If you use fixed values instead of tables, the frequency range is from 0 Hz to infinite.

4.6.4 LISN



For a description of the configuration of a **"TEM Waveguide"**, see [Chapter 4.6.7, "TEM Waveguide"](#), on page 154.

For a description of the configuration of other **"Transducers"** (no LISNs), see [Chapter 4.6.8, "Transducer"](#), on page 157.

Line impedance stabilization networks (LISNs, also called artificial networks or V-networks) are used for two purposes in conducted EMI measurements:

- These auxiliary networks extract the conducted RF interference that an EUT injects into the lines of its power supply.
- LISNs suppress any RF interference coming from the power supply, allowing to evaluate exclusively the EUT's interference emissions into the power line.



Protect the receiver against voltage spikes

If you use a LISN without a built-in [pulse limiter](#), consider inserting a separate pulse limiter at the receiver's input port.

In this case, enter the pulse limiter's attenuation in the [Measurement Correction](#) of the [Signal Path](#).

R&S ELEKTRA distinguishes between **2-line LISNs** for single-phase AC mains systems and **4-line LISNs** for three-phase rotary current mains systems.

The software supports the following Rohde & Schwarz LISN [types](#):

- "AMN 6500" (2-line LISN, max. 240 V DC, 16 A, with TTL remote control, switchable 140 dB μ V pulse limiter, built-in 10 dB attenuator pad and switchable 150 kHz highpass filter)
- "ENV 216" (2-line LISN, max. 50 V DC, 16 A, with TTL remote control, switchable 140 dB μ V pulse limiter and switchable 150 kHz highpass filter)
- "ENV 432" (4-line LISN, max. 350 V DC, 32 A, with TTL remote control and switchable 140 dB μ V pulse limiter)
- "ENV 4200" (4-line LISN, high-current design for max. 4 x 200 A, with TTL remote control)
- "ESH2-Z5" (4-line LISN, max. 400 V, 25 A, with TTL remote control)

- "ESH3-Z5" (2-line LISN, max. 250 V, with TTL remote control)
- "HM6050-2" (2-line LISN, max. 250 V, 16 A, with serial remote control)



Common mode or differential mode

You can perform conducted EMI tests with a LISN either in common mode (unsymmetric test setup) or in differential mode (symmetric test setup):

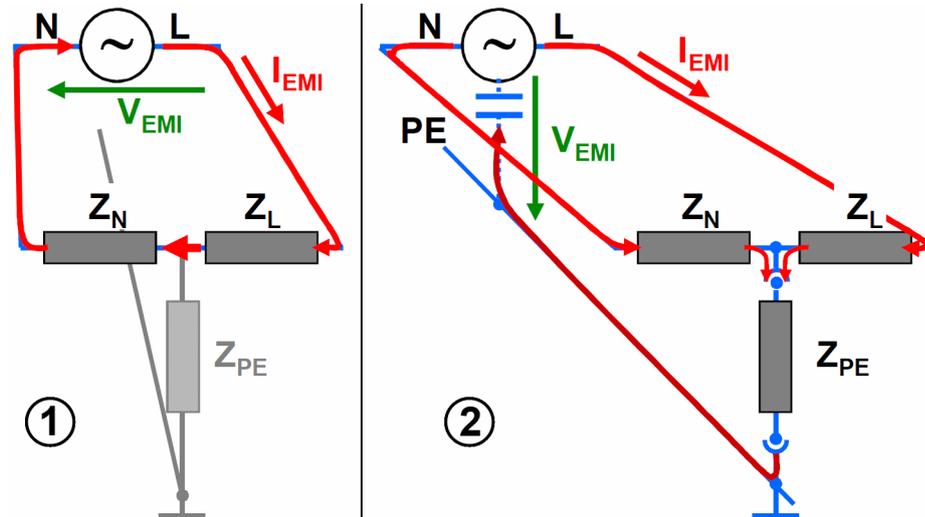


Figure 4-42: 2-line LISN in differential mode (1) and in common mode (2)

- 1 = Schematic of the differential mode setup
- 2 = Schematic of the common mode setup
- L = Live line
- N = Neutral line
- PE = Protective earth (ground)
- Z_L = Impedance of the L line
- Z_N = Impedance of the N line
- Z_{PE} = Impedance of the PE line
- V_{EMI} = Voltage of the disturbing signal
- I_{EMI} = Current of the disturbing signal

The **common mode** setup in Figure 4-42 is also called **unsymmetric** test setup. The 2-line LISN configuration used here is also called a **V-type** artificial network. It does not distinguish between common mode and differential mode signals and is therefore typically used for power lines.

The **differential mode** setup in Figure 4-42 is also called **symmetric** test setup. The 2-line LISN configuration used here is also called a **T-type** or **Y-type** artificial network. It extracts the common mode signals and is therefore typically used for signal lines (with wanted signals in differential mode).



LISN type "HM6050-2"

The LISN type "HM6050-2" has a serial interface for remote control. This LISN is the only one with a "Connection" dialog, if [remote control](#) is enabled:

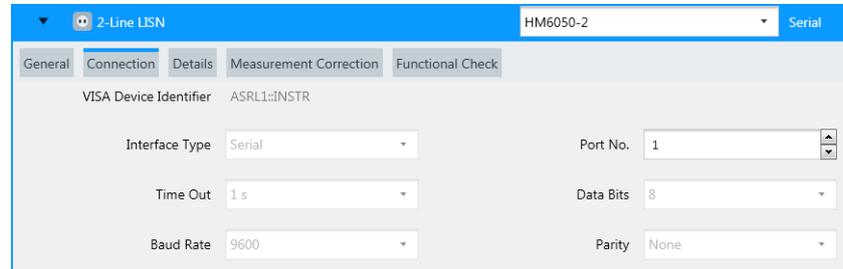


Figure 4-43: Connection dialog for the LISN HM6050-2

In this dialog, all parameters are preselected and fixed at the appropriate settings, except for the "Port No.". Set this parameter to the port number of your computer's serial port, to which the LISN is connected by a serial cable.

This chapter describes all individual device properties tabs, but not the **"General"** properties tab, which is similar for all devices and described [here](#).

Besides the content mentioned above, this device dialog has the following content:

- [Details](#)..... 147
- [Measurement Correction](#)..... 148
- [Functional Check](#)..... 149

4.6.4.1 Details

Specifies the LISN control details.

Control

Specifies manual or remote control operation of the LISN:

- If you use "Manual" LISN control, R&S ELEKTRA generates messages during the test with instructions for manual LISN switching.
- "Remote-controlled" selects a [Receiver](#) as the control device. Rohde & Schwarz receivers feature TTL remote control for automatic switching of the LISN line to be evaluated during a test.
To use this feature, make sure that the LISN is connected to the receiver's user port via the appropriate cable.



If you change settings of the receiver that is selected as the [Control](#) of a LISN, R&S ELEKTRA considers this LISN as changed, too.

Note that the LISN "HM6050-2" uses the following serial control commands instead of a bit pattern: "O" for manual control, "N" for line N and "n" for line L1.

Editing LISN line names

For all LISN [types](#), you can edit the names of the LISN lines, except for the "Manual" line.

The dialog accepts a maximum name length of 10 characters. R&S ELEKTRA checks if all line names are unique. Otherwise, it brings up an error message.

When you save the LISN after changing line names, the software updates the names in other dialogs that refer to this LISN.

LISN Lines

Available only for the LISN [type](#) "Multi-Line".

- The button "Add Single-Line LISN"  adds "Single-Line" LISNs to the table of referenced devices. In this table, you can reference the same "Single-Line" LISN several times. The remote control device specified for the "Multi-Line" LISN can control and switch all "Single-Line" LISNs referenced in the table.
- The "Name" column of the table identifies the referenced LISNs by an arbitrary name. Use a unique "Name" for each entry in the table. We recommend using short names, like "L1".
- The "Single-Line LISN" column of the table identifies each referenced LISN by its original device name.
- "Default" is an optional preselection for switching the path (hence, the line) referenced by this "Single-Line" LISN, when the software [connects](#) the "Multi-Line" LISN. Also, in test templates that use the "Multi-Line" LISN, the software preselects this line in the [Accessory Settings](#) > "Range" column.
- "Path" selects one of the switching paths (hence, lines) defined in the "Multi-Line" LISN's remote control device. The selected path switches the "Single-Line" LISN, to which it is assigned in the table.
- The button "Remove Single-Line LISN"  removes the selected (highlighted) single-line LISN from the list.

4.6.4.2 Measurement Correction

To evaluate the real signal level generated by the EUT, transduced by a LISN and measured by the receiver, correct the receiver's readout by suitable correction values or tables. This dialog specifies how to correct the measurements by selecting the appropriate cable attenuation and transducer correction data.



For the measurement correction of other **transducers** (no LISNs), see [Chapter 4.6.8.2, "Measurement Correction"](#), on page 158.

For the measurement correction of **TEM waveguides**, see [Chapter 4.6.7.2, "Measurement Correction"](#), on page 155.

LISNs are often used in a firm connection with a LISN cable. However, the LISN's specifications typically provide only correction data for LISN itself, not for the cable. To handle this situation flexibly, the dialog offers separate parts for specifying values for the LISN cable and for the LISN lines.

See also [Chapter 5.4, "Attenuation in signal paths"](#), on page 197.

You can select a predefined table for each LISN line. Hence, the values in the "Correction Level" column of the selected table are valid for the N and L1 line of a two-line LISN and for the N, L1, L2 and L3 lines of a four-line LISN.

Cable Correction

The RF cable, which connects the LISN's RF output with the test receiver, can be described by a simple attenuation in units of dB.

- "Fixed Value"
Specifies a constant attenuation value in dB for the LISN cable.
- "According to Attenuation Correction Table"
Selects an [attenuation table](#) with one column of frequency-dependent attenuation values in dB for the LISN cable.

LISN Correction

The network part of the LISN converts physical units. Its influence on the RF signal is therefore described by a transducer correction with potentially different units on the input side (measurement) and output side (result). Typically, the correction level values are in dB μ V.

- "Fixed Correction"
Specifies a constant correction value for all N and L lines. You can set the unit for the correction value (typically dB μ V).
- "According to Transducer Correction Table"
Select a [Transducer Correction Table](#) that contains one column of frequency-dependent "Correction Level" values for all N and L lines in a result unit (typically "dB μ V") that is defined in this table. The result unit is read from the transducer correction table and serves for converting the measured values from the receivers measurement unit, which is in general "dB μ V", to the final result unit of the converted values.
The table allows defining specific correction values for each N and L line.

4.6.4.3 Functional Check

Allows you to test the remotely controlled switching of LISN lines. The following prerequisites apply:

- The LISN [Control](#) in the [Details](#) tab must be set to "Remote" control via the EMI test receiver
- The [Receiver](#) must be in [connected](#) state.
- On hardware side, the LISN must be connected to the receiver's user port via an appropriate cable.

To test any one of the available LISN lines, click the button of this LISN line, for example "L1". If the test is successful, the software displays the LISN driver's control bit pattern for this LISN line, for example "L1: #B00001101".

The "Manual" button switches the LISN to local manual control at its front panel, which otherwise displays the state that is set via remote control.

4.6.5 Receiver



Receivers and spectrum analyzers are key instruments for measuring electromagnetic emissions. Without a test receiver or spectrum analyzer, EMI measurements are impossible.

R&S ELEKTRA supports the following Rohde & Schwarz receiver and analyzer [types](#):

- "ESC13" / "ESC17" receiver
- "ESL3" / "ESL6" receiver
- "ESPI3" / "ESPI7" receiver
- "ESR3" / "ESR7" / "ESR26" receiver
- "ESRP3" / "ESRP7" receiver
- "ESU8" / "ESU26" / "ESU40" receiver
- "ESW8" / "ESW26" / "ESW44" receiver
- "FPC1000" / "FPC1500" analyzer
- "FPH2" / "FPH6" / "FPH13" / "FPH26" analyzer
- "FPL1003" / "FPL1007" analyzer
- "FSL3" / "FSL6" / "FSL18" analyzer
- "FSV3" / "FSV4" / "FSV7" / "FSV13" / "FSV30" / "FSV40" analyzer
- "FSV3004" / "FSV3007" / "FSV3013" / "FSV3030" / "FSV3044" analyzer
- "FSVA3004" / "FSVA3007" / "FSVA3013" / "FSVA3030" / "FSVA3044" analyzer
- "FSW8" / "FSW13" / "FSW26" / "FSW43" / "FSW50" / "FSW67" / "FSW85" analyzer
- "FSWT26" analyzer

In contrast to other device classes, for which you can specify multiple devices, the device class "Receiver" is limited to one receiver, only. Rather than adding different receivers, you can exchange the receiver by [selecting the type](#).

To verify the selection, enter the new receiver's "IP Address" in the [Connection](#) tab, select the correct [receiver type](#) and [connect](#) the receiver.

For a receiver exchange, the following rules apply:

- If the replaced receiver is referenced in an existing test, the results data of this test remains unchanged. If you rerun the test, the software discards the original test results and uses the new receiver for the measurement.
- If the replaced receiver is referenced in a test template, this test template is synchronized to the new receiver when you open it or use it to create a test. The properties of the new receiver can cause the validation to fail. In this case, either use a receiver that is compatible with the settings in the test template or adjust these settings.
- [Connecting](#) the receiver is possible only, if you have selected the correct [Type](#) of receiver.

In addition to the receiving function in EMI measurements, R&S ELEKTRA supports the use of Rohde & Schwarz receivers for remote control of a [LISN](#) via the receiver's user port.



If you change settings of the receiver that is selected as the **Control** of a LISN, R&S ELEKTRA considers this LISN as changed, too.

In the **General** tab, the "Option" field shows a list of options that are available for the receiver, for example "FSV-B29".

You can select a "Receiver" (= test receiver) or an "Analyzer" (= spectrum analyzer) with their specific features. If your test receiver can measure in spectrum analyzer mode, you can choose between the **Operating Mode** "Test Receiver" or "Spectrum Analyzer" in a test template.



If a spectrum analyzer is used as the receiver, some constraints apply. For example, spectrum analyzers are not suited for compliant measurements (precompliance, only).

For the selection of the receiver's RF input connector in a test template, see **"Input Selection"** on page 112.



The availability of "Time Domain Scan" measurements requires a receiver that can operate in this **Scan Mode**, for example with option "ESR-K53".

This chapter describes all individual device properties tabs, but not the **"General"** properties tab, which is similar for all devices and described [here](#).

Besides the content mentioned above, this device dialog has the following content:

- [Connection properties](#)..... 151
- [Details](#)..... 153
- [Functional Check](#)..... 153

4.6.5.1 Connection properties

This tab contains connection settings for the remote control of your receiver. If the receiver is **connected**, its connection settings are only displayed but cannot be edited.

The tab includes the following parameters:

VISA Address String	151
Interface Type	152
Timeout	152
Address	152
Mode	152
Board No	153

VISA Address String

Also called "VISA Device Identifier" or "VISA Resource String". Displays the VISA address string for the selected [interface type](#).

R&S ELEKTRA generates the VISA address string from the device parameters as specified and uses it for connecting to the devices. You cannot edit it, but it is displayed for your information.

The following list and table describe this string in more detail.

Examples of the VISA address string are:

- TCPIP0::10.113.0.75::inst0::INSTR
- GPIB::3::INSTR

Besides the separator " : :", the VISA address strings consists of the following elements:

Table 4-7: Structure of the VISA address string

Interface	TCP/IP internet protocol		GPIB 8-bit parallel
Header	TCPIP _x , with "x" = Board No.		GPIB _x , with "x" = Board No.
Address	IP Address in one of two VXI11 modes:		GPIB Address: integer from 1 to 31
	Hostname:	IPv4 format:	
	arbitrary alphanumeric string	four blocks, each with one to three numbers, separated by dots: xxx.xxx.xxx.xxx	
Delimiter	inst0::INSTR	inst0::INSTR	INSTR

Interface Type

The following interface types are available:

- "TCP/IP" Transmission Control Protocol / Internet Protocol
- "GPIB" General Purpose Interface Bus for 8-bit parallel communication according to IEEE-488

Timeout

Defines the time period in seconds applied to detect a timeout in the communication of a single command.

Address

The address field depends on the [Interface Type](#):

- For TCP/IP: **"IP Address"** or **"Host Name"** (depending on the address [Mode](#))
- For GPIB: **"Primary Address"**: numeric value from 1 to 31

Mode

Address mode, depending on the ["Interface Type"](#) on page 152"Interface Type":

For TCP/IP:

- "VXI11 Hostname" - LAN instrument protocol using a hostname as address
- "VXI11 IPv4" - LAN instrument protocol using an IP address with up to 4x3 digits (xxx.xxx.xxx.xxx)
- "HiSLIP Hostname" - LAN instrument protocol using a hostname as address
- "HiSLIP IPv4" - LAN instrument protocol using an IP address with up to 4x3 digits (xxx.xxx.xxx.xxx)

For GPIB:

- "Normal" - default GPIB address setting, for example *GPIB::1::INSTR*

Board No.

TCP/IP board number (values from 0 to 9) or GPIB board number (values from 0 to 31).

4.6.5.2 Details

If the field "External Gain Path" is still empty when you start a test, R&S ELEKTRA automatically executes an additional internal reference measurement with the path "Gain 0 dB". The software calculates the gain path to be used for the normal measurement by the following formula:

"External Adaptive Gain" =

$\text{Max}(\text{Gain_Step}) \cdot \text{LessEqual}(\text{neededAttenuation_dB})$

- where
 $\text{neededAttenuation_dB} = (\text{preampMaxLevel_dBm} - \text{refMeasGain0Level_dBm}) + \text{bandwidthCorrection_dB}$
- where
 $\text{preampMaxLevel_dBm} = -10 \text{ dBm (fixed value)}$
 $\text{refMeasGain0Level_dBm} = \text{max level found in the reference measurement}$
 $\text{bandwidthCorrection_dB} = 10 * \text{Log10}(\text{SignalCarrierWidth} / \text{RBW_in_use})$

"Reference Frequency Source"

Selects either the receiver's internal oscillator or an external 10 MHz reference frequency source connected to the receiver.

4.6.5.3 Functional Check

"Screenshot" > "Capture" allows showing a screenshot of the [connected](#) receiver's or spectrum analyzer's graphical user interface. A dialog opens to display the screenshot without further options.

4.6.6 Signal Path

A signal path describes the physical RF signal connection between two devices in an EMI test setup. In a conducted setup, it typically contains information on the cable loss (attenuation) and insertion loss of connectors or switches between these devices. Hence, it also includes the switch paths of a referenced switch unit.

You can create and edit signal paths in the device list or in a test template.

This chapter describes all individual device properties tabs, but not the "General" properties tab, which is similar for all devices and described [here](#).

Besides the content mentioned above, this device dialog has the following content:

- [Measurement Correction](#)..... 154

4.6.6.1 Measurement Correction

Specifies how to correct the measurement values by setting the appropriate cable attenuation value or table for the signal path.

See also [Chapter 5.4, "Attenuation in signal paths"](#), on page 197.

Constant

Specifies a fixed attenuation value in dB for the signal path.

Table

Selects one or more [attenuation tables](#) with one column, each, of frequency-dependent attenuation values in dB for the signal path. Make sure that the tables' frequency ranges match your test scenario.

If your signal path comprises several physical components in series, for example more than one cable and a switch, its measurement correction can require a combination of several attenuation tables. In the overlapping parts of the frequency ranges, the attenuation values of the tables add up linearly.

4.6.7 TEM Waveguide



A typical TEM waveguide is the "gigahertz transverse electromagnetic" (or **GTEM**) cell in the shape of an extended rectangular hollow pyramid, which acts as an EMI test chamber. Inside, the bare metal walls reflect and guide RF radiation, while the base of the pyramid is lined with RF absorber material. With this design, the cell forms an enclosed TEM stripline that can be used as a receiving or transmitting RF antenna. The EUT is placed in the GTEM cell's test volume.



For a description of the configuration of a "**LISN**", see [Chapter 4.6.4, "LISN"](#), on page 145.

For a description of the configuration of other "**Transducers**", see [Chapter 4.6.8, "Transducer"](#), on page 157.

This chapter describes all individual device properties tabs, but not the "**General**" properties tab, which is similar for all devices and described [here](#).

Besides the content mentioned above, this device dialog has the following content:

- [Details](#)..... 154
- [Measurement Correction](#)..... 155
- [Functional Check](#)..... 157

4.6.7.1 Details

Available only for the device [type](#) "GTEM".

Control

Toggles between "Manual" and "Remote-controlled" operation of the GTEM cell.

- In manual operation, R&S ELEKTRA generates messages during the test with instructions for manual GTEM cell operation.
- In remote-controlled operation, you can select a [Receiver](#) for controlling DUT positions in the GTEM cell automatically during tests. If you use an IO device to control the positions, it does so by sending the specified "Bit Pattern" via its first digital port to the GTEM cell.

4.6.7.2 Measurement Correction

Specifies how to correct the TEM waveguide's measurement values by setting the appropriate cable correction value or table and GTEM correction factor C1.



For the measurement correction of **LISNs**, see [Chapter 4.6.4.2, "Measurement Correction"](#), on page 148.

For the measurement correction of other **transducers** (no LISNs), see [Chapter 4.6.8.2, "Measurement Correction"](#), on page 158.

TEM waveguides are typically used in a firm connection with "their own" cable. However, the device's specifications often provide only correction data for the waveguide itself, not for the cable. To handle this situation flexibly, the dialog allows specifying an individual attenuation value for the cable. In addition, measurements with a GTEM cell require a GTEM correction factor. The dialogs for specifying these values are described below.

Cable Correction

The cable part of the TEM waveguide assembly can be described by a simple attenuation in units of dB.

See also [Chapter 5.4, "Attenuation in signal paths"](#), on page 197.

- "Fixed Value"
Specifies a constant attenuation value in dB for the TEM cable.
- "According to Attenuation Correction Table"
Selects an [attenuation table](#) with one column of frequency-dependent attenuation values in dB for the TEM cable.

GTEM Correction

A GTEM cell is a receiving structure for electromagnetic fields. Its structure can be compared to a coaxial cable that is geometrically expanded extremely wide, making room to place an EUT between the inner and outer conductor. This outer conductor is represented by the outer shell of the GTEM cell, while the inner conductor is represented by the cell's septum (inner conductor).

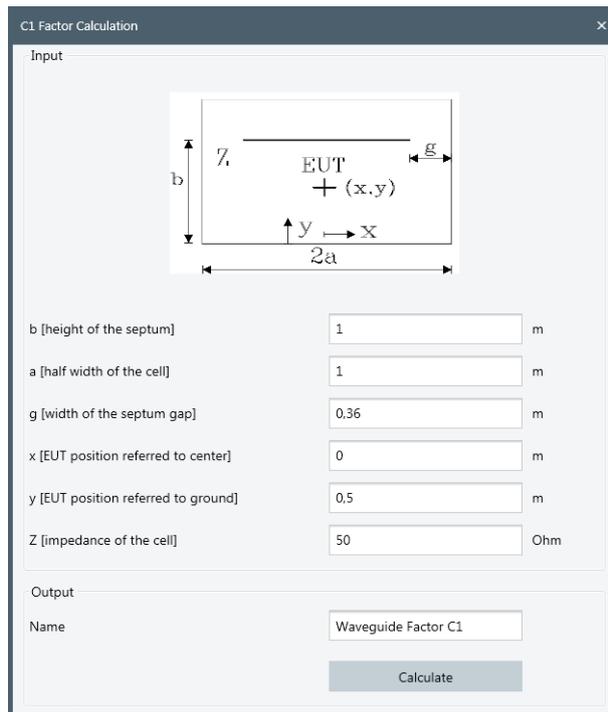
As the oscillating field directly induces an alternating voltage between septum and outer shell, the GTEM cell does not convert physical units. Therefore, the conversion

factors (C1 values), that depend on the cell's characteristics, are described by a simple [attenuation table](#). Such a table contains one column of frequency-dependent "Attenuation Level" values in dB.

You can either select an existing attenuation table or let the software compute correction factors to create a table automatically.

Use the  button to select an existing table.

Alternatively, click "Create new factor" to let R&S ELEKTRA calculate a GTEM correction table based on a set of input parameters. The software automatically creates this table for the frequency range 1 Hz to 30 GHz.



C1 Factor Calculation

Input

Diagram: A rectangular cell with height b , half-width $2a$, and a septum of height Z and gap width g . An EUT is positioned at (x, y) .

Parameters:

b [height of the septum]	1	m
a [half width of the cell]	1	m
g [width of the septum gap]	0.36	m
x [EUT position referred to center]	0	m
y [EUT position referred to ground]	0.5	m
Z [impedance of the cell]	50	Ohm

Output

Name: Waveguide Factor C1

Calculate

Figure 4-44: C1 factor calculation

Use the following "Input" parameters:

- "b" = vertical position of the septum in relation to the ground plate of the GTEM cell
- "a" = horizontal half width of the GTEM cell
- "g" = vertical width of the gap between septum and side wall
- "x" = horizontal position of the EUT in relation to the center of the GTEM cell
- "y" = vertical position of the EUT in relation to the ground plate of the GTEM cell
- "Z" = impedance of the GTEM cell



Do not consider the default values suggested in the dialog as recommended by Rohde & Schwarz.

For the "Output", specify a name for the attenuation table.

Click "Calculate" to let R&S ELEKTRA automatically create and save this table.



For the site correction factors C2 (GTEM correlation for an open area test site / OATS), see [Site Correction Factors \(C2\) for the GTEM Correlation](#).

4.6.7.3 Functional Check

Allows you to test the automatic positioning of the EUT in a motorized GTEM cell.

Available only, if "Details" > [Control](#) is set to "Manual" operation.

Selects the "EUT Orientation" in the GTEM cell:

- "Parking position" moves the EUT to a default position, typically suited for loading the EUT into the GTEM cell
- "X" moves the EUT to a position aligned with the x-axis
- "Y" moves the EUT to a position aligned with the y-axis
- "Z" moves the EUT to a position aligned with the z-axis

To test any one of the available positions, click its button, for example "X".

- In "Manual" control of the device, a dialog comes up to alert you to switch to this position manually (as in a test). When you confirm the dialog, the software displays the selected position.
- In "Remote" control of the device, a warning comes up, if the control device does not respond. In this case, the functional check is not successful. Otherwise, the software displays the selected position.

4.6.8 Transducer



The device type "**Probe**" is a general type of transmitting or receiving transducer, such as a current clamp, a current probe, a near field probe, an antenna or a calibration adapter. A "Probe" is characterized by converting one physical unit into another. For example, an antenna converts an electric field (V/m) into a voltage (V), while a current clamp converts electric current (A) into a voltage (V).

Some other special transducing devices, such LISNs or TEM waveguides, are handled separately:



For a description of the configuration of a "**LISN**", see [Chapter 4.6.4, "LISN"](#), on page 145.

For a description of the configuration of a "**TEM Waveguide**", see [Chapter 4.6.7, "TEM Waveguide"](#), on page 154.

This chapter describes all individual device properties tabs, but not the "**General**" properties tab, which is similar for all devices and described [here](#).

Besides the content mentioned above, this device dialog has the following content:

- [Transducer Type](#)..... 158
- [Measurement Correction](#)..... 158

4.6.8.1 Transducer Type

Defines the type of transducer, either conducted or radiated. Do not confuse this property with the [device type](#), which is "Probe" for all transducers.



If you change the type of transducer from conducted to radiated, or vice versa, you must also change the "Transducer Correction Table" (see [Measurement Correction](#)) to ensure compatibility of units. The measurement unit of a conducted transducer is typically dB μ V, dB μ A or dBm, while the measurement unit of a radiated transducer is typically dB μ V/m or dB μ A/m. Select a "Transducer Correction Table" with a measurement unit that matches the "Transducer Type".

Conducted

Select this transducer type, if the transducer is characterized by emitting or receiving RF signals via a cable. Common basic measurement units of conducted transducers are V, A or W (typically dB μ V, dB μ A or dBm).

Examples of conducted probes are:

- Current probe
- Coupling/decoupling network (CDN)
- Single-line LISN
- Absorbing clamp
- Calibration adapter for a CDN
- Calibration jig

Radiated

Select this transducer type, if the transducer is characterized by emitting or receiving RF signals via free space. Common basic measurement units of radiated transducers are V/m or A/m (typically dB μ V/m or dB μ A/m).

Examples of radiated probes are:

- Near-field probe
- Antenna

4.6.8.2 Measurement Correction

Specifies how to correct the transducer's measurement values by setting the appropriate cable attenuation and transducer correction data.



For the measurement correction of **LISNs**, see [Chapter 4.6.4.2, "Measurement Correction"](#), on page 148.

For the measurement correction of **TEM waveguides**, see [Chapter 4.6.7.2, "Measurement Correction"](#), on page 155.

Transducers such as antennas or current clamps are often used in a firm connection with a cable. However, the transducer's specifications provide only correction data for the transducer itself, not for the cable. To handle this situation flexibly, the dialog offers separate parts for specifying values for the cable and for the signal-converting part of the transducer.

Cable Correction

The cable part of the transducer can be described by a simple attenuation in units of dB.

See also [Chapter 5.4, "Attenuation in signal paths"](#), on page 197.

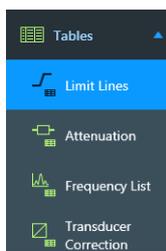
- "Fixed Value"
Specifies a constant attenuation value in dB for the transducer cable.
- "According to Attenuation Correction Table"
Selects an [attenuation table](#) with one column of frequency-dependent attenuation values in dB for the transducer cable.

Transducer Factor (Measurement Unit → Result Unit)

The signal-converting part of the transducer converts physical units. Its influence on the RF signal is therefore described by a transducer correction with potentially different units on the input side (measurement) and output side (result). Typically, the correction level values are in dB μ V/m, dB μ A/m or dBpW.

Select a [Transducer Correction Table](#) that contains one column of frequency-dependent "Correction Level" values in a result unit that is also defined in this table. The result unit can be, for example, "dB μ V/m" for a dipole antenna, "dB μ A/m" for a loop antenna or "dB μ A" for a current clamp. The result unit is read from the transducer correction table and serves for converting the measured values from the measurement unit, which is typically "dB μ V", to the result unit as defined in the table.

4.7 Tables



Access: "Home" > "Tables"

Tables can be created by measurement or calibration, they can be edited (from scratch, if necessary) or they can be imported. Tables can contain, for example:

- Frequency values
- Power or voltage levels
- Attenuation or gain data
- Correction factors



This chapter does not refer to [Test result tables](#), which are implemented only within the [Test container](#). [Chapter 4.3.3, "Configuring test tables"](#), on page 68 describes how to handle test result tables. Instead, this chapter refers to the so-called "global" tables that are available at "Home" > "Tables".

For all these global tables (other than test result tables), the buttons for common actions such as create, delete, open, copy or rename are described in [Chapter 3.3, "Common action buttons"](#), on page 39.

When you open a table, the dialog provides the following set of action buttons:

Name	Frequency	Limit 1	Limit 2	Limit 3	Limit 4
Unit	MHz	dBµV	dBµV	dBµV	dBµV
Detector		Quasi Peak	Average	Maximum Peak	None
Interpolation	Logarithmic	Linear	Linear	Linear	Linear
1		0.000			

Figure 4-45: Example of a table dialog header, here in a limit line table



The "Rename" button expands a text line for entering a new table name. Click to save the name and collapse the text line.



The "Save" button (Ctrl+S) and the "Save As..." button (F12) save the table to the R&S ELEKTRA database.



The "Delete rows" button removes one or more selected (highlighted) rows from the table. To delete a row, it must be selected as a whole, not only a cell in the row. To select a whole row, click its far left row-header field. Hold [Shift] or [Ctrl] to select multiple rows.



The "Copy" button copies the selected (highlighted) rows.



The "Paste" button pastes the previously copied rows into the table and sorts the rows by frequency.



The "Add new row" button inserts a new row above the currently selected position.



The "Show / Hide Columns" button enables or disables individual columns. You cannot disable the "Frequency" column.



The "Show / Hide Column Headers" button enables or disables individual column headers. You cannot disable the "Name" and "Unit" headers.



The "Select table" button selects all cells in the table, for example for copying.



The "Show Graphics Display" button opens a dialog for selecting the columns to be displayed in a chart. Select the columns and click "OK" to let R&S ELEKTRA generate a graphical representation of the table.



The [import](#) and [export](#) functions are described below.



The "Set default sorting" button sorts the table by a combination of increasing frequency ranges and frequency values. This feature is especially helpful, if your test contains *overlapping* frequency ranges, and if you have re-sorted, for example, a result table by clicking one of the table headers. "Set default sorting" resets the the table to its original order.



The "Print" button opens a dialog for sending the table to your printer (unless the table is empty).

Other functions for handling the various tables are described in the subsequent chapters.



Table nomenclature

Whenever you create a table, we recommend establishing a comprehensible **nomenclature** for saving tables with speaking names.

For example, "BB-antenna1_ESR7" is a speaking name for an [attenuation table](#) that describes the frequency-dependent attenuation of the [Signal Path](#) from the broadband antenna 1 to the receiver R&S ESR7.

Importing tables

To import tables from files in standard file formats, for example `.xlsx` or `.csv`, do not use the [Import](#) tool. Instead, go to "Home" > "Tables" and proceed to the type of table you want to import (for example [Limit Lines](#)). Here, you have two options:

- Click "Create"  to create a table and paste some copied table content from your external `.xlsx`, `.txt` or `.csv` file into this table. Use [Ctrl+c] to copy the external content and [Ctrl+v] to paste it.
- Click  to import a table directly from an external `.csv`, `.SnP` or `.txt` file. This option is not available for `.xlsx` files.

If you use the  import option, a "Table Import" wizard supports you in transferring your table content. This wizard works case-sensitive for each specific table type. The following example is for importing external `.csv` content into a limit line table:

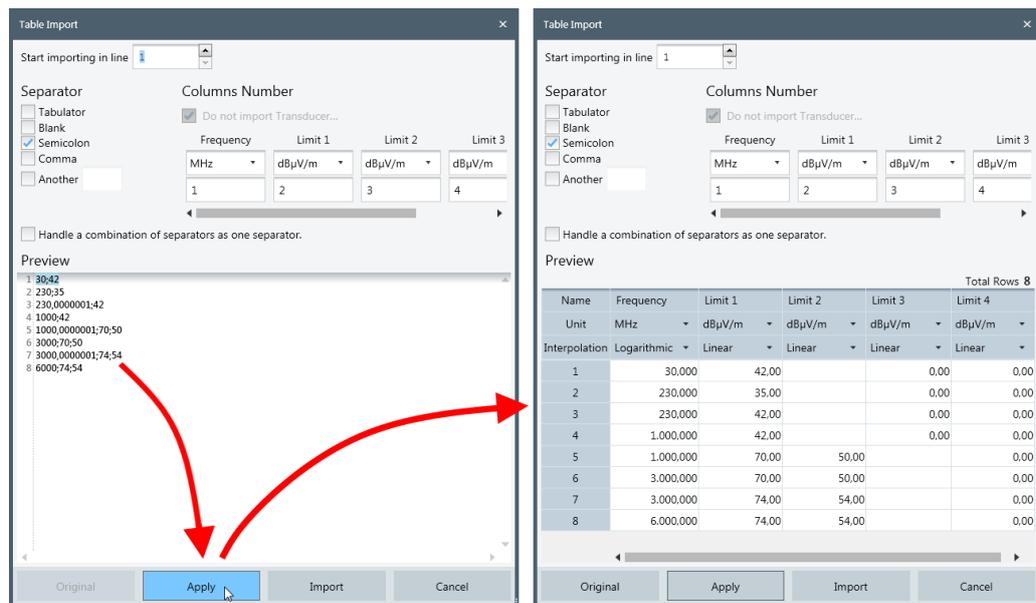


Figure 4-46: Two dialog views of the Table Import wizard for .csv files

Left = Manually select the separator and the frequency and limit units

Right = "Apply" the settings to create a table in R&S ELEKTRA format, ready for import

Verify or edit the pre-settings in the "Table Import" wizard:

- Select the first line for starting the import of table values
- Specify the correct table cell separator or a combination of separators
- Set the units for the frequency (Hz, kHz, MHz, GHz) and for the data values, for example:
 - Limit in dBµV/m
 - Attenuation in dB
 - Correction level in dBpT

"Apply" converts the data with your settings into a table in R&S ELEKTRA format.

"Import" terminates the wizard and opens the imported table in a new tab, where you can still edit it. If you wish to keep the table, make sure to save it.

Exporting tables

To export tables from R&S ELEKTRA to files in **.xlsx** or **.csv** format, do not use the **Export** tool. Instead, go to "Home" > "Tables" and proceed to the type of table you want to export (for example **Limit Lines**). Open the table you want to export. Here, you have two options:

- Select and copy the table content that you want to export and paste it into an external **.xlsx** or **.csv** table file. Use [Ctrl+c] to copy the content and [Ctrl+v] to paste it.
- Click  to export a table directly into an external **.csv** file. This option is not available for **.xlsx** files.

R&S ELEKTRA distinguishes the following global tables according to their use:

- [Limit Lines](#)..... 163
- [Attenuation](#)..... 165
- [Frequency List](#)..... 166
- [Transducer Correction](#)..... 166

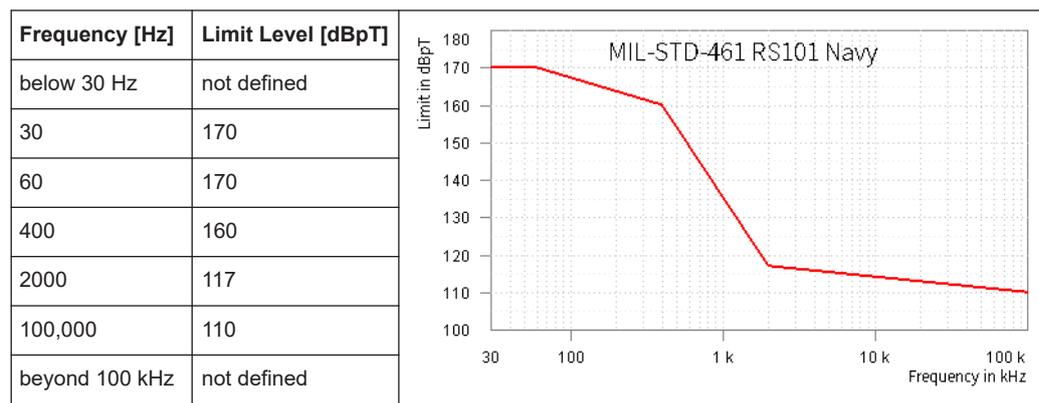
4.7.1 Limit Lines

A limit line is typically defined by a standard. Create or import your limit line tables accordingly. By using the [Configuration Wizard](#), you can let R&S ELEKTRA create a basic set of limit lines.

In R&S ELEKTRA, a **limit line table** consists of a frequency list in the first column and up to four **limit line columns** with limit levels for up to four individual detectors. Specify the [detector types](#) in the table header.

Example:

For the magnetic flux density, the standard MIL-STD-461G specifies the following RS101 limit for all navy applications:



The limit levels between the frequency points specified in this table are linearly interpolated in a semi-logarithmic chart (linear levels over logarithmic frequencies).

Unit

Define physical units in the limit line headers. For example, consider a limit line for tests that use an antenna: The true physical unit of the RF levels is a field strength (dB μ V/m), even though the receiver measures a voltage (dB μ V). Therefore, enter the result unit as described in [Chapter 4.6.8.2, "Measurement Correction"](#), on page 158.

Accuracy

Specifies the number of decimal places of the values displayed in the selected column. You can set this parameter from 0 to 8 decimal places.

"Accuracy" is available only, if it is enabled at "Show / Hide Column Headers".

Detector

For each limit line, select from the drop-down list the detector, for which this limit line is defined.

Interpolation

Defines whether to interpolate between the table rows in linear or logarithmic mode. To select "Linear" or "Logarithmic" interpolation for an individual column, click its "Interpolation" header.

To achieve the following, you must set the "Interpolation" correctly in the table definition:

- Setting "Interpolation" to "Linear", if the axis is scaled linear, too, results in a straight line between the defined points in a chart.
- Setting "Interpolation" to "Logarithmic", if the axis is scaled logarithmic, too, results in a straight line between the defined points in a chart.
- Otherwise, the line between points in the chart is curved.

Base Unit

Displays the base unit of the column and cannot be edited.

"Base Unit" is available only, if it is enabled at "Show / Hide Column Headers".

Applicable standard

On the right-hand side of the limit line table, a dialog shows the following:

- The "Application", which is "EMI"
- The "Standard", which you can select from a drop-down list, according to your test application
- The "Revision" of the standard, which you can enter here
- The "Subclass" of the standard, which you can enter here

Gaps in a limit line

As a special feature, you can define gaps in limit lines. To define a gap, enter 2 dash characters ("--") in a cell of the limit line table:

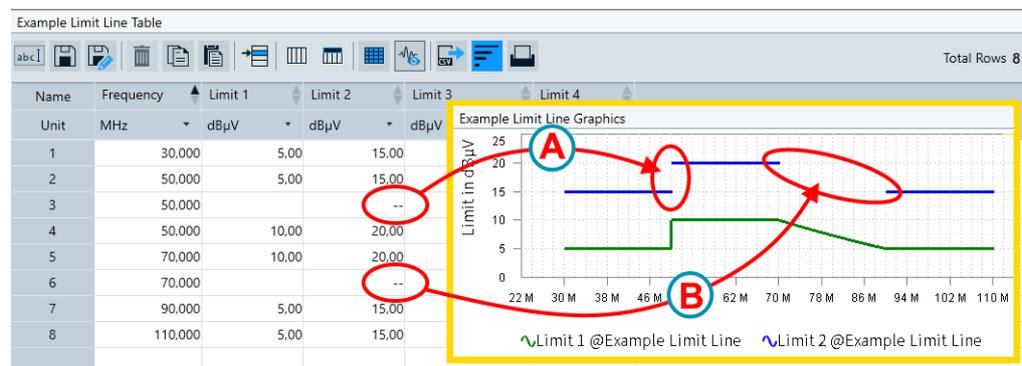


Figure 4-47: Examples of entries in a limit line table, and resulting graphics

A = Vertical gap (from one frequency to the same frequency)
B = Horizontal gap (from one frequency to a higher frequency)

To define a gap, use 3 rows in the table:

- The 1st row specifies the frequency, at which the previous section of the line ends and the gap begins
- The 2nd row contains the 2 dash characters ("--") that generate the gap
 - For a "vertical gap" (labeled (A) in [Figure 4-47](#)), use the same frequency as in the 1st row
 - For a "horizontal gap" (labeled (B) in [Figure 4-47](#)), use any frequency between the 1st row and the 3rd row

To avoid the same gaps in other limit lines of the same table, leave the corresponding cells of non-involved limit columns empty.

- The 3rd row specifies the frequency, at which the gap ends and the next section of the line begins

4.7.2 Attenuation

In the propagation of RF radiation across real media, there is always some loss of power due to attenuation. A technically especially relevant example is the propagation through an RF cable.

With the simplified assumption of the same amount of attenuation across all frequency bands, no attenuation tables would be required. Instead, a single attenuation value would be sufficient, for example for cable loss.

Attenuation tables serve to represent the frequency dependency of RF radiation across true propagation media. This frequency dependency describes the attenuation characteristics, for example of a piece of cable. A typical application of an attenuation table in R&S ELEKTRA is its use in the definition of a [Signal Path](#).

By using the [Configuration Wizard](#), you can let R&S ELEKTRA create a basic set of attenuation tables.

We recommend that you save your tables according to the suggested [nomenclature](#).



Gain vs. attenuation

Within R&S ELEKTRA, attenuation has a positive sign, gain has a negative sign.

Hence, to specify a gain table (for example for a preamplifier), enter negative attenuation levels.

Unit

This table header defines the frequency unit in Hz, kHz, MHz or GHz, and the attenuation level typically in dB.

Interpolation

Defines whether to interpolate between the table rows in linear or logarithmic mode. To select "Linear" or "Logarithmic" interpolation for an individual column, click its "Interpolation" header.

To achieve the following, you must set the "Interpolation" correctly in the table definition:

- Setting "Interpolation" to "Linear", if the axis is scaled linear, too, results in a straight line between the defined points in a chart.
- Setting "Interpolation" to "Logarithmic", if the axis is scaled logarithmic, too, results in a straight line between the defined points in a chart.
- Otherwise, the line between points in the chart is curved.

4.7.3 Frequency List

A frequency list contains a single column with frequencies. It defines discrete frequencies, for example in a test template, to let R&S ELEKTRA measure at these frequencies in addition to - or instead of - the frequencies defined by a given frequency setting.

Frequency lists are typically created by hand. Write the frequencies into the table or paste them there from a different source, for example from a spreadsheet.

For emission measurements, frequency lists can also be created by data reduction. The resulting list can be used in the final measurement.

Unit

Available frequency units are Hz, kHz, MHz and GHz. To select the unit, click the column header.

Comment

You can optionally enter arbitrary comments in each frequency row, for example the name of a frequency band.

4.7.4 Transducer Correction

Transducer correction tables are typically generated by hand, by copy-paste from the transducer manufacturer's specifications or through a calibration process. By using the [Configuration Wizard](#), you can let R&S ELEKTRA create a basic set of transducer correction tables.

Unit

In a table, the "Unit" row defines the units of the table's values.

Interpolation

"Interpolation" defines whether to interpolate between the table rows in linear or logarithmic mode. To select "Linear" or "Logarithmic" interpolation for an individual column, click its "Interpolation" header.

To achieve the following, you must set the "Interpolation" correctly in the table definition:

- Setting "Interpolation" to "Linear", if the axis is scaled linear, too, results in a straight line between the defined points in a chart.
- Setting "Interpolation" to "Logarithmic", if the axis is scaled logarithmic, too, results in a straight line between the defined points in a chart.
- Otherwise, the line between points in the chart is curved.

The tables are used to consider for the transfer function of a LISN or transducer (antenna, current clamp, etc.), as described in [LISN Measurement Correction](#) and [Transducer Measurement Correction](#).

The "Unit" in the "Correction Level" header defines the physical result unit as described in [Chapter 4.6.8.2, "Measurement Correction"](#), on page 158. For example, if there is a transducer correction table for an antenna: The RF levels are measured as some voltage (dB μ V) at the receiver's antenna connector. This voltage is converted by the transducer correction table into the field strength (dB μ V/m) that the antenna actually received. In this way, result tables and charts can display signal levels with their true physical units, rather than measured voltage levels.

An antenna factor table contains a list of frequencies and the antenna factor values in dB/m at these frequencies. [Figure 4-48](#) shows the graphical representation of such a table:

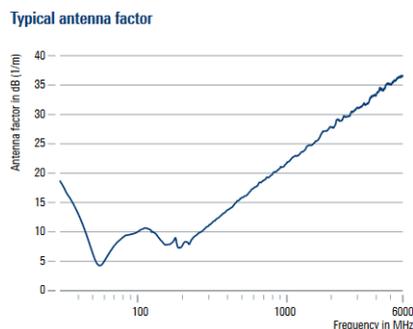


Figure 4-48: Example of a plot of the frequency-dependent antenna factor

R&S ELEKTRA extracts only the numeric values from the antenna factor table. If you import an antenna factor table, select the physical result unit as the "CSV unit" rather than the original antenna factor's unit.

Name	Frequency	Correction Level
1	30.000	18.53
2	32.000	17.27
3	34.000	16.31
4	36.000	15.13

Figure 4-49: Example of an imported antenna factor table

1 = Result unit



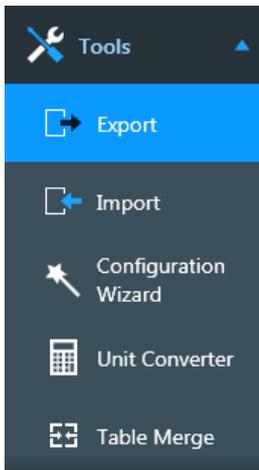
Correction factor

The correction factor (or "k factor") serves for the frequency and linearity correction of measured field strength values in EMS tests. The true (correct) field strength E_{corr} as a function of frequency is calculated from a reading R (for example returned by a field probe) using the following equation:

$$E_{corr} = (R + k_{Lin}) * 10^{(k_{Freq} / 20)}$$

with the linearity correction factor $k_{Lin} = E_{true} - E_{displayed}$ and the frequency correction factor $k_{Freq} = E_{true} / E_{displayed} [dB] = 20 * \log_{10} (E_{true} / E_{displayed})$.

4.8 Tools



Access: "Home" > "Tools"

Opens the tools described below.

- [Export](#)..... 169
- [Import](#)..... 170
- [Configuration Wizard](#)..... 171
- [Unit Converter](#)..... 172

4.8.1 Export

Access: "Home" > "Tools" > "Export"

All data in R&S ELEKTRA is saved in a single database file that can only be interpreted by this software. To make individual sets of data available outside of R&S ELEKTRA, you can export selected items.



"Export" is also an option for exchanging data between different instances of this software. However, if you wish to migrate to a new (higher) version of R&S ELEKTRA, we recommend [using the installation wizard](#) and [copying an existing database](#) into the new installation. Do so, *before* you start working and creating data with your new version of R&S ELEKTRA.

Export procedure

To export data, proceed as follows:

1. Click the  button to specify a target folder and **filename**.
The export file has the format of a ZIP archive.
Note: If you have previously exported data, the filename of that export is set as the default. To **avoid overwriting** your previous export, make sure to specify a different filename (or folder).
2. Deselect the types of items that you do not wish to export.
For example, deselect "Device(s)" and "Report Template(s)", leaving the other types selected.
3. Click "Next" to confirm your selection of item types.
4. For each selected type of items, select the individual items you wish to export.
You can sort the lists of items by clicking their headers, for example, the "Name" header or the "Change Date" header.
5. If you have previously pinned any [searches](#) to the dashboard, you can include these searches into the export file by selecting "Include saved search". This feature permits transferring your configured search parameters to a different installation.
6. Click "Next" to confirm your selection of items.
7. Repeat ["Export procedure"](#) on page 169 for all selected types of items.
8. When you have defined your selection for all types of items, complete the export process by clicking "Finish & Execute".

Note: The button "Finish & Execute" is available from the beginning of this procedure, if at least one type of items is selected. You can use "Finish & Execute" as a shortcut, without using the "Next" button for selecting individual items. However, if you do so, be aware that the wizard exports *all* items of *all* selected types.

The wizard generates the export file by writing the data sets into individual XML files (extensible markup language). Then it automatically archives all XML files into a single ZIP file and saves it into your selected target folder.

At the same time, the dialog shows "Logging Information". To see this information, click "Open Log".



Exporting tables

To export tables into `.xlsx` or `.csv` files, do not use the export tool described above. Instead, proceed as described in [Chapter 4.7, "Tables"](#), on page 159.

4.8.2 Import

Access: "Home" > "Tools" > "Import"

The import feature allows importing data from external ZIP or XML files into the R&S ELEKTRA database. Use this feature especially for importing data that has previously been [exported](#).



"Import" is also an option for exchanging data between different instances of this software. However, if you wish to migrate to a new (higher) version of R&S ELEKTRA, we recommend [using the installation wizard](#) and [copying an existing database](#) into the new installation. Do so, *before* you start working and creating data with your new version of R&S ELEKTRA.

Import procedure

To import data, proceed as follows:

1. Click the  button to select the ZIP or XML file you wish to import.

Tip: If the selection field shows a path and filename from a previous import, you can open this file by *placing the cursor in the selection field* and pressing [Enter]. Alternatively, remove the filename entry and start with a new file selection.

2. Click "Open".

If the selected file is suited for import, the dialog lists all items that are contained in the file, and the types of these items.

3. Deselect all types of items that you do not wish to import.

4. Click "Next".

The import wizard now checks, if any items among the selected types of items are already available in the database.

The results of this check appear in the column "Import Status/Options".

R&S ELEKTRA handles items that already exist in the database in the following way:

- If an existing item is [not referenced](#), the wizard lets you select one of the following options:
 - "Create New" creates an additional item with a modified name
 - "Use Existing" skips importing this item
 - "Overwrite" imports this item, which overwrites the existing item

- Otherwise, if the software lists an "Already Existing" item, it has a deactivated checkbox and you cannot import this item. This handling is equivalent with a forced "Use Existing" as described above.
5. Out of those items with activated checkboxes, select those items that you wish to import.
If options are available as described above, also select one of the options.
 6. Proceed in the same way with every selected type of items.
 7. Click "Finish & Execute".

The items are now imported and saved into their lists. For example, an imported test template is now available in the list of test templates.



Importing is only possible for ZIP and XML files that are validated by R&S ELEKTRA as having compatible content. If you try to import an incompatible file, an error message comes up and warns you that the import of this file is not allowed.



Importing tables

To import tables from `.xlsx` or `.csv` files, do not use the import tool described above. Instead, proceed as described in [Chapter 4.7, "Tables"](#), on page 159.



Importing tests

When you open an imported test and rerun it, R&S ELEKTRA validates it, discards the stored data and updates the test with the global table data and device data. This procedure ensures using always data that is currently valid, for example changed device IP addresses or new antenna transducer factors.

4.8.3 Configuration Wizard

Access: "Home" > "Tools" > "Configuration Wizard"

Run the wizard as described in [Chapter 2.4, "Configuration Wizard for creating basic data"](#), on page 23.



This tool creates application-specific sample data or demo sample data for tests.

It can generate some of the following content:

- [Test Templates](#)
- [Report Templates](#)
- The [Devices](#) required for the generated test templates
- The [Limit Lines](#) required for the generated test templates
- [Attenuation Tables](#)
- [Frequency Lists](#)
- [Transducer Correction Tables](#)

The "Description" line at the lower edge of the dialog shows details of an item that you select (highlight).

4.8.4 Unit Converter

Access: "Home" > "Tools" > "Unit Converter"

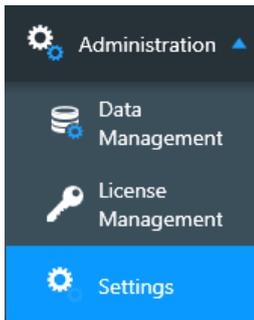
Alternative access: Click the calculator  icon on the right-hand side of the title bar.

Use this tool to convert a broad range of input values and units into output values and units.

Since many unit conversions depend on the system's "Impedance", you can specify this parameter. The default is "50 Ohms".

The button "Show Unit Converter Dialog" opens the same dialog in a separate window. You can keep this window open and move it to an arbitrary position, while using other dialogs of R&S ELEKTRA.

4.9 Administration



Access: "Home" > "Administration"

For all settings dialogs, go to [Chapter 4.9.3, "Settings"](#), on page 181.

Opens the administration dialogs described below.

- [Data Management](#).....172
- [License Management](#).....177
- [Settings](#).....181

4.9.1 Data Management



Access: "Home" > "Administration" > "Data Management"

Available only, if at least one of the following conditions is met:

- You are logged in as an administrator or expert user. If in doubt, ask your R&S ELEKTRA administrator.
- You have activated the [license](#) for "ELEMI-S", which requires that a [dongle](#) with this license is connected.

The "Data Management" dialog gives access to the following settings:

- [Backup](#).....173

4.9.1.1 Backup

Access: "Home" > "Administration" > "Data Management"

Available only, if you are logged in as an administrator or expert user. If in doubt, ask your R&S ELEKTRA administrator.

Use backups to save copies of your R&S ELEKTRA database in this folder:

C:\ProgramData\Rohde-Schwarz\ELEKTRA\x.xx.xx\Backup

The "Backup" dialog defines all backup settings.

The dialog headline has these functions:



"Save" stores the [Backup Configuration](#) settings. Without saving, your changed settings have no effect and are lost upon shutting down R&S ELEKTRA.



"Discard all changes" resets the configuration to the state before you changed these settings.



"Reset to Default" resets the configuration settings to their default state and saves it.



"**Create a backup**" immediately creates a backup of the R&S ELEKTRA database. If the number of created backups has reached the number specified in the field "Keep the last <n> backups", the creation of a new backup immediately deletes the oldest backup file. This deletion is not protected by a warning.



"Refresh" immediately refreshes the backup dialog. It consolidates the state of the backup dialog with the current settings and with the available data. For example, if you have copied one or more backup files from a different directory into the backup folder of your current version of R&S ELEKTRA, the "Refresh" button makes these files visible in the list of backups.

Below the dialog headline, the software displays the date of the most recent backup.

Backup Configuration

Defines the following database backup settings:

- **"Keep the last <n> backups"**
The setting of <n> defines the number of backups to keep. The minimum is one backup, maximum is 50. If you reduce this number below the number of existing

backups, saving this setting deletes the oldest backups that exceed the number of backups to be kept. For example, if you have stored 5 backups and then reduce the number of backups to be kept to 3, saving this setting deletes the 2 oldest backup files. This deletion is not protected by a warning.

- **"Make a backup" ...**

Upon shutting down R&S ELEKTRA, the software saves a backup (unless you have selected "never"), if the latest backup is older than the specified timeframe:

- "never"
- "daily"
- "every 2 days"
- "every week"
- "every month"

- **"Copy new backup automatically to folder"**

Enables selecting a target folder, to which the software automatically copies each new backup of the database. Note that the target folder can be in a network drive.

Below the "Configuration" settings, the dialog lists all available backup files in a table:



Backup Files

Lists the names of the created backup files with the following parameters:

- "Backup Files" shows the filenames in the format

`ELEKTRA_<date>_<time>.zip`

You can edit the filenames in the dialog.

The backups are saved in `.zip` files (archives). In addition, with each `.zip` file, R&S ELEKTRA saves an `.xml` file with the same filename. This file is not shown in the list, but is available in the backup folder.

- "Description" can contain arbitrary content, which you can edit with your own comments.

Per default, this field shows the following content:

- If you have created the backup file by the "Create a backup" button , this field is empty.
- If the backup file was created according to the timing settings described above, the field shows "scheduled automatic backup".
- If the backup file was created automatically by the R&S ELEKTRA installer, for example, if you select to install a clean or old database during the [Modify](#) installation procedure, the field shows "backup (installer)".

- "Keep Backup?" enables or disables keeping the selected backup file *in addition* to the selection of "Keep the last <n> backups" described above. If enabled, a lock icon is shown in the "Backup Files" field and the "Delete" button  is disabled.

- "File Size" of the backup files

- "Date of Creation" and time at which each of the backup files was created

- "Version" shows the R&S ELEKTRA version number, under which each of the backup files was created

To sort the list by file size or by date, click the column header. For reverse order, click the header again.



Restore

Overwrites the currently used database with the selected backup file. Restoring a backup is protected with a confirmation dialog:

"Are you sure you want to restore to this backup file?"

Clicking "Yes" restores and restarts R&S ELEKTRA with the selected backup data.

NOTICE

Risk of losing data

If you restore an older database without saving the current data before this action, your current data is irrevocably lost. Especially the data of previously executed tests can be a serious loss.

Therefore, always **create a backup of the current data** before you restore an older one.

If you copy a backup file of a newer version of R&S ELEKTRA into the backup folder of an older version, the "Restore" button is disabled in the backup administration dialog of that older version. Instead, the following mouse-over text is displayed: "Unable to restore a backup from a newer version".

Retrieving individual items from a backup

If you want to add only some items from a previous backup to your current database, proceed as follows:

1. Create a backup of your current data.
2. Restore the backup that contains the desired items.
3. [Export](#) the desired items into an external file.
4. Restore the backup that you have created in [step 1](#).
5. [Chapter 4.8.2, "Import"](#), on page 170 the items that you have exported in [step 3](#).



Delete

Deletes the selected backup file.

The deletion of a file is protected with a confirmation dialog:

"Are you sure you want to delete this backup file?"

Click "Yes" to confirm or "No" to quit deleting the file.



Upgrade this backup to the current version

Available only, if you have copied one or more backup files from the backup folder of a previous version of R&S ELEKTRA into the backup folder of the current version.

Clicking this button starts a procedure to upgrade the older backup file to be compatible with the database structure of the current version.

- If the upgrade succeeds, the following **blue** dialog comes up:
"Database upgrade completed"
 "Backup file ELEKTRA_<date>_<time>.zip successfully upgraded."
- If the upgrade does not succeed, a **red** dialog like the following comes up:
"Database upgrade failed"
 "Failed to upgrade the backup file. Error is I/O error during "ReadFile" operation for file "C:\PROGRAMDATA\ROHDE-SCHWARZ\ELEKTRA\X.XX.XX\BACKUP\TEMP\ELEKTRA_<date>_<time>\ELEKTRA.FDB". Error while trying to read from a file.

If the upgrade succeeds, the entry in the "Version" field changes from the old to the current R&S ELEKTRA version number.



When you terminate R&S ELEKTRA, the software first checks, if a backup is due according to your settings. If a backup is due, instead of terminating, the software saves a backup while showing a backup notification message.

To shut down R&S ELEKTRA, click the terminate (or "Close") button again.

Compress Database File

Launches a compression tool for reducing the size of the database file `ELEKTRA.FDB` currently used by R&S ELEKTRA. You can find this file in your computer in the following folder:

```
C:\ProgramData\Rohde-Schwarz\ELEKTRA\XX.XX.XX
```

Here, `XX.XX.XX` is the version number of your R&S ELEKTRA installation.

To compress the database

1. Click "Compress Database File".
 A warning comes up, which alerts you that this tool overwrites the current database. The dialog offers to create a backup of the database before compressing it.
2. Click "Yes", unless you want to skip creating a backup.
 R&S ELEKTRA creates a backup file and saves it with the present timestamp. The dialog alerts you that the software shuts down before compressing the database file. It asks if you want to continue.
3. Click "OK", unless you want to cancel the database compression.
 R&S ELEKTRA shuts down. The dialog of the compression tool comes up, which reports the current file size of the database and allows you to start the compression.
4. Click "Compress Database File".
 The compression procedure starts.
5. Wait for the procedure to complete.
 When the dialog reports successful completion, it also shows the new file size, and the percentage of the saved size.

6. Close the compression tool's dialog.
In the folder mentioned above, the database file ELEKTRA.FDB has a reduced size.
7. Optionally restart R&S ELEKTRA.

4.9.2 License Management



Access: "Home" > "Administration" > "License Management"

Manages the licenses for R&S ELEKTRA.

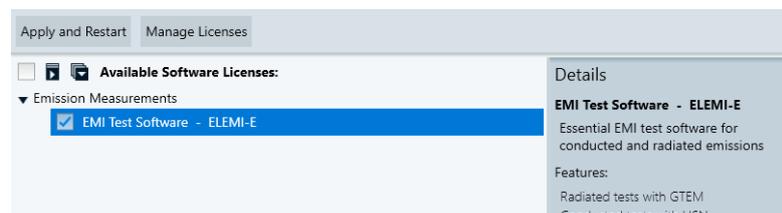


Figure 4-50: License management dialog, right: details of the selected (highlighted) license

Use the checkbox "Select/Deselect All" to select or deselect all entries in the list. Use  to collapse all entries in the list or  to expand all.

To see the expiration date of an evaluation license, click "Manage Licenses" to open the "R&S License Server Manager" dialog and refer to the "Validity" column.

Disabled Licenses!

If R&S ELEKTRA detects a license that cannot be used, for example after a version update and due to an expired maintenance period or invalid base licenses, it displays the message "Disabled Licenses" in the title bar. For more details on deactivated licenses, refer to the "R&S License Server Manager" dialog, available by clicking "[Manage Licenses](#)" on page 177.



Without licenses: "demo mode"

The R&S ELEKTRA EMC Test Software runs in "ELEMI-E" demo mode, if any of the following conditions applies:

- You do not own a license
- Your [License dongle](#) is not connected

In this EMI demo mode, no physical measurements can be made. If you have selected to [Allow Device Simulation](#), all test data comes from simulation and tests are labeled as simulated.

Manage Licenses

Access: "Home" > "Administration" > "License Management" > "Manage Licenses"

Brings up the following "R&S License Server Manager" dialog in your standard browser:

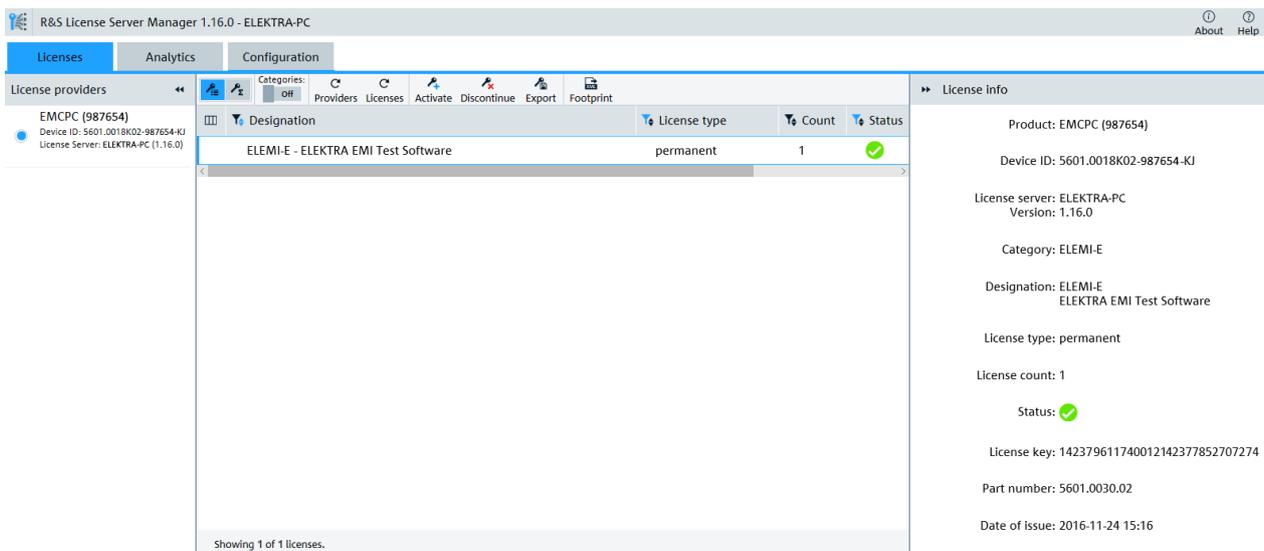


Figure 4-51: Example of the license server manager dialog

Use this dialog to view and manage the licenses that are contained in your [License dongle](#).

To terminate the "R&S License Server Manager", close the browser tab.

Note: User manual of R&S license server. At

c:\Program Files (x86)\Rohde-Schwarz\LicenseServer\doc\Manuals, you can find the file `RS_LicenseServer_Local_UserManual.pdf`.

Licenses ← Manage Licenses

This dialog has the following content in 3 tabs:

- The available "**License providers**", which are your license dongles
- A full **list of licenses** found on the selected license provider
- **Detailed information** on the license selected in the list

The list of the licenses (middle tab) provides the following features:



"Show license key list" displays a list of all license keys available on the dongle selected in the "License providers" column.



"Show option license summary" displays a list of all licensed options available via the selected dongle.



Available only, if "Show option license summary" is enabled.

"Group by categories" groups the options by license categories.



"Providers" reloads the available license providers.

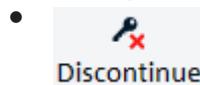


"Licenses" reloads the available licenses.



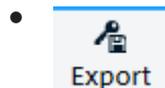
"Activate license key" activates a license by a key.

A dialog with the "Activate license" wizard opens. Enter a 30-digit or 32-digit "License key", or browse for a "License file" (.xml or .rsi format) that contains the key.



"Discontinue license key" discontinues a license by a key.

A dialog with the "Discontinue license" wizard opens. Enter a 30-digit or 32-digit "Deactivation key", or browse for a "License file" (.xml or .rsi format) that contains the key.



Available only, if "Show license key list" is enabled.

"Export license key" saves the selected license to a license-key file in .xml format.



"Export device footprint" saves all installed licenses and further product self-information of the selected dongle to a device-footprint file in .xml format. If necessary, you can send this file to Rohde & Schwarz for troubleshooting purposes.



To select the columns to be displayed, click the column icon . Enable or disable the columns or select "Show all".

The following columns are available, if "Show license key list"  is enabled:

- "Designation": the name of the license
- "License type", for example "permanent" or "software maintenance"
- "Count": the license count, typically "1"
- "Status": active or invalid (discontinued or expired)
- "Validity": number of days and hours remaining before the license expires
- "Invalidity reason": no entry up until the expiry date, "expired" after this date has passed
- "License key": the 30-digit or 32-digit keycode
- "Part number": order no. of the license key

The following columns are available, if "Show option license summary"  is enabled:

- "Designation": the name of the license
- "Total licenses", number of license keys saved on the license provider
- "Used licenses": "1" if activated, "0" if discontinued
- "Maintenance expiration": last day of validity of the license



To sort and filter the content in the list by a column, click this column's headers.

Analytics ← Manage Licenses

"License providers" shows details of the available dongles, for example "Situated at": the name of the computer, to which the selected dongle is connected.

Configuration ← Manage Licenses

"Local license server" shows configuration details, for example, the host name of the computer, on which R&S ELEKTRA is executed.

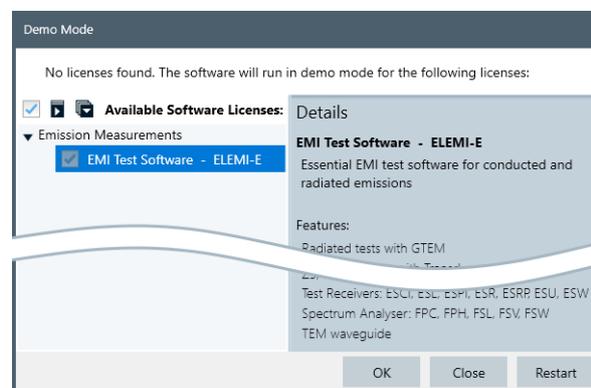
Apply and Restart

Restarts the software to apply your selection of enabling or disabling the checkbox for "EMI Test Software - ELEMI-E".

"Enabled" / "Disabled" You can use the restarted R&S ELEKTRA with all *enabled* licenses that are available on your [License dongle](#), as shown in the "License Management" dialog, see [Figure 4-51](#).

Note that you cannot disable the "ELEMI-E" license.

License dongle not inserted You can use the restarted R&S ELEKTRA in demo mode, only. During restart, the following dialog comes up:



Select OK to proceed with starting in demo mode. R&S ELEKTRA displays the words "Demo Mode" on the right-hand side of the title bar. See [Chapter 3.2, "Graphical user interface"](#), on page 37.

Note: If this dialog comes up while starting R&S ELEKTRA, because you have not yet inserted your license dongle, insert the dongle and click "Restart".

To leave the demo mode and use the software with your "ELEMI-E" license enabled, reinsert your license dongle. Go to "Home" > "Administration" > "License Management" and click "Apply and Restart".

4.9.3 Settings

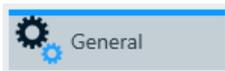


Access: "Home" > "Administration" > "Settings"

Opens the settings dialogs described below.

- [General](#)..... 181
- [Test](#).....183
- [Graphics](#).....184
- [Report](#)..... 187
- [Log](#)..... 189
- [External Mixer](#)..... 190

4.9.3.1 General



Access: "Home" > "Administration" > "Settings" > "General"

Selects the settings described below.

The dialog headline has these functions:



"Save" stores the general settings. Without saving, your changed settings have no effect and are lost upon shutting down R&S ELEKTRA.



"Discard all Changes" resets all general settings to the state before your changes.



"Reset to Default" resets all general settings to their default state and saves it.

Allow Device Simulation

Enables or disables running tests with simulated data. The software distinguishes the following cases:

- If you use R&S ELEKTRA **without licenses** in demo mode, no physical measurements can be made. All test data comes from device simulation. The tests are labeled as simulated.
- If you use R&S ELEKTRA **with a license**, the measurement mode depends on the availability of the devices required for a test:

- If all devices are available and the automatic test validation confirms the connection, the software uses the physical data, even if you have allowed simulation.
- If one or more devices are not connected, and if you confirm that you wish to let R&S ELEKTRA simulate a measurement, all test data comes from this simulation. The tests are labeled as simulated.

Show Welcome Screen on startup

Enables or disables the "Welcome Screen" upon starting R&S ELEKTRA. This screen also allows creating sample test data, as described in [Chapter 2.4, "Configuration Wizard for creating basic data"](#), on page 23.

Enable auto-refresh of search lists

If enabled, the software updates search results also upon creation of new items (devices, test templates) in other tabs. If not enabled, an update of search results can require manual switching between tabs. We recommend deactivating the auto-refresh feature only, if many searchable items slow down the generation of search views. In this case, deactivation can accelerate software performance.

Show troubleshooting info selection screen

If enabled, you can select options for including or not including specific types of content into troubleshooting zip files. See [Chapter 10.4, "Troubleshooting information"](#), on page 245.

Show Test Id

If enabled, the software assigns an individual test ID for each test. You can use the ID only with higher license versions of R&S ELEKTRA.

Show Done option when saving test

If enabled, R&S ELEKTRA brings up a dialog box at saving a completed test that asks: "Do you want to mark this test as Done?"

If you select "Yes" in this dialog, the software marks the test as "Done" in the following places:

- Checkmark  icon next to the "Save" on page 214 button in the test control top menu
- Checkmark  icon in the "Done" column of the [Tests](#) search dialog
- Entry "Test marked as Done on:" with date and timestamp in the [Details](#) section of the test's search dialog and of the [dashboard](#)

Note that you cannot edit "Done" tests, and you cannot remove the "Done" state.

Dashboard: Show ...

To enable or disable the displaying of individual categories of items in the [Dashboard](#) dialog, use the following checkboxes:

- "Dashboard: Show Tests"

- "Dashboard: Show Test Templates"
- "Dashboard: Show Report Templates"

The intention of limiting the categories of pinned items in the "Dashboard" dialog is to provide simple access to - and a good overview of - exactly the pinned items and searches that you require. In combination with user-defined [Searches](#), this selection is especially helpful, if you have created many items or searches over time.

EMI: Download the ... into the receiver when the test ends

R&S ELEKTRA supports enhanced communication with your test receiver: The download option facilitates switching between using a receiver with and without control from R&S ELEKTRA. Hence, this feature optimizes the match between measuring with a receiver under local control and under control of R&S ELEKTRA.

For example, if the software "knows" attenuation correction data of switching paths, the measurement results can differ from the results of a receiver that does not "know" this data. Downloading the data into the receiver aims at compensating this difference and can improve the measurement reproducibility in these two scenarios.

To enable this feature, you can download selected data into the receiver at the end of a test execution under software control.

You can enable or disable the following features individually:

- "EMI: Download the **transducer sum** into the receiver when the test ends", see ["Correction sum download"](#) on page 211
- "EMI: Download the **limit lines** into the receiver when the test ends"
- "EMI: Download the **scan settings** into the receiver when the test ends", which refers to a set of basic scan parameters, see ["Scan settings download"](#) on page 212

EMI: Run *.py scripts within ELEKTRA

Enables using the built-in Python environment of R&S ELEKTRA for executing Python scripts. The built-in environment typically improves performance. If you disable the checkbox, an external Python environment is required. It must be installed on your computer and can help, if there are compatibility issues.



Save any changed settings before you leave this dialog.

4.9.3.2 Test



Access: "Home" > "Administration" > "Settings" > "Test"

Defines list categories and default content for the [Test Information](#) section of your test template.

The dialog headline has these functions:

-

"Save" stores the settings. Without saving, your changes have no effect.



"Discard all Changes" resets all changes to the state before saving.



"Reset to Default" restores the original settings.

Per default, the following categories (titles) are predefined in this dialog:

- "Description"
- "Test Standard"
- "Test Site"
- "Operator Name"

To add an arbitrary new category, click the "Add Information" button . Enter a name for the new category in the "Category" field.

Enter arbitrary content in each row of test information. You can also leave the content of a row blank and enter only the category, for entering the content later (within the tests).

To sort the rows alphabetically by their categories or contents, click the headline.

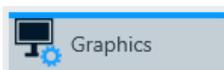
To swap the position of the selected row with the one above or below it, click "Shift Row Up / Down" .

Use the checkbox in the first column ("Add Entry") to activate or deactivate displaying selected categories in the "Test Information" dialog.

To remove a category, click the "Delete" button  in the last column of this entry.

When you have completed editing the entries, save your settings by clicking the "Save" button .

4.9.3.3 Graphics



Access: "Home" > "Administration" > "Settings" > "Graphics"

Defines global settings for color, font size, style, etc. of the background of graphic charts, of their labels, legends, markers, grid lines, axes and traces.

While these settings are globally valid for all new graphics, you can also define the same settings differently for individual graphic charts. To do so while working with a graphic chart, right-click the chart and select [Graphics Properties](#).

The dialog headline has these functions:



"Save" stores the settings. Without saving, your changed settings have no effect and are lost upon shutting down R&S ELEKTRA.



"Discard all Changes" resets the settings to the state before your changes.



"Reset to Default" resets the settings to their default state and saves it.

Note that this button does not only reset the settings to their default that are currently visible in the dialog. Instead, all the following settings are reset to their default.

Graphics.....	185
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Traces.....	187

Graphics

Access: "Home" > "Administration" > "Settings" > "Graphics" > "Graphics"

This dialog defines the following graphics settings:

- **"General"**
"Background Color" selects the color of the chart's background.
- **"Legend"**
 - "Legend On for Grid Chart" enables showing a legend below each chart.
 - "Show Beside" enables showing the legend beside the chart instead of below it.
- **"Label"**
"Limit Line Label On for Grid Chart" enables showing labels that indicate the names of all limit lines.
- **"Font Family"** selects the "Font", "Typeface" and "Size" of text in the title, axis labels and legend of graphics
- **"Accessory Settings"**
"Show Accessory Settings in the Graphic Traces and Markers" enables an interactive option: You can click a trace or on a marker in a test chart of a stopped test to let R&S ELEKTRA display accessory settings. For example, it can display the antenna polarization, the EUT's azimuth angle or the position of an accessory.
- **"Default Arrangement of Test Graphics"** selects the default arrangement of all graphics. You can choose to display as follows:
 - "Horizontal" - arrange the graphs in a row
 - "Vertical" - arrange the graphs in a column
 - "Cascading" - arrange the graphs as one tab per chart, and show only the graphic of the selected tab

Marker

Access: "Home" > "Administration" > "Settings" > "Graphics" > "Marker"

This dialog defines the following marker settings:

- **"General"**
 - If the checkbox "Use the color of the referenced trace" is enabled (= default), the color of each **un-referenced** marker is set to the color of its own trace.

- To select a global "Marker Color" for unreferenced markers, disable the checkbox.
As an exception, the currently selected marker is always highlighted in a light blue color.
- Optionally select the "Marker Size" to be "Small", "Medium" (= default) or "Large". This setting is valid for all kinds of markers.
- **"Delta Marker"**
 - If the checkbox "Use the color of the referenced marker" is enabled (= default), the color of **delta** markers (synchronized or not) is set to the trace color of the referenced markers.
 - To select a global "Marker Color" for delta markers, disable the checkbox.
As an exception, the currently selected marker is always highlighted in a light blue color.
- **"Pixel Mode"**

The default "Show Pixel Mode" enables markers to be moved from pixel to pixel between the frequency (measurement) points. If disabled, markers can only jump from one frequency point to the next. The effect of this setting becomes especially noticeable, if only a few frequency points are visible, for example when zooming deeply into a trace.

To access this setting in a graphic chart, right-click the chart and select "Graphic Properties" > "Marker" > "Pixel Mode". Alternatively, right-click the chart and select "Marker" > "Pixel Mode", or right-click a marker and select "Pixel Mode".
- **"Search"**

Specifies the "Peak Excursion" value (in dB), which is the minimum amplitude variation required for a measurement result to qualify as a peak.

"Peak Excursion" is always specified with respect to a local maximum value. To qualify as a peak, the signal must fall on both sides of this local maximum by at least the peak excursion value without at any point rising above the local maximum.

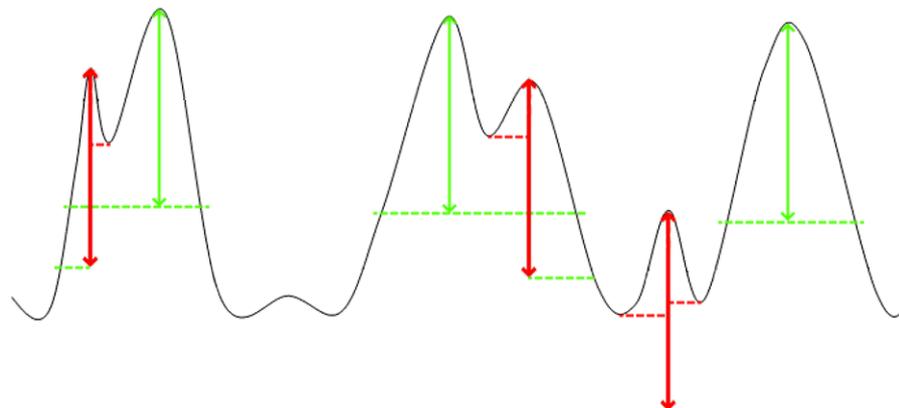


Figure 4-52: Illustration of Peak Excursion in a signal trace

Height of arrows = Peak Excursion

Green arrows = Peaks qualify, because the trace falls on both sides below the bottom of the arrow without rising above the top of the arrow

Red arrows = Peaks do not qualify, because the trace rises above the top of the arrow before falling below the bottom of the arrow

Hence, the size of the "Peak Excursion" determines whether the software detects separate peaks or classifies them as a single peak. For example, consider a level dip between two local maxima being 3 dB down, and the level values left and right of them being 5 dB down. In this case, with a "Peak Excursion" of 4 dB, the two local maxima are regarded as one peak. But with a "Peak Excursion" of 2 dB, the two maxima are regarded as two separate peaks.

Grid

Access: "Home" > "Administration" > "Settings" > "Graphics" > "Grid"

This dialog defines the following grid settings:

- **"Horizontal Grid"** selects "Color" and "Style" of horizontal grid lines. The "Color" setting requires "Style" to be set different from "None".
- **"Vertical Grid"** selects "Color" and "Style" of vertical grid lines. The "Color" setting requires "Style" to be set different from "None".
- **"Axis"** enables or disables "Logarithmic X-Axis" and "Title of Y-Axis rotated by 90 deg", selects "Label Color" and "Font Size". If you enable "Y-Axis Auto Scaling of Test Graphics", R&S ELEKTRA automatically scales the vertical axis of test charts depending on the measured levels.

Traces

Access: "Home" > "Administration" > "Settings" > "Graphics" > "Traces"

This dialog defines the following marker settings:

- **"Trace"** selects the "Trace", "Limit Line" or "Symbol Trace" to be configured.
- **"Line"** specifies "Style", "Color" and "Thickness" of the selected trace or line. The settings "Color" and "Thickness" require "Style" to be set different from "None".
- **"Symbol"** specifies "Shape", "Color" and "Size" of symbols on the selected trace or line. The settings "Color" and "Size" require "Shape" to be set different from "None".
- **"Vertical Line To the Bottom"** specifies "Style", "Color" and "Thickness" of lines that connect symbols (or points) on the selected trace to the lower edge of the chart. The settings "Color" and "Thickness" require "Style" to be set different from "None".
- **"Use for EMI Detector"** selects a [detector type](#), and assigns it the properties of a selected trace. Hence, you can use this function to define individual trace layouts specifically for each available detector.
The selection "Use for EMI Detector" is available only for traces 1 to 8 and for "All other Traces". Automatically, the detector that you select for one "Trace" is assigned also to the "Limit Line" and "Symbol Trace" with the same index number.

4.9.3.4 Report



Access: "Home" > "Administration" > "Settings" > "Report"

Defines global settings for reports, report graphics and report templates used per default.

The dialog headline has these functions:

-

"Save" stores the settings. Without saving, your changed settings have no effect and are lost upon shutting down R&S ELEKTRA.



"Discard all Changes" resets the settings to the state before your changes.



"Reset to Default" resets the settings to their default state and saves it.

General

Specifies the "Report Title", "Header", "Footer", "Logo", "Font" and "Export Format", which are then available in the "General" section of [Report Templates](#).



Before you leave this dialog, save your changes to activate them. To reset the report configuration to the default settings, click the "Reset to Default" button .

For the "Header" and "Footer" of reports, the following selections are available for the left, center and right sections, respectively:

- "None" leaves this section blank
- "Date" in the format "dd.mm.yyyy"
- "Time" in 24-hour clock format "hh:mm"
- "Date / Time"
- "Page Number" = the current page number in a report
- "Page Number / Count" = "Page Number" and the total number of pages, separated by "/"
- "Test Name" = the name of the test that is described by the report
- [Verdict](#) = a "Passed", "Failed" or "Inconclusive" statement resulting from a [test](#)
- "Version" = the name "ELEKTRA" together with this software's version number
- "Title" = the "Report Title" specified above
- "Logo" = the logo image file selected below

The "Logo" image file is stored within the R&S ELEKTRA database. To select a new logo, click the  button. The existing logo is replaced by the new logo. To view the currently selected logo, click the  button. To restore the original logo, click the "Reset to Default" button . Note that this action resets all other report settings, too.

The font of reports can be specified individually for the following "Font Items":

- "Title"
- "Component Title"
- "Table Contents"
- "Normal Text"



The "Export Format" of reports can either be "PDF" (Adobe Acrobat portable document format = default) or "DOCX" (MS Word for Windows). The option that you select deter-

 mines the export format offered in a report (PDF  or DOCX ). However, with one file format preselected, the other file format is still available in the "Save As" dialog.

Graphics

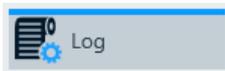
"Add Graphics Title" globally activates or deactivates the graphics title as a default for reports.

"Graphics Arrangement" specifies either one chart over the full page width or up to four charts next to each other, at a reduced width.

Tables

"Max. Printed Rows" specifies the number of lines of a table to be printed in a report.

4.9.3.5 Log



Access: "Home" > "Administration" > "Settings" > "Log"

The logging function of R&S ELEKTRA tracks software events by a specific protocol transcript and saves the log information in several files to the folder

C:\ProgramData\Rohde-Schwarz\ELEKTRA\x.xx.x\Logs.

Use the "Log Settings" dialog to configure the [Log information](#).

The dialog headline provides the following functions:



"Save" stores the log settings. Without saving, your changed settings have no effect and are lost upon shutting down R&S ELEKTRA.



"Discard all Changes" resets the log settings to the state before you changed these settings.



"Reset to Default" resets the log settings to their default state.



"View Logs" opens a dialog for viewing the log entries, as described in [Chapter 10.2, "Log information"](#), on page 243



You can open the "View Logs" dialog also by the [short key](#) [Alt]+[L].

- **SCPI**

Opens the "ELEKTRA Spy" tool in a separate window. This "inspection" tool for text-based commands (like SCPI) displays log entries of the device communication, which is useful for diagnosis purposes.



You can also open the **"ELEKTRA Spy"** dialog by the [short key](#) [Alt]+[I].

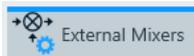
Log File Settings

Defines the maximum log data volume (in megabytes) and the maximum log file count.

SCPI Settings

Defines the maximum number of command and respond lines in the SCPI log. When it reaches the maximum number of lines, R&S ELEKTRA automatically removes the oldest 25% of lines from the log.

4.9.3.6 External Mixer



Access: "Home" > "Administration" > "Settings" > "External Mixer"

Available only, if "Spectrum Analyzer" is selected as the "Operating Mode" in an EMI test template.

Defines the parameters of the "External Mixers" in the list of [Input Selection](#) of the EMI test template.

The dialog headline has these functions:



"Save" stores all the unsaved settings. Without saving, your changes have no effect.



"Discard all Changes" resets all changes to the state before saving.



"Reset to Default" restores the original settings.

External Mixers

Specifies the parameters of an external mixer, which are then visible in the [Input Selection](#) of the [Test Templates](#).

Table 4-8: Preconfigured external mixers and some of their parameters

Mixer Name	Frequency Range	Harmonic Number	Local Oscillator Power	Comment
R&S TC-RSE60	41 GHz - 60 GHz	4	13	L.O. power may need extra attenuation down to max. 7 dBm
R&S TC-RSE90 mod.02	60 GHz - 93 GHz	6	13	L.O. power may need extra attenuation down to max. 7 dBm
R&S TC-RSE90 mod.03	60 GHz - 90 GHz	6	13	L.O. power may need extra attenuation down to max. 7 dBm
R&S TC-RSE140 (X8)	90 GHz - 138 GHz	8	15	Set to x8 via OSP
R&S TC-RSE140 (X16)	130 GHz - 145 GHz	16	15	Set to x16 via OSP
R&S TC-RSE200	138 GHz - 200 GHz	12	13	L.O. power may need extra attenuation down to max. 7 dBm
R&S TC-RSE220	145 GHz - 220 GHz	16	13	L.O. power may need extra attenuation down to max. 7 dBm
R&S TC-RSE325	220 GHz - 325 GHz	24	13	L.O. power may need extra attenuation down to max. 7 dBm
R&S FS-Z60	40 GHz - 60 GHz	4	13.5	R&S ext. mixer hardware (RPG)
R&S FS-Z75	50 GHz - 75 GHz	6	13.5	R&S ext. mixer hardware (RPG)
R&S FS-Z90	60 GHz - 90 GHz	6	13.5	R&S ext. mixer hardware (RPG)
R&S FS-Z110	75 GHz - 110 GHz	8	13.5	R&S ext. mixer hardware (RPG)
R&S FS-Z140	90 GHz - 140 GHz	10	13.5	R&S ext. mixer hardware (RPG)
R&S FS-Z170	110 GHz - 170 GHz	12	13.5	R&S ext. mixer hardware (RPG)
R&S FS-Z220	140 GHz - 220 GHz	16	13.5	R&S ext. mixer hardware (RPG)
R&S FS-Z325	220 GHz - 325 GHz	22	13	R&S ext. mixer hardware (RPG)
R&S FS-Z500	325 GHz - 500 GHz	36	14	R&S ext. mixer hardware (RPG)
RPG SHM 75-110	75 GHz - 110 GHz	8	13.5	L.O. power may need extra attenuation down to max. 10 dBm
RPG SHM 90-140	90 GHz - 140 GHz	10	13.5	L.O. power may need extra attenuation down to max. 10 dBm
RPG SHM 110-170	110 GHz - 170 GHz	12	13.5	L.O. power may need extra attenuation down to max. 10 dBm
RPG SHM 140-220	140 GHz - 220 GHz	16	13.5	L.O. power may need extra attenuation down to max. 10 dBm
RPG SHM 170-260	170 GHz - 260 GHz	18	13.5	L.O. power may need extra attenuation down to max. 10 dBm
RPG SHM 220-330	220 GHz - 330 GHz	22	13	L.O. power may need extra attenuation down to max. 10 dBm

Mixer Name	Frequency Range	Harmonic Number	Local Oscillator Power	Comment
RPG SHM 325-500	325 GHz - 500 GHz	36	14	L.O. power may need extra attenuation down to max. 10 dBm
"Experimental Mixer"	600 GHz - 1000 GHz	64	15	3rd party / research hardware

When you have edited any parameters, save your settings by clicking the "Save" button  in the "Functions" column.

To add a new entry, click the "Add new External Mixer" button . Double-click the default "Mixer Name" field to enter a name for the new external mixer.

To duplicate an entry, select the entry and click the "Copy" button  either in the "Functions" column or at the bottom of the dialog.

To remove an entry, click the "Delete" button  either in the "Functions" column or at the bottom of the dialog.

The checkboxes in the first column of this table allow you to duplicate or remove multiple external mixers.

When you have completed editing the entries, save your settings by clicking the "Save" button .

If you wish to discard all unsaved changes, click the "Discard all changes" button .

If you wish to restore the original settings, click the "Reset to Default" button .

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Mixer Type.....	192
Bias Current.....	193
Harmonic Number.....	193
Local Oscillator Power.....	193
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Mixer Name

Defines the name of an external mixer.

Frequency Range

Defines the start and stop frequency of the mixer.

This value is validated for the corresponding range defined in the [Test Templates](#).

Functions

Allows the user to save, copy or delete an entry.

Mixer Type

Selects either the "2-port" or "3-port" mixer type.

Note: All R&S or RPG harmonic mixer products are three-port mixers.

Bias Current

Defines the mixer's bias current, in steps of 1 mA.

Note: Typically 0 mA. Only single diode mixers require a value other than 0 mA.

Harmonic Number

An integer value that determines the available frequency range, where the number represents multiples of a fundamental frequency. R&S ELEKTRA applies a default value of 8 for a new entry.

Local Oscillator Power

Defines the power consumption of the local oscillator (L.O.), in steps of 0.1 dBm.

If the smallest possible power consumption is too high for the mixer, insert an attenuator such as an amplifier with long cables.

Auto Signal Identification

This setting takes effect only for measurements in [Operating Mode](#) = "Spectrum Analyzer". It is not applicable with zero-span sweeps as used for single measurements.

If enabled, R&S ELEKTRA performs an additional sweep measurement using the [Auto ID Threshold](#) definition. For more details, refer to the receiver's user manual.

If disabled, R&S ELEKTRA ignores the "Auto ID Threshold", even if you set it.

Comment

Provides additional information on the mixer, for example a recommended attenuator to be used with the mixer.

5 Measurement basics

This chapter introduces the users to the fundamental measurement principles for EMI tests and helps to structure tests in an application-related matrix.

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- [Test matrix](#)..... 194
- [Detectors](#)..... 196
- [Attenuation in signal paths](#)..... 197

5.1 Fundamental principles

Electrical appliances that emit electromagnetic waves (conducted or radiated) can interfere with other appliances that receive these waves. With a transmitter, this behavior can be intentional or unintentional.

To ensure reasonable operation of electrical appliances, international [EMI standards](#) regulate the maximum level of emitted interfering power of an appliance.

EMI tests (electromagnetic interference, or emission) that simulate the actual interference situation serve to evaluate the compliance of equipment with these standards. The measurements and the applicable limit lines defined in the standards are frequency-dependent.

5.2 Test matrix

The type of electrical appliance (EUT) and its field of application determine, which EMI tests must be [performed](#) according to which standard. The following table provides an overview:

Table 5-1: EUT-related test matrix

EUT type	Interference type	Run EMI tests according to
automotive / boats (with combustion engines)	conducted emission	CISPR 12 / 25 / 36
	radiated emission	
broadcast	conducted emission	CISPR 13 / 32
	radiated emission	
household	conducted emission	CISPR 14-1
	radiated emission	
industrial, scientific, medical (ISM)	conducted emission	CISPR 11 / 28
	radiated emission	
IT equipment	conducted emission	CISPR 22 / 32
	radiated emission	

EUT type	Interference type	Run EMI tests according to
lighting	conducted emission	CISPR 15
	radiated emission	
military, aerospace	conducted emission	MIL-STD-461
	radiated emission	
multimedia	conducted emission	CISPR 32
	radiated emission	

The regulations in the applicable [EMI standards](#) lead to the following action items:

- The [measurement devices](#) that you must use
- The [Test Templates](#) that you must configure
- The [Limit Lines](#) that you must apply
- In radiated tests, the measurement distances between emitter and receiver that you must observe
- The frequency ranges that you must cover by the various test methods.

An example for non-military EMI tests is shown in [Figure 5-1](#):

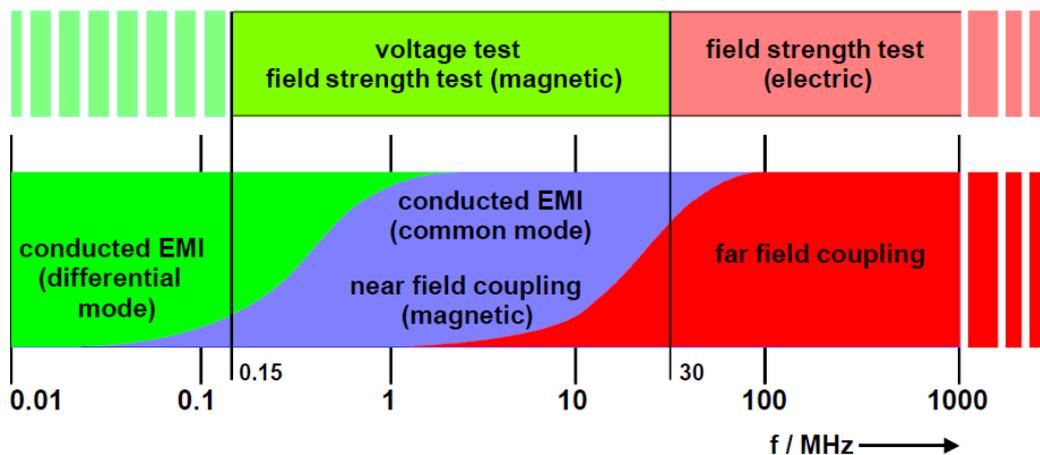


Figure 5-1: Signal propagation and appropriate EMI setups in different frequency ranges

Voltage test	= see EMI tests (with artificial mains network / LISN)
Field strength test	= see Figure 4-8 (magnetic: with loop antenna / electric: with dipole antenna)
Conducted EMI	= see Common mode or differential mode
Near field coupling (magnetic)	= For example, in RFID tests, use an H near-field probe
Far field coupling	= see below

Regarding the near-field to far-field transition shown at a frequency $f = 30$ MHz in [Figure 5-1](#), consider the following: At a given distance $r = 10$ m between the EUT and an antenna, the near-field condition $r < \lambda$ is fulfilled at frequencies f below 30 MHz. The reason is that the wavelength $\lambda = c/f$ is then >10 m (with signal propagation speed $c = 3 \cdot 10^8$ m/s). This relation is valid for radiated measurements in EMI tests.

5.3 Detectors

In EMI measurements, detectors are algorithms that specify how to weight the envelope of the measured IF signal.

Table 5-2: Detector types

Detector name	Detector description
Average (AVG)	For average measurements, the linear time-averaged value of the rectified voltage at the output of the envelope demodulator is indicated. It is calibrated using the RMS value of an unmodulated sinusoidal signal. If an unmodulated sinusoidal signal is applied to the receiver input, its RMS value is thus indicated. If an AM signal is present, the RMS value of the carrier is indicated. With the ESCS, analog averaging is performed using lowpass filters, the time constants of which are switched depending on the measuring time.
CISPR Average (CISPR AV, CAV)	CISPR Average is the weighting average detector according to CISPR 16-1-1. The CISPR average detector supplies a weighted average. When measuring the average according to CISPR 16-1-1, the maximum value of the linear average during the measurement time is displayed. The detector is used, for example, to measure pulsed sinusoidal signals with a low pulse repetition frequency. It is calibrated with the RMS value of an unmodulated sinusoidal signal. Averaging is with lowpass filters of the second order (simulation of a mechanical instrument).
Maximum Peak (MaxPeak, Peak, PK+)	Peak value measurements return the maximum value of the rectified voltage at the output of the envelope demodulator within the selected measuring time. The detector is calibrated using the RMS value of an unmodulated sinusoidal signal that supplies the same detection voltage. Average and peak value of an unmodulated sinusoidal signal basically return the same indication. However, with peak value weighting, the noise voltage indication is about 11 dB higher than with average weighting. Therefore, higher values are indicated when the signal-to-noise ratio is not sufficient. Peak value indication serves for determining the levels of keyed carriers, pulse signals or peak voltages of AM signals. As peak value measurements can be carried out considerably faster than quasi-peak measurements, we recommend for RFI measurements to begin with a general measurement in indicating peak mode. After that, run a quasi-peak measurement at the critical frequencies.
Minimum Peak (Min-Peak, PK-)	For negative peak-value measurements, the minimum value of the rectified voltage at the output of the envelope demodulator within the selected measuring time is indicated.
Quasi Peak (QPK)	Quasi-peak measurement weights pulse signals using a quasi-peak detector with defined charge and discharge time. IF bandwidth and mechanical time constant of the meter are also specified. The characteristics the receiver has in this indication mode are defined in CISPR 16 or in VDE 0876. Due to the long time constants of weighting, it takes relatively long until a valid measurement result is displayed after every change in frequency or attenuation at the receiver. It is therefore futile to use measuring times of less than 1 s, especially for automatic measurements. The maximum level value during the measuring time set is shown on the digital level display. The timing of the quasi-peak test voltage can be observed on the analog meter at the same time. In addition to monitoring of the interference source, this measurement often allows you to draw useful conclusions as to the character of the interference. Quasi-peak weighting places high demands on the dynamic characteristics of the receiver. With low pulse frequencies, however, the operating range cannot be fully utilized, as otherwise the RF input would be overloaded. When an overload occurs, the software informs you about it by way of the overload indication ( Overload) in the test window. In this case, increase the RF attenuation to such an extent that the overload message disappears. In automatic operation, the receiver itself correctly sets the attenuation.
RMS	For RMS value measurements, the RMS value of the rectified voltage at the envelope demodulator output is indicated. Irrespective of the signal shape, the envelope demodulator power is indicated. Analog RMS value generation is performed. The time constant for RMS value generation is set via the measuring time and is identical with the time constant of average value generation with the measuring time already specified.

Detector name	Detector description
RMS Average (RMSAV)	RMS Average is the weighting detector according to an amendment of CISPR 16-1-1 (CISPR/A/628/CD). The RMS average detector supplies a weighted reading of the input signal. When measuring the RMS average according to the amendment, RMSAV returns the maximum value of the RMS average during the measurement time. This detector is used, for example, to measure pulsed sinusoidal signals with a low pulse repetition frequency. It is calibrated with the RMS value of an unmodulated sinusoidal signal. Averaging uses lowpass filters of the second order (simulation of a mechanical instrument).
Sample	Displays the level value that is measured first in a particular statistical bin, and ignores all other values measured in such a bin.

5.4 Attenuation in signal paths

Due to RF attenuation in signal paths, for example in cables, the RF power level at one end of the path can differ from the level at the other end. Depending on the precision requirements of your application, if the attenuation is low, you can neglect it. Neglecting is equivalent with specifying 0 dB attenuation in a given path.

Otherwise, if you do not want to neglect attenuation effects, specify the attenuation characteristics of your signal paths by constant values or by frequency-dependent [attenuation tables](#). R&S ELEKTRA can use this information for power level compensation: It can calculate the power at one end of a signal path, if it knows the power at the other end and the level of attenuation in the path.

5.4.1 EMI measurement correction

Based on the receiver's raw measurement data, R&S ELEKTRA can calculate the [emission level](#). This chapter describes, how the software uses [attenuation tables](#) referenced in a [signal path](#) and [transducer correction tables](#) for this calculation.

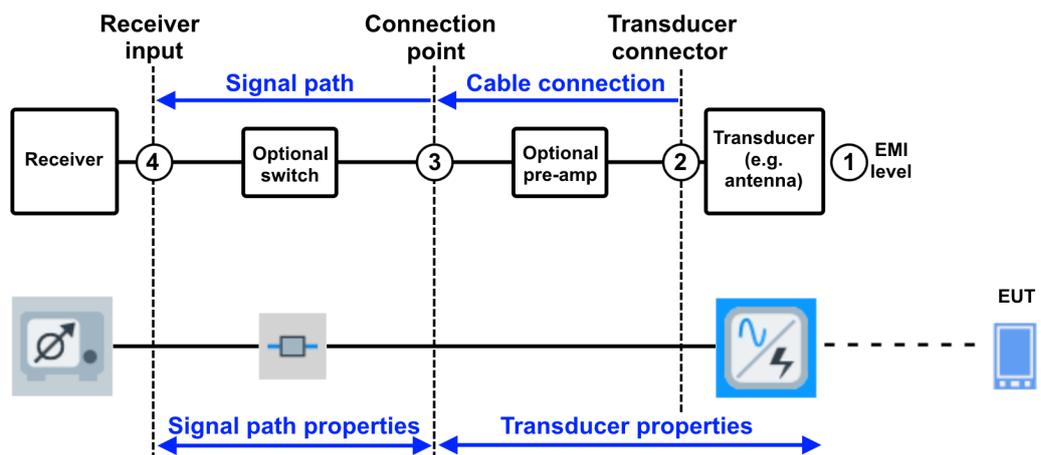


Figure 5-2: Paths in an EMI hardware setup that can contribute to signal attenuation

1 to 4 = Measurement points

Path [1-2] = Transducer input to output, see fixed correction value or [transducer correction table](#) specified in the [Transducer Factor](#) dialog

Path [2-3] = Transducer output to connection point, see fixed value or [attenuation table](#) specified in the transducer's [Cable Correction](#) dialog

Path [3-4] = Connection point to receiver input, see constant value or one or more [attenuation tables](#) specified in the [Measurement Correction](#) dialog of the [signal path](#)

- If the EMI hardware setup is radiated, hence if the transducer is an antenna, the setup typically uses the connection point of a shielded chamber and includes a pre-amplifier (optional).

If there is a pre-amplifier, enter its gain as a negative attenuation in the [Measurement Correction](#) dialog. Alternatively, consider entering the gain information as negative attenuation in the cable properties or in the signal path's attenuation.

- In conducted setups, the transducer's cable is often connected directly to the receiver, and the signal path [3-4] in [Figure 5-2](#) does not exist.

Calculating the emission level

The following equation shows, how R&S ELEKTRA calculates the emission level at measurement point 1. The algorithm uses the raw level reading, measured by the RF receiver at its input (measurement point 4, typically in dB μ V). The emission level depends on the path correction:

- ▶ Emission level = receiver level + correction [1-2] + correction [2-3] + correction [3-4]

6 Special software features

This chapter provides helpful information for operating some specific features of R&S ELEKTRA, typically in the [graphical user interface \(GUI\)](#).

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6.1 Handling changed items

If you change any content in a dialog that supports saving, the "Save" button of the dialog is marked by an asterisk (*).

- To keep the changes (upon closing the dialog, at the latest), select "Save" or "Save As".
- To discard the changes upon closing the dialog, select "Don't Save". To avoid accidental loss of data, R&S ELEKTRA prompts you to confirm, if you would like to save your changes or not.
- To return to the dialog without saving and without closing it, select "Cancel".



Changed content or items are handled differently in the "Device List", see [Save all changes](#), [Discard all changes](#), [Save](#) and [Delete](#).

6.2 Dashboard search

When you enter a keyword in the search field (top right in the [Dashboard](#) dialog), the software immediately starts searching for items that meet the search criteria. The search results, which are displayed in a drop-down hit list, also depend on the activated filter button:

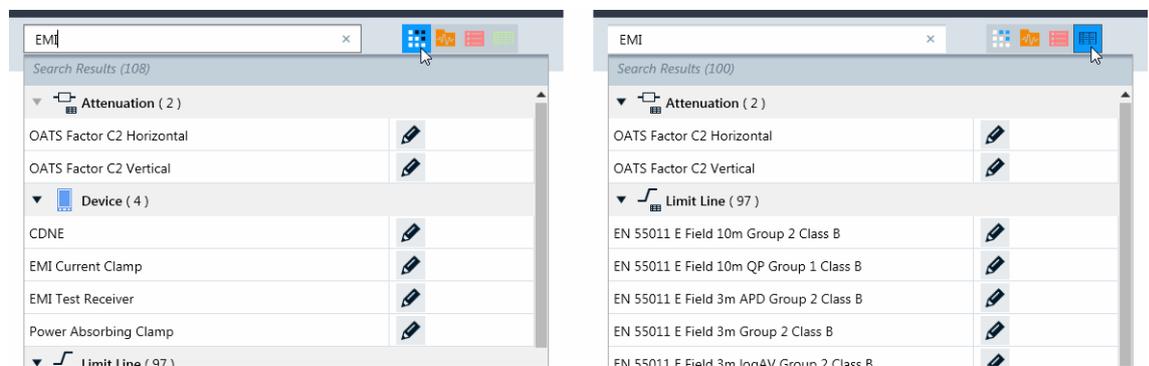


Figure 6-1: The dashboard search and its filter buttons

For example:

- When you select the left filter button ("Search All"), as shown on the left in [Figure 6-1](#), the hit list comprises all categories of items.
- When you select the right filter button ("Search Tables"), as shown on the right in [Figure 6-1](#), the hit list comprises only tables.

The dashboard search function includes search terms from the following features of items:

- Names, for example the names of test templates, tests or tables
- Frequency values, as part of, for example, a device's or table's frequency range
- Tags

To open a found item directly from the hit list, click the "Open" button  next to it.

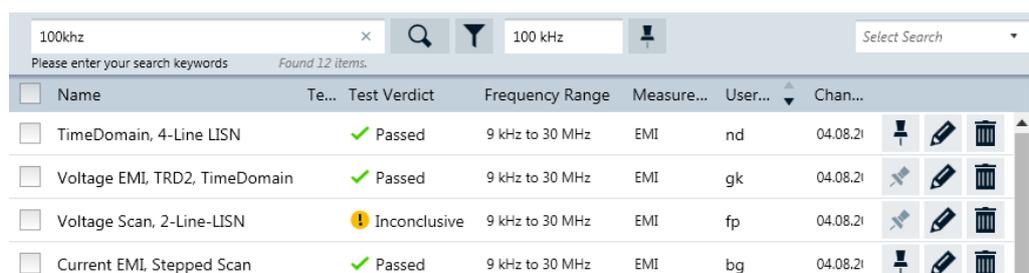
If a "Create Test from Template" button  is shown next to a test template in the search results, you can create this test directly from the hit list.

If a "Pin to Dashboard" button  or  is shown next to a search result, you can pin it directly from the hit list to the dashboard.

If a search result is already pinned to the dashboard, an "Unpin from Dashboard" button  or  is shown next to it. You can unpin this item directly by clicking the button in the hit list.

6.3 Searches

R&S ELEKTRA offers a versatile search and filter functionality. Many dialogs, such as the item search dialog () , provide a field for entering a search term  and for setting filters :



<input type="checkbox"/>	Name	Te...	Test Verdict	Frequency Range	Measure...	User...	Chan...
<input type="checkbox"/>	TimeDomain, 4-Line LISN		✓ Passed	9 kHz to 30 MHz	EMI	nd	04.08.21
<input type="checkbox"/>	Voltage EMI, TRD2, TimeDomain		✓ Passed	9 kHz to 30 MHz	EMI	gk	04.08.21
<input type="checkbox"/>	Voltage Scan, 2-Line-LISN		⚠ Inconclusive	9 kHz to 30 MHz	EMI	fp	04.08.21
<input type="checkbox"/>	Current EMI, Stepped Scan		✓ Passed	9 kHz to 30 MHz	EMI	bg	04.08.21

Figure 6-2: Example: Results of a search for the string "100khz" in the list of tests

"100khz" = Search string in the search field

"100 kHz" = User-defined name to label and pin this search

"Select Search" = Field for selecting pinned searches

To sort the list of search results by one of its headline parameters in ascending or descending order, click this headline parameter. For example, click "Change Date" to sort the list's content in the order of the latest date of saving. For reverted sorting, click the headline parameter again.

To confine the currently displayed list of items to those items that contain a certain **search** criterion, enter it into the search field , as shown in [Figure 6-2](#).

Permitted search criteria are:

- **Arbitrary text**
Any text string that can appear in the name of an item, in its description, in the "User Tags" or similar fields.
- **Physical data**
For example, searching the list of "Tests" for the frequency value *7 GHz* finds each item, which is specified for a range that includes this frequency, like *1 to 8 GHz* or *3 to 24 GHz*. However, this search does not find an item that is specified for the frequency range *150 kHz to 30 MHz*.

To confine the currently displayed list of items to those items that contain a certain **filter** criterion, click the filter button . In the "Filters and Tags" subdialog that opens, select from the available filter criteria, see [Figure 6-3](#). R&S ELEKTRA adds the selected filter criterion to the search field as a search string. If there is already some search string, before you add a new filter criterion, the software combines the strings in the search field by a Boolean "AND" operation.

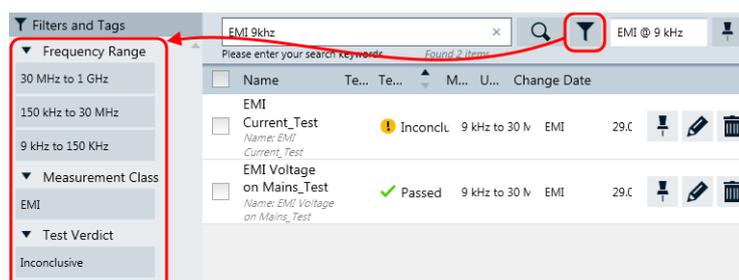


Figure 6-3: The filter button opens the list of available filter criteria

To close the "Filters and Tags" subdialog, click the filter button  again.

Pinning and selecting searches



The "Add to Dashboard"  button allows you to [pin](#) or save the current search. It also adds your search in the "Select Search" drop-down list.

For items available in the "Dashboard" dialog, access the pinned (saved) searches directly in the "Dashboard" dialog. The search is shown there as an item with magnifying lens icon among the appropriate category of items. For example, a pinned "Test" search (from the original dialog "Tests") is shown together with the other "Test" items that you have pinned to the "Dashboard" (see [Figure 3-5](#)).

Find the pinned searches of other items, such as [Tables](#) or [devices](#), in the "Select Search" field of the respective dialog.

To rename a search item in the dashboard, check the checkbox at the top-right corner of the search item. Then, click the "Rename"  icon and enter the desired name in the field.

To reopen a search result list in the original dialog, click its search item in the "Dashboard" dialog. Alternatively, within the search's original list dialog (for example "Tests"),

open the drop-down list in the field "Select Search" and click the name of the search. The reopened result list includes all items that meet the search criteria, also those items that have been created after defining the search.

To cancel the current search or filter in the original dialog, click the "x" button in the search field. Note that this action leaves pinned searches in the "Dashboard" dialog untouched.

There are two ways to remove a search from the list dialog's "Select Search" field:

- Open the drop-down list in the "Select Search" field and click the "x" button next to the search you want to remove. This action also unpins the corresponding search item from the "Dashboard" dialog.
- Go to the "Dashboard" dialog and **unpin** the corresponding search item there. To do so, check the checkbox in the top-right corner of the search item and click the "Unpin from Dashboard"  button in the actions bar. This action also removes the corresponding search item from the drop-down list in the "Select Search" field of the original dialog.

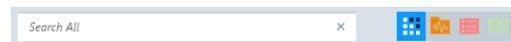


Each list of items (e.g. "Tests") remains reduced, as long as a search or filter criterion is entered in the search field. This reduction pertains even after leaving the dialog and returning to it, later on. To see all items in a list, make sure to clear the search field (which also removes any filters) by clicking the "x" button in the search field.

If at some point you return to a list and miss any items, we recommend checking the search field for any entries that you may have left there unintentionally.



Dashboard search



For a description of the dashboard search, see [Chapter 6.2, "Dashboard search"](#), on page 199.

Show Details

Displays the "Details" panel of a selected item inside the search dialog.

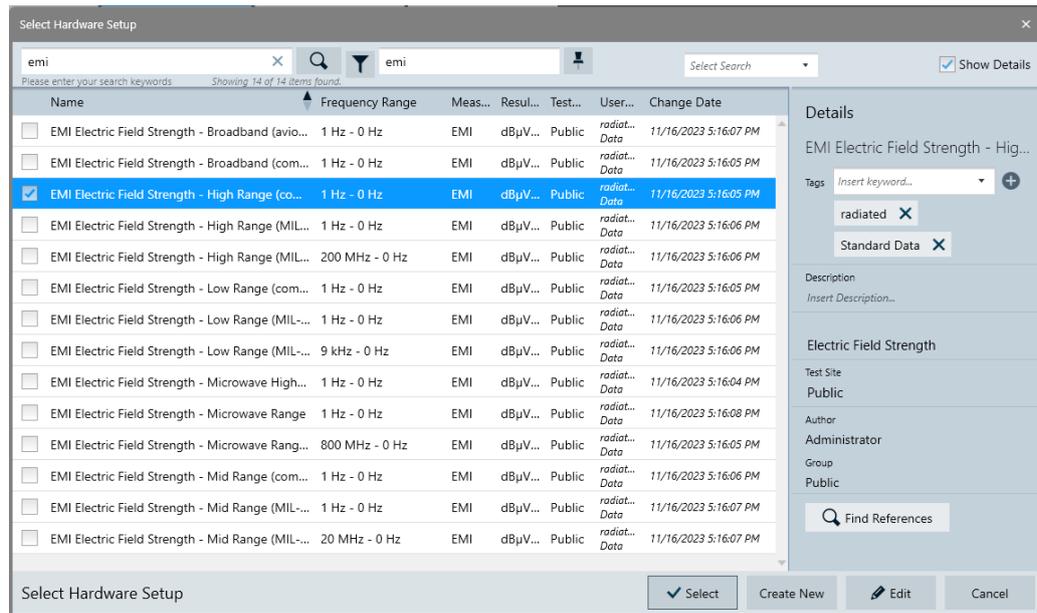


Figure 6-4: An example of the details shown for a selected hardware setup

By default, the "Show Details" checkbox is enabled. To hide the details panel, uncheck the checkbox.

6.4 Arranging elements in tests

You can rearrange the following elements of a test window:

- Charts (top)
- Tables (bottom)
- Dialogs (or control elements) in the [side panels](#)

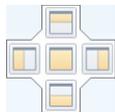
- [Charts and tables](#).....203
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- [Cross icons](#).....205

6.4.1 Charts and tables

For arranging **charts** and **tables**, R&S ELEKTRA offers the following features:

- To minimize the charts or tables, click their top bar. The charts or tables become as slim as their top bar, placed at the top or bottom edge of the test window. Minimizing both charts and tables leaves their top bars visible, only.
If originally both graphics and tables are visible (half screen, each), minimizing the graphics shows the tables in full size, and vice versa.
- To open a minimized chart or table, click the slim bar that represents the minimized element. Opening the graphics while the tables are minimized shows the charts in full size, and vice versa.

- To change the ratio of shared space of graphics and tables, move the mouse pointer over the separation line between graphics and tables, until the pointer becomes an arrows icon. Drag this vertical arrows icon down to enlarge the charts and reduce the tables, or vice versa.
- To arrange several charts or several tables either horizontally or vertically or to cascade them behind each other, use the buttons .
- To make a chart or table **float** over the test window, click and hold its top bar and drag it out of its original position. As a result, the chart or table jumps out of its original position and floats nearby.
This feature is only available, if more than one chart or more than one table is opened in the test window.
- To move a floating chart or table to an arbitrary position, click and hold its top bar and drag it to the desired position.
Note that you cannot immediately drag a chart or table anywhere, after you made it float by dragging it out of its original position. Instead, you must release the mouse pointer, then click and hold the element's top bar again and drag it to the desired position.
- To resize a floating chart or table, move the mouse pointer over any edge of the chart or any corner of the table, until the pointer becomes an arrows icon. Drag this arrows icon to resize the dialog.
- To move a floating chart or table back to its original position, click the "Window Position" button  again and select "Dock".
- You can dock a floating chart or table in the central region of the test window. To dock a floating chart or table, click and hold its top bar and drag it to a position where a cross icon appears:

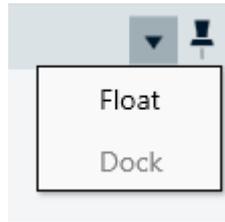


Proceed as described in [Chapter 6.4.3, "Cross icons"](#), on page 205.

6.4.2 Dialogs

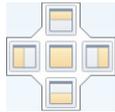
For arranging dialogs, R&S ELEKTRA offers the following features:

- To minimize a dialog, click the vertical "Auto Hide" button . The dialog becomes a slim tab marker at the left or right edge of the test window.
- To open a minimized dialog (instead of its slim tab marker), click the tab marker. A slim version of the dialog opens, in which you can click the horizontal "Auto Hide" button . This action opens the dialog in its original position.
- To make a dialog **float** over the test window, click the "Window Position" button  and select "Float".



Note: If you use more than one screen, the floating dialog can have jumped to a different screen than the original one.

- To resize a floating dialog, move the mouse pointer over any of the dialog's edges or corners, until the pointer becomes an arrows icon. Drag this arrows icon to resize the dialog.
- To move a floating dialog back to its original position, click the "Window Position" button (▼) again and select "Dock".
- To move a floating dialog to an arbitrary position, click and hold its top bar and drag it to the desired position.
- You can dock a floating dialog in the left or right region of the test window. To dock a floating dialog, click and hold its top bar and drag it to a position where a cross icon appears:

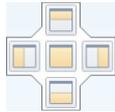


Proceed as described in [Chapter 6.4.3, "Cross icons"](#), on page 205.

6.4.3 Cross icons

This chapter describes positioning a floating element, such as a [chart](#), [table](#) or [dialog](#) in a test window, with the help of a cross icon.

The cross icon can appear in two versions:

- 
- 

It comes up in the following procedure:

1. Click and hold the top bar of a floating element (chart, table or dialog).
2. Drag it to any position where you can dock the element.

The cross icon appears.

3. Keep holding the element at its top bar.
4. Without letting the element go, drag the mouse pointer over any of the square sections of the cross icon.

An outline like in [Figure 6-5](#) comes up that corresponds with your selection in the cross icon:

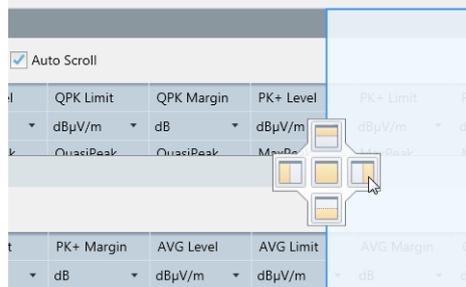


Figure 6-5: When using the cross icon for positioning a table, an outline appears in light blue color

In this example, the mouse pointer is positioned over the square section on the right-hand side of the cross icon. This mouse position creates an outline (shown in light blue color) in the place, where you can dock the element. In [Figure 6-5](#), the outline indicates that the element can be docked at the right-hand side.

5. Release the mouse pointer.

The element is docked in the outlined position.

To move an element to a different position, use any of the features described in [Chapter 6.4.1, "Charts and tables"](#), on page 203 and [Chapter 6.4.2, "Dialogs"](#), on page 204.

6.5 Keyboard shortcuts

If you are looking for a keyboard shortcut (or "shortcut", "short key") to a software function, refer to the following tables:

Table 6-1: Shortcuts for moving the selected marker in a chart

Shift+P	Moves to peak
Ctrl+P	Moves to next peak
Shift+M	Moves to minimum
Ctrl+M	Moves to next minimum

Table 6-2: Shortcuts for modifying the axes in a chart

Shift+X	Auto-scales X axis
Shift+Y	Auto-scales Y axis

Ctrl+X	Toggles log-mode for X axis
Ctrl+Y	Toggles log-mode for Y axis

Table 6-3: Shortcuts for modifying the zoom in a chart

Shift+ +	Enables (further) zoom-in
Shift+ -	Switches off zoom

Table 6-4: Shortcuts for modifying the legend in a chart

Shift+L	Toggles legend off/on See also Table 6-9 .
---------	---

Table 6-5: Shortcuts for navigating in the home menu

Alt+A	Expands the Administration node
Alt+B	Expands the Tables node
Alt+D	Shows the Dashboard view
Alt+M	Shows the Test Templates view
Alt+O	Shows the Export view
Alt+R	Shows the Report Templates view
Alt+T	Shows the Tests view
Alt+V	Shows the Device List view

Table 6-6: Shortcuts in the Actions section of the test template editor

Alt+ ↑	Moves selected item up (if several items are in one node)
Alt+ ↓	Moves selected item down (if several items are in one node)

Table 6-7: Shortcuts to be used in the text editor (for example, for viewing the test-flow log)

Ctrl+F	Shows search box (find mode) Available also in content window of Help dialog, for example. See also Table 6-8 .
--------	---

Table 6-8: Shortcuts to be used in the table editor (for example, for viewing a transducer table)

Ctrl+F	Goes to a frequency
Ctrl+G	Goes to a table row
Ctrl+O	Goes to a table row

Table 6-9: Other global shortcuts (some are valid in some dialogs, only)

F1	Provides Help (context sensitive)
Ctrl+A	Selects all content
Ctrl+C	Copies selected content

Ctrl+X	Cuts selected content
Ctrl+V	Pastes copied or cut content
Ctrl+S	Saves content
Ctrl+Shift+S	Saves all
F12	Saves as
Alt+X	Generates Troubleshooting information
Alt+L	Shows the Logs window
Alt+I	Shows the ELEKTRA Spy window

7 Running tests

This chapter explains how to run tests, use the side panels ([test control elements](#)), handle the [test container](#) and work with test results ([tables](#) and [graphics](#)).



- For an overview of which EMI test has to be performed according to which standard, see [Chapter 5.2, "Test matrix"](#), on page 194.
- For information on how to configure test templates for these tests, see [Chapter 4.4, "Test Templates"](#), on page 73.
- For getting started with testing, see [Chapter 3.6, "Performing a test"](#), on page 45.

A completed EMI test in R&S ELEKTRA is not just a single result table, but a [Test container](#). It typically contains:

- Test definition ([Test Template](#) with hardware setup, [Measurement Settings](#) and [Device properties](#))
- References for used [Tables](#), including [Limit Lines](#)
- [Test result tables](#) with [configuration parameters](#)
- [Test result graphics](#) with [configuration parameters](#)
- [Test Reports](#) with [configuration parameters](#)
- Also, during the test:
 - [Measurement Flow Control](#) dialogs provide information about the current position in a [test sequence](#)
 - [Accessories control panels](#) facilitate handling devices like LISNs or GTEM cells

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7.1 EMI tests

For the general steps of preparing a test, see [Chapter 3.6, "Performing a test"](#), on page 45. After test preparation, proceed as follows:

Creating and running tests

- To **create** a test, alternatively execute one of the following options:
 - Select "Home" > "Dashboard" and click the "New Test" button (🏠➕). To "Select a Test Type", click any of the available options. In the first dialog that opens ("New Test"), select at least the test template on which to base the new test. Then click "New Test".
 - Alternatively, select "Home" > "Tests" > "Create Test" (🏠➕). Then proceed with the "New Test" dialog as above.
 - Alternatively, select a test template at "Home" > "Test Templates" and select "New Test" (🏠➕). Then proceed with the "New Test" dialog as above.
 - Alternatively, open a test template at "Home" > "Test Templates" and select "Create test from template" (🏠➕).
 - Alternatively, at "Home" > "Test Templates" click "Create test from template" (🏠➕) or "Open test configuration" (🏠⌵) in the line of the test template you wish to select.
 - Or alternatively, open (🔗) an *existing* test by selecting it at "Home" > "Tests", for example to rerun it with updated device properties. Note that you cannot run or rerun an imported test. If you have opened an imported test, it is labeled as "Imported Test (Read Only)".

Note: In an opened test template, the button "Create test from template" is only available, if the test template has been saved.
- To run an **automated measurement** (🔍), click the "Start" button (▶) in the [Test control toolbar](#).
The software performs a [Test Validation](#), then executes the test and automatically displays the results in both graphical and tabular format, labeled "Overview Graphic" and "Final Results Table" as in [Figure 3-8](#).
- Optionally run **interactive measurements** (🔍), using the [side panels](#).
If you remeasure a level value at a "Critical Point", R&S ELEKTRA suggests for this measurement the "final measurement" detector that relates to the overview detector, which has originally found this "Critical Point". However, you can change the default settings, including the detector selection.

- Click "Save" (📁) or "Save As" (📁) to save the test and to specify a name for it - ideally, use speaking names. Additional options in the "Save" dialog:
 - Optionally enable "Add to Dashboard" to pin the saved test to the "Dashboard" dialog, see [Graphical user interface](#).
 - Optionally add user-defined "Tags" to the test. Tagging allows searching for tagged tests. Hence, tagging facilitates finding (groups of) tests with specific tags.



Firewall

For information on what to do, if a firewall message comes up, see [Chapter 2.7, "Network firewall settings"](#), on page 30.



Overload

If a measured level overloads the receiver, a flashing "Overload" warning is displayed in the top of the test window:



In this case, the measurement is **invalid**.

Stop the measurement and eliminate the overload condition, for example by setting a higher [RF Attenuation](#) in the [test template](#). Then run a new test based on the modified setting.

You can stop the "Overload" warning from flashing by clicking it.

The test result representation is based on the frequency range (X-axis) and level range (Y-axis) as defined in the [test template](#). The number of traces in the overview graphic and columns in the overview table depend on the number of detectors and limit lines specified in the test template.

Correction sum download

Transducer factor correction sums are the accumulated amounts of "Correction" and "Attenuation", specified for the transducer and the signal path used in this measurement. The correction sums are stored in the "Spectrum Overview" result table of a test. The download of a correction sum always transfers 625 correction points into the receiver.

When measuring via a test receiver, per default R&S ELEKTRA does not transfer the correction sums to the receiver. Therefore, the trace on the receiver's display represents *raw levels* and thus can differ from the measurement values in the software's result tables. During the test, R&S ELEKTRA computes the correction sums for each frequency point and adds these corrections to the receiver's raw measurements. Optionally, at the end of the test, the software can transfer the correction sums to the receiver, if you have enabled this feature in the [Administration > General](#). See "[EMI: Download the ... into the receiver when the test ends](#)" on page 183.

Scan settings download



After an EMI measurement with a test receiver, and depending on your [General](#) (see [EMI: Download the ... into the receiver when the test ends](#)), R&S ELEKTRA can proceed as follows: It can program a best match of basic [scan settings](#) (as specified in the [test template](#)) into the test receiver's internal scan table. You can use these settings for measurements that you control manually at the test receiver's front panel.

Optionally select "Refresh" (↻) to rerun a [Test Validation](#). If you have changed any settings in the test template's copy that the test uses (see [Test container](#)), "Refresh" also activates these changes.

Optionally select "Clear Results" (✕) to delete all measured values. This action is protected by the following message: "Please confirm: Are you sure you want to refresh the test and thus delete the existing test results?"

After having executed and saved a test, proceed with [Test results](#) and [Reporting](#).

7.1.1 Automated measurement



After [creating](#) a test based on a [test template](#), you can let R&S ELEKTRA perform an automated measurement. To do so, select the automated measurement mode (⚙️) and click the "Start" button (▶) in the [Test control toolbar](#).

The software runs a [Test Validation](#) and automatically performs the measurement according to the [Measurement Flow](#) specified in the test template. Typically, an automated measurement consists of an [Overview Measurement](#) (see [Settings \(Overview\)](#)), followed by [Data Reduction](#) and [Final Measurement](#).

When the measurement is completed, the [Test results](#) and the [Verdict](#) are displayed. You can configure the result [graphics](#) and [tables](#) according to your needs and generate a [report](#).

These steps complete the automated measurement. To examine the EUT in more detail at selected frequencies, run an [Interactive measurement](#).

7.1.2 Interactive measurement



Interactive measurements are typically performed after an [automated measurement](#), which gives you an overview of the spectral emission situation and identifies critical points. Hence, interactive measurements can help to address special DUT properties or specific results from the overview measurement, facilitating dedicated or repeated measurements, depending on individual requirements of your test.

We recommend [saving](#) (💾) the test with the results of the automated measurement before you proceed.

When you change to the interactive mode, the [Final Measurement](#) settings are loaded from the test template into the [Measurements](#) dialog.

You can run two kinds of interactive measurement (

- For a **manually controlled** interactive measurement, click the "Repeat Measurement at Single Frequency" button () in the [Test control toolbar](#).
The software runs a [Test Validation](#).
Use the [Measurements](#) dialog and the [Frequency Control](#) dialog to control the measurement. Especially, use the provided frequency-control features to select the frequency points, at which you want to measure. To save individual measured level values at selected frequency points, click record (). These values are labeled "Interactive" in the "Source" column of the "Final Results" table.
- For a **semi-automatic** interactive measurement, which requires "Critical Points" identified in a previous [automated measurement](#), click the "Start" button () or the "Start reverse" button () in the [Test control toolbar](#).
Note that you can edit the list of "Critical Points" manually, as described in [Chapter 7.3, "Test result tables"](#), on page 229. For example, you can add points from the "Overview" table to the "Critical Points" table or delete one or more critical points. The software runs a [Test Validation](#) and then measures each critical point. This measurement leads to additional level values that are labeled "Critical Points" in the "Source" column of the "Final Results" table.

7.2 Using the test control elements

This chapter describes the buttons and dialogs in the top menu and in the left-hand and right-hand side panels of an [opened test](#):

• Test control top menu	213
• Test control toolbar	215
• Test Components	218
• Measurement Flow Control	221
• Accessories	222
• Frequency Control	223
• Parameter	226
• Measurements	226
• Test Validation	228

7.2.1 Test control top menu

The test control top menu in the top-left part of a "Test" window has some buttons for basic functions in a test.



For the buttons in the test control toolbar (top-right part of the "Test" window), see [Chapter 7.2.2, "Test control toolbar"](#), on page 215.

The buttons in test control top menu have the following functions:

Save.....	214
Save As.....	214
Refresh.....	214
Clear Results.....	214
Add Report.....	214
Chart Menu.....	214
Marker Menu.....	215
Group.....	215

**Save**

Opens the "Save Test" dialog, if you save this test for the 1st time. Saving the same test again later does not open the dialog, but overwrites the previously saved state of the test.

**Save As**

Available only, if the test has been saved before. "Save As" allows saving the test under a different name and with different user tags.

**Refresh**

Reruns a test validation, but does not delete existing test results, as in [Clear Results](#).

**Clear Results**

Refreshes the test and deletes existing test results.

Note: Automatic clearing of test results. When you change settings in an [integrated](#) test template copy (while the test is stopped), R&S ELEKTRA brings up a dialog. It suggests clearing (discard) all existing results of the test, into which the copy is integrated.



Figure 7-1: Dialog that decides about clearing test results

Clearing is required to keep settings and results always consistent with each other. A saved test reflects the entirety of settings and measurement results at the time of testing.

However, when you save the modified test, the software allows you to decide about clearing the results. If you select "Do not clear", the resulting inconsistency between test settings and test results is in your responsibility. If you cancel this decision dialog, R&S ELEKTRA does not save the modified test.

**Add Report**

Creates a report in the same way as described in [Chapter 3.9, "Reporting"](#), on page 50.

**Chart Menu**

Opens the graphics context menu in the same way as right-clicking a chart.

See [Chapter 4.3.2.1, "Chart"](#), on page 59.



Marker Menu

Opens the marker context menu in the same way as right-clicking a marker.

See [Chapter 4.3.2.3, "Marker"](#), on page 65.



Group

Displays the user group, to which this test is assigned. You have access only to tests and test templates that are assigned to the "Public" group or to your currently selected specific user group.

7.2.2 Test control toolbar

Most buttons of the test control toolbar in the top-right part of the "Test" window are similar to a video recorder.

An exception is the twin button with the **robot**  and **hand**  icons at the left end of the toolbar: This button is a changeover switch that toggles between the automated and interactive measurement modes.

The **test control toolbar** is available with different functions that depend on the measurement type:



Figure 7-2: For automated EMI measurements



Figure 7-3: For interactive EMI measurements



For the buttons in the test control top menu (top-left part of the "Test" window), see [Chapter 7.2.1, "Test control top menu"](#), on page 213.

The buttons in the test control toolbar have the following functions:

Automated Measurement	215
Interactive Measurement	216
Start or Resume	216
Start Reverse or Resume reverse	216
Repeat Measurement at Single Frequency	216
Record	216
Pause	217
Stop	217



Automated Measurement

If the robot icon is highlighted, the test is in **automated measurement** mode. For changing to interactive measurement mode, click the toggle switch, which is available only, while the test is stopped .

**Interactive Measurement**

If the hand icon is highlighted, the test is in **interactive measurement** mode. For changing to automated measurement mode, click the toggle switch, which is available only, while the test is stopped

**Start or Resume**

Not available while the test is running.

- In automated measurement mode, this button starts (or resumes) a measurement from the **current frequency point** to the highest frequency point, across all steps of the test template's **Measurement Flow**, unless disabled in the **Measurement Flow Control**.
- In interactive measurement mode, this button starts (or resumes) a measurement from the **current critical frequency point** to the highest critical frequency point. The measured values are labeled as "Critical Points" in the "Source" column of the results table. If no critical points are available, the button has no effect. The "Start" button is available only, if "Source" = "Critical Points" is selected in the **Frequency Control** dialog (see **Figure 7-10**).

If the initial "Current Frequency" is the highest frequency point, the measurement automatically starts from the lowest frequency point.

When the test run reaches the highest frequency point, it automatically stops and resets the "Current Frequency" to the lowest frequency point.

**Start Reverse or Resume reverse**

Not available while the test is running.

This button starts (or resumes) a reverse measurement from the **current critical frequency point** to lower critical frequency points, if available. If the initial "Current Frequency" is the lowest frequency point, the reverse measurement automatically starts from the highest frequency point.

"Start Reverse" is available only in interactive measurement mode, and only, if "Source" = "Critical Points" is selected in the **Frequency Control** dialog (see **Figure 7-10**), while critical points are available.

**Repeat Measurement at Single Frequency**

Available only in interactive measurement mode.

Without changing the frequency, it starts an interactive measurement (or "single measurement") at the frequency point that is selected in the **Frequency Control** dialog (see **Figure 7-10**). The measured value appears in bold font in the lowest row of the results table.

As long as you do not select "Record" , the measured value is continuously updated, depending on the settings in the **Measurements** dialog. As soon as you select "Record", R&S ELEKTRA keeps the measured value in the lowest row of the table and creates a new row below it. To proceed with measuring at the next frequency point, click or in the **Frequency Control** dialog.

**Record**

Available only in an interactive measurement that is in one of the following states: started , measuring at a single frequency or paused .

"Record"  performs the following actions:

- Records a measured value in the lowest row of the results table
- Labels this value as "Interactive" in the table's "Source" column
- Creates a new row in the table, for the next measurement value
- Continues measuring at the same frequency point.

To proceed with measuring at the next frequency point, click  or  in the [Frequency Control](#) dialog.



Pause

Interrupts the active measurement of a test sequence.

In contrast to [Stop](#), "Pause" does not disconnect the measurement devices and accessories. Hence, it accelerates resuming the measurement, because it does not require to re-establish all connections.

Pausing the measurement does not change the "Current Frequency" value. Hence, when you resume   the measurement, it continues from the same frequency point for the rest of the test sequence.



Stop

Stops the active measurement and disconnects the devices. Thus, a different test or another instance of R&S ELEKTRA can use the devices.

Stopping the measurement also terminates the test sequence and influences the "Verdict", as described in [Chapter 3.8, "Verdict"](#), on page 48.

However, "Stop" does not change the "Current Frequency" value. Hence, when you resume   the measurement, it continues from the same frequency point for the rest of the test sequence. Only if an automated measurement reaches the final frequency point of the test sequence, R&S ELEKTRA automatically resets the "Current Frequency" value to the start frequency.

7.2.3 Test Components

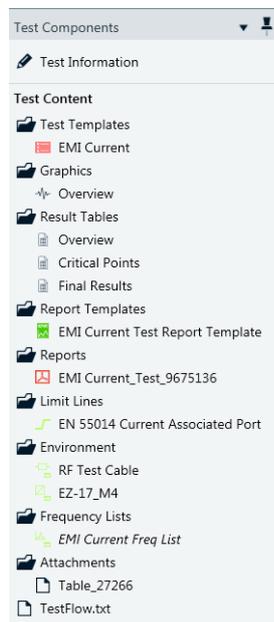


Figure 7-4: Test components dialog

The "Test Components" dialog in a "Test" window lists all content that is relevant for an individual **EMI test**. This content is stored in the R&S ELEKTRA database within a so-called **Test container**, with a hierarchy as illustrated in [Figure 3-1](#).

The dialog allows opening each test component. Depending on the type of component, you can right-click to "Open", "Close", "Rename", "Remove" or "Copy" items in the list of components. Also, you can open most tables as a chart by selecting "Open Graphic".

"Test Information" shows a dialog with information for this test [predefined in the test template](#) and optionally edited for the individual test. The content of this dialog is not reset upon rerunning the test.

Test container

The test container (labeled "Test Content") comprises the following components:

- "Test Templates" shows the embedded copy of the [Test Template](#) that was used to generate this test, containing:
 - Hardware setups as integrated parts of this test template
 - All measurement settings
 - References for the devices, signal paths and limit lines that are used by this test template

Note that you can open the template copy in the test window. However, if you want to modify settings in the embedded template copy, existing test results do no longer match the test conditions persisted in the template copy after the modification. Therefore, you can modify settings only, if the test is already saved (and with it, the test results and correlated test conditions). Also, you can delete or confirm the

deletion of existing results before your modification. This deletion is protected by a confirmation dialog, which allows you interrupting the process and closing the test without saving it, hence keeping the test results.

By right-clicking the test template, you can select "Export to Global Test Template". This feature allows saving a copy of the embedded test template as a globally available test template.

- "Graphics" shows a list of the physically measured values of this test in the format of frequency-dependent [Charts](#).
Each test has one "Spectrum Overview" graphic, at least. There can be several graphics for the tables listed below.
- "Result Tables" shows a list of the physically measured values of this test in the format of the following frequency-dependent [Test Tables](#):
 - "Spectrum Overview"
 - "Critical Points"
 - "Final Results"
 - Reference tables, hence copied result tables (note that working with reference tables requires the "System" [license](#) "ELEMI-S")
 - "Loop Results" for individual steps in the [accessories settings](#)
If you have enabled the [Add Spectrogram Graphic](#) checkbox in the [Test Templates](#), the "Loop Results" folder contains also "Spectrum Overview" tables for each "waterfall" spectrogram graphic.

By right-clicking a result table, you can select more functions from a context dialog, for example:

- "Copy" creates a copy of the result table in the test container
- "Open Graphics" opens a chart with the contents of the result table, without opening the table
- "Set Reference" creates a copy of a spectrum overview table (and provides more features with the "System" [license](#) "ELEMI-S")
- "Export to CSV", see [Export to CSV file format](#)
- "Report Templates" shows a list of copies of the [Report Templates](#) that can be used in this test. To add a template to the test container, right-click "Report Templates" and select from the following options:
 - "New Report Template" adds an empty template for you to specify all settings
 - "Add a global Report Template" adds a predefined global report template
 Note that right-clicking a report template opens a context dialog for more options.
- "Reports" shows a list of all [reports](#) that you have created for this test.
- "Limit Lines" shows a list of the [Limit Lines](#) selected for this test.
- "Environment" lists the copies of all [Attenuation](#) and [Transducer Correction](#) tables used by the test
- "Frequency Lists" shows any [Frequency List](#) that is used by this test.
- [Attachments](#)
- `TestFlow.txt` shows a log file of the test execution with timestamps and test details.



Every user is responsible for thoughtfully handling the test containers' contents. The following examples are relevant for **modified test templates**:

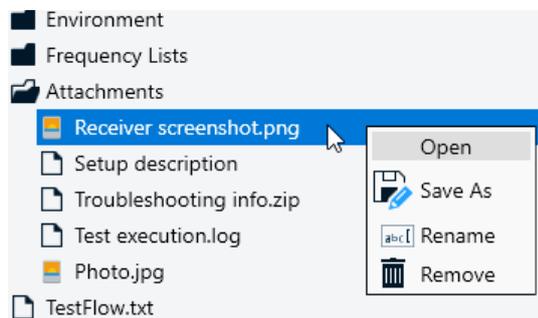
- If settings in a global test template are altered, these changes only become effective for tests created in the future based on that global template.
- If settings in a test template's copy within a test container are altered, these changes only become effective for the next rerun of that test executed in the future. Existing test results are **cleared**, but existing reports are not affected.
- In most scenarios, we recommend generating new test templates rather than modifying or overwriting existing ones. This procedure is easily implemented, for example:
 - Open an existing test template
 - Modify it as required
 - Save it under a different name

However, circumstances could require that you radically modify basic test templates. This modification could be appropriate, for example, if standards have evolved, or if you have exchanged a measurement device, requiring additional or different settings.

When **rerunning** a test, the software **clears** (deletes) all existing measurement values in this test container. Another [Test Validation](#) is performed, and the new measurement values are written into the overview table. Therefore, if you wish to keep existing results, make a copy of the overview table within the opened test before you rerun it. To generate such a table copy, go to the "Test Components" > "Test Content" > "Result Tables" and right-click "Overview" > "Copy". The copy is saved in the same test container folder "Result Tables", for example as "Overview - Copy".

7.2.3.1 Attachments

The "Attachments" folder contains a list of file attachments that you save with this test, for example pictures of the test setup. To attach a file, right-click "Attachments" and select "Attach a file".



To select one of the following options for an individual attachment, right-click this attachment:

- "Open" opens the attachment, for example in a text viewer or image viewer window, or in a suitable application

- "Save As" opens a dialog for saving the attachment to an arbitrary destination outside of R&S ELEKTRA
- "Rename" opens a dialog for renaming the attachment
- "Remove" deletes the attachment

7.2.4 Measurement Flow Control

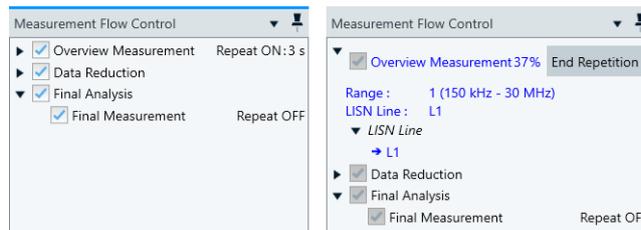


Figure 7-5: Two examples of the Measurement Flow Control dialog

Left = Before a LISN test with [Repeat Measurement](#) is enabled

Right = During the test, repetitions are running and can be stopped by "End Repetition"

The "Measurement Flow Control" dialog in a "Test" window summarizes the test template's [Measurement Flow](#) settings:

- Overview measurement
- Data reduction
- Final measurement
- "Repeat Measurement" ON or OFF
- Selected LISN lines, if the test uses a LISN

Before running a test, you can modify this dialog individually as follows:

- You can enable or disable the overview measurement, the data reduction and/or the final measurement
- You can right-click to bring up a context dialog that allows editing steps:
 - Enable or disable steps
 - Set a step as the start step
 - Disable all steps except the selected step

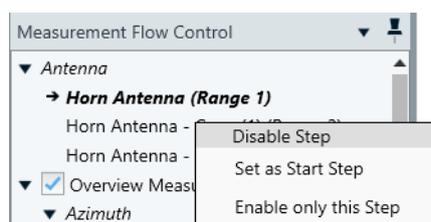


Figure 7-6: Example of options in context dialog of the Measurement Flow Control

While a test is running, R&S ELEKTRA highlights the active step by an arrow and by blue color. Test progress is represented also by display of a percentage value, for example "Overview Measurement 37%" in the top of the dialog on the right in [Figure 7-5](#).

If the overview measurement runs in [Repeat Measurement](#) mode, you can manually terminate the repetition by clicking "End Repetition".

7.2.5 Accessories

Accessories side panels are available only in a "Test" window, if the test template uses at least one of the devices described in the following chapters (listed below).

Accessories control summary

The "Accessories Control Summary" is a side panel that provides a condensed overview of the status of controllable devices used in a test. The content of the summary is only for your information. For more details and for user interaction, refer to the dialogs described in the following chapters:

- [LISN](#)..... 222
- [TEM Waveguide](#)..... 222
- [Triple Loop](#)..... 223

7.2.5.1 LISN

The "LISN" side panel is an accessories dialog that allows switching the [LISN](#) lines in an [Interactive measurement](#) .

You can interact with the LISN via this dialog only, while the measurement is paused. While the test is running, the dialog highlights the active LISN line in blue color.

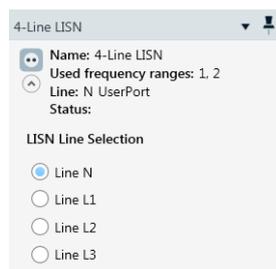


Figure 7-7: Accessories dialog for LISN control, here for a 4-line LISN

7.2.5.2 TEM Waveguide

The "TEM Waveguide" side panel is an accessories dialog that tells you, for which EUT orientation inside a [TEM Waveguide](#) the current measurement values are stored.



Figure 7-8: Accessories dialog for GTEM control

While the test is running, R&S ELEKTRA prompts you to "Switch the EUT axis to X" (or Y or Z, respectively). When you confirm having switched the orientation, the dialog highlights the active EUT axis in blue color.

Note that interactive EMI measurements with a "TEM Waveguide" are disabled.

7.2.5.3 Triple Loop

The "Triple Loop" antenna side panel is an accessories dialog for selecting, which loop orientation is activated.

While the test is running, R&S ELEKTRA prompts you to "Set Magnetic Loop Antenna to Loop X" (or Y or Z, respectively). When you confirm having switched the orientation, the dialog highlights the active loop axis in blue color.

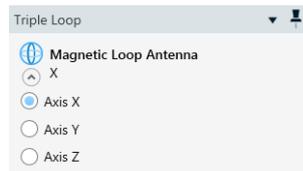


Figure 7-9: Accessories dialog for Triple Loop antenna control

7.2.6 Frequency Control

The "Frequency Control" dialog handles all frequency settings of the measurement instrument, for example a receiver, in [automated](#) and [interactive](#) measurements.

Current Record

Displays and sets the current frequency value. This frequency setting is always visible, independent of the tab ([Source](#) / [Range](#) / [Tuning](#)) selected below.

You can change both the value and the unit ("[Hz]", "[kHz]", "[MHz]" or "[GHz]") while the measurement is paused or stopped.

For editing the frequency value, you have the following alternatives:

- **Type** a new frequency value into the field.
Depending on the "Source" setting (see below), the software adjusts your entry to the closest permitted frequency value.
- **Step** the frequency value up or down by the  or  buttons. You can use also the up- or down-keys of your keyboard, when the cursor is in the frequency field.
The step size depends on the "Source" setting (see below):

If "Source" = "Test Template", the [Step Size](#) is as specified in the test template.

If "Source" = "Critical Points", the steps correspond with the frequency values in the critical points table.

If "Source" = "Final Results", the steps correspond with the frequency values in the final results table.

- Click and hold a detail from a test chart or table and **drag and drop** it into the "Current Record" field.

The detail (the origin of the drag-and-drop action) can be any spot in a graphic (trace node, limit line node or marker) or any field in a table. The action copies the corresponding frequency value into the "Current Record" field.

To drag and drop a detail in touch operation, touch and hold the detail, then drag it to the destination and release it there.

Restore Test Template Settings

- ↻ Sets all changed parameters back to the settings given in the test template, including the settings in the [Parameter](#) and [Measurements](#) dialogs.

For more setting, select a tab below:

Source	224
Range	225
Tuning	225

Source

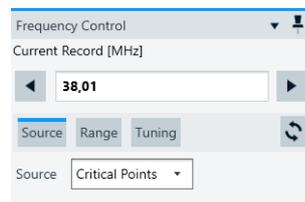


Figure 7-10: Source tab of the Frequency Control dialog

This field always shows the source that currently determines the frequency values, and hence also the steps. You can select the source only in interactive measurement mode.

"Source" defines the domain from which the frequency values are taken:

- "Test Template"
Permits using only frequency values that are defined by the steps in the test template.
- "Critical Points"
Permits using only frequency values from the critical points table.
- "Final Results"
Permits using only frequency values from the final results table.

Range

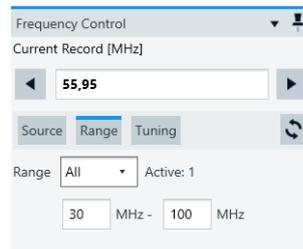


Figure 7-11: Range tab of the Frequency Control dialog

- "Range"
Selects one or all frequency ranges defined in the test template. You can change the selection while the measurement is paused or stopped. For example, if you set "Range" = "1", only frequencies from the 1st frequency range are selected for the measurement and available for the field "Current Record". If you set "Frequency Range" = "All", the software also displays the number of the currently active frequency range. If you select a frequency range that was previously not active, the "Current Record" value is automatically changed to the lowest frequency of the newly selected frequency range.
- "... xHz" - "... xHz"
Unless edited, these fields show the lower and upper end of the one or more frequency ranges selected above. To restrict this overall frequency range, for example, to analyze details in a second scan, you can change the range values while the measurement is paused or stopped: Either type new frequency values into the fields or drag-&-drop details from a test chart or table, as described for "Current Record".

Tuning

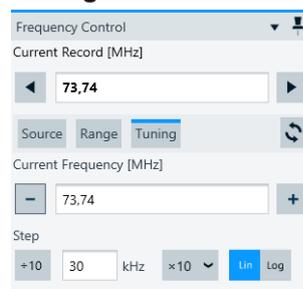


Figure 7-12: Tuning tab of the Frequency Control dialog

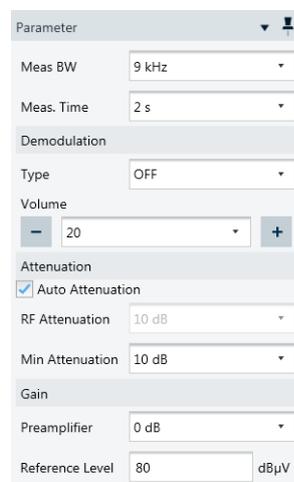
You can tune the frequency only in interactive measurement mode.

- "Current Frequency"
Specifies the frequency to be used for the next measurement. You can modify this frequency value in the following ways:
 - This field permits using any frequency value within the test template's frequency range.
 - When you change the frequency value in the [Current Record](#) field, it overwrites the "Current Frequency" value.

- You can step the frequency value up or down by the **+** or **-** buttons. You can use also the up- or down-keys of your keyboard, when the cursor is in the frequency field.
The step size depends on the "Step" setting (see below).
- "Step"
Allows specifying the step size and step mode, even during a measurement:
 - "Lin" mode: linear steps in frequency units ("Hz" or "kHz")
 - "Log" mode: logarithmic steps of a relative size ("%")

7.2.7 Parameter

Available only in EMI tests running in [interactive measurement](#) mode.



Parameter	
Meas BW	9 kHz
Meas. Time	2 s
Demodulation	
Type	OFF
Volume	
-	20
+	
Attenuation	
<input checked="" type="checkbox"/> Auto Attenuation	
RF Attenuation	10 dB
Min Attenuation	10 dB
Gain	
Preamplifier	0 dB
Reference Level	80 dBµV

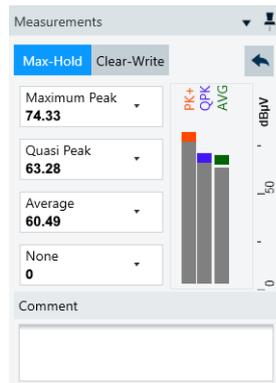
Figure 7-13: Receiver parameter dialog in an interactive EMI test

This dialog allows an individual configuration of the receiver parameters, overriding the settings specified in the test template. For a description of these settings, see ["Settings \(Overview\)"](#) on page 108, except for "Demodulation", which is described in ["Audio Demodulation Type"](#) on page 82.

The last parameter in this dialog, "Reference Level", is available only, if the [Operating Mode](#) is "Spectrum Analyzer".

7.2.8 Measurements

The "Measurements" dialog serves for controlling the detectors in an [Interactive measurement](#).



This dialog offers the following features:

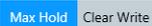


Detectors

Selects up to four detectors and displays their measured "Clear Write" level values. The values are shown in numerical form (top to bottom) and as bargraphs (left to right).

The bargraphs with one vertical bar per detector display the "Clear Write" level. On top of each bar is a colored rectangle as "Max Hold" indicator. The colors correspond with the trace colors in the chart.

You can only change the detector selection, if the measurement is paused or stopped.



Max Hold / Clear Write

Toggles between the "Max Hold" and "Clear Write" mode.



Max Hold ← Max Hold / Clear Write

Measures the level values of the selected detectors and keeps the maximum value during a measurement. In this mode, the "Max Hold" value appears in the active row of the results table. It is also indicated in the bargraph via the max-hold indicators on top of each bar, while the "Clear Write" values are shown in the "Detectors" selection fields.

Note: The "Max Hold" level value is only stored in the results table, if you click the [Record](#) button (●).

The "Max Hold" value is either reset by changing the measurement frequency or by the clicking the "Reset Max Hold" button.



Reset Max Hold ← Max Hold ← Max Hold / Clear Write

Resets the max-hold value and the max-hold indicator back to the currently measured "Clear Write" value. Available only, if "Max Hold" is enabled.



Clear Write ← Max Hold / Clear Write

Continuously overwrites the level value of the previous measurement with the level value of the most recent measurement. In this mode, the "Clear Write" level value is entered and continuously overwritten both in the active row of the results table and in the "Detectors" selection fields.

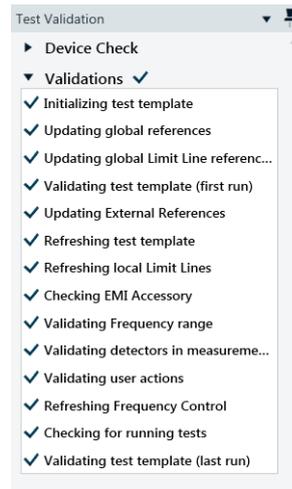
Note: The "Clear Write" level value is only stored in the results table, if you click the [Record](#) button (●).

Comment

Enter arbitrary text to be saved with the measurement value in the "Comment" column of the result table.

7.2.9 Test Validation

After starting (▶ / 📄) or refreshing (🔄) a test, R&S ELEKTRA first performs a "Test Validation":



This process is to verify that all conditions required in the test template are met.

If the conditions are **not** all met, R&S ELEKTRA prompts you with details of the problem. For example, the dialog could state that a **limit line** has the wrong unit for the measurement values of the selected transducer. In this case, select or define the correct limit line.

Two examples of test validations are shown below:

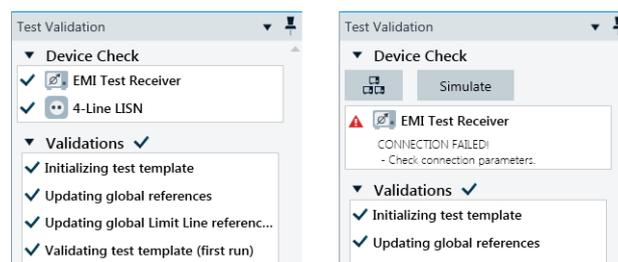


Figure 7-14: Test validation, left: successful, right: receiver connection check failed

In the right-hand example in [Figure 7-14](#), the receiver's connection cannot be confirmed.

To solve this issue, you can try the following:

- [Search](#) for the missing device in a network
- Revise your [Receiver](#) settings in the [Device List](#)
- [Recheck](#) the connection

- [Simulate](#) the device (which leads to simulated random test results)

If the "Test Template Validation" is successful, R&S ELEKTRA continues with the action that led to the validation process, for example running a test.

7.3 Test result tables



- For information on how to configure test result tables, see [Chapter 4.3.3, "Configuring test tables"](#), on page 68.
- For information on test charts, see [Chapter 7.4, "Test result graphics"](#), on page 231.

R&S ELEKTRA supports test result tables that are **created** by either of the following actions:

- Measurements
- Manual editing (including copy/paste from external spreadsheets)
- [Import](#) of compatible data in XML format

Some **basic features** of the three types of test result tables:

- "Spectrum Overview" tables are generated during an [Automated measurement](#). You can edit data in the "Level" and "Comment" columns.
- "Critical Points" tables are generated automatically during the data reduction to help selecting a limited number of frequencies for a closer examination of the EUT. The selected frequency points come from the "Spectrum Overview" measurement, while the selection depends on the "Measurement Flow" settings. You can [edit](#) data in the "Level" and "Comment" columns.
- "Final Results" tables are either generated in the [Automated measurement](#) mode by remeasuring at "Critical Points", or in the [Interactive measurement](#) mode by manual frequency selection. A new row in a "Final Results" table is created when you click the "Record" button. An automatic scan in the interactive measurement mode is only possible, if you have selected "Source" = "Critical Points" (see [Frequency Control](#)). You can edit data in the "Level" and "Comment" columns of the final results.

Editing results

You are allowed to edit (hence, manipulate and change) measured "Level" values of EMI tests in all tables ("Spectrum Overview", "Critical Points" and "Final Results"). Editing can be reasonable in various situations, for example if known signals from a nearby radio station must be eliminated from test results in an open area test site (OATS). As an operator, you are responsible for the test results.



Editing measured level values can influence the test's [Verdict](#).

The following limitations apply to editing values:

- You cannot edit values during an active test.
 - You cannot edit values in columns that are controlled by given settings or by calculation. Examples are the "Limit", "Margin" and "Correction" columns.
- | | |
|---|-----|
| • Merged overview results | 230 |
| • Editing critical points | 230 |
| • Margin | 230 |

7.3.1 Merged overview results

If the transducer used in the measurement is a **LISN**, the "Spectrum Overview" table and chart show **merged** maximum levels measured on any of the selected lines (worst case).

For example, consider a test template that [defines measurements](#) on lines N and L1. Therefore, the overview results can comprise levels measured on line N in some parts of the frequency range and measured on line L1 in other parts of the frequency range. The "Line" column in the test table indicates, from which line the level result in each row was taken.

The overview results show merged maximum (worst-case) levels. On the contrary, the individual "Result Tables" from the "Loop Results" folder [Test Components](#) dialog show the results for each individual setting.

To see a graphical representation of a table, click the "Show Graphic Display" button .

7.3.2 Editing critical points

You can let R&S ELEKTRA measure at more or other frequencies than the automatically selected "Critical Points". To do so, add frequency points from the "Spectrum Overview" table to the "Critical Points" table or enter your own arbitrary frequency points. Optionally, edit entries in the "Process State" column. Also, you can delete existing critical points from this table.

However, you cannot edit "Limit", "Margin" and "Correction" values.

For example, if you have identified one or more additional frequency points in the "Spectrum Overview" chart that you want to include into the final or interactive measurement, drag it from the graphic into the "Critical Points" table. This action copies not only the frequency value but also the level and margin values and other information to this table. R&S ELEKTRA automatically adds the row in the right order of frequency values.

7.3.3 Margin

At each frequency point, the margin is defined as the limit line's value minus the measured level value.

Example:

Level [dBµA/m]	Limit [dBµA/m]	Margin [dB]	Remark
20.1	15	-5.1	If the level value is too high (above limit), the margin is negative .
23.2	25	1.8	If the level value is low enough (below limit), the margin is positive .

R&S ELEKTRA automatically calculates this difference. You cannot edit margin values.

7.4 Test result graphics



- For information on how to configure test result graphics, see [Chapter 4.3.2, "Configuring test charts"](#), on page 58.
- For information on how to preconfigure graphics, see [Chapter 4.9.3.3, "Graphics"](#), on page 184.
- For information on the measurement values in these graphics, see [Chapter 7.3, "Test result tables"](#), on page 229.

Test result charts are a graphical representation of [Test result tables](#). A table is either automatically shown as a chart, or you can bring up a chart by clicking the [Show Graphic Display](#) button (📊) in the table header. In the dialog that comes up, you can select the columns to be displayed in the chart. Also, you can select to display the values in an existing chart or in a new chart.

In test charts, R&S ELEKTRA displays a continuous line in the "Spectrum Overview" chart that represents the measurement results. "Critical Points" and "Final Results" are shown in the same chart as individual nodes, each with a symbol and a vertical line to the bottom. Additionally, "Limit Lines" are superimposed in test result charts as continuous lines or with [gaps](#).

If you have enabled the [Add Spectrogram Graphic](#) checkbox in the EMI test template, R&S ELEKTRA creates a waterfall spectrogram in the "Graphics" section of the chart. With the proceeding test, the graphic successively displays the color-coded measurement results of the 1st detector. R&S ELEKTRA sets a marker to the maximum level.

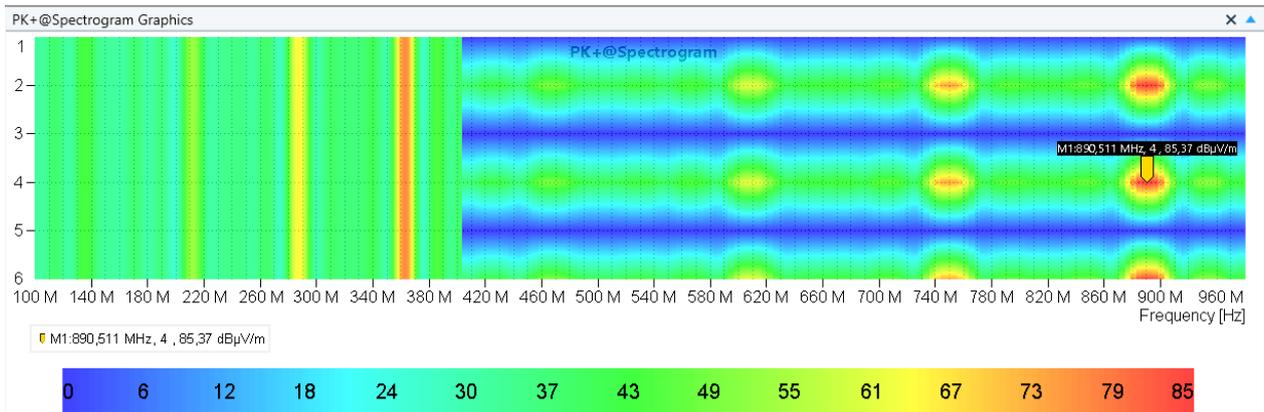


Figure 7-15: Example of a "waterfall" spectrogram, which evolves during the test

Vertical axis = Number of measurements shown in the spectrogram, hence the cycle or loop count

Color scale = Visualization of the color-coded measurement level results in the same unit as the marker, for example dBµV/m

Some basic features of charts:

- During a measurement, the current test frequency is indicated in the chart by a moving **Marker**.
- You can use markers to identify individual measured values and set them into relation with other values. Also, you can drag markers into frequency input fields of the test dialog, which simplifies the entering of a selected frequency value.
- You can use the **Zoom** function to view details in a chart.
- You can integrate charts into your **reports** and **configure** them there.



Overview of LISN results

If the transducer used in the measurement is a LISN, the "Spectrum Overview" chart can show **merged** maximum levels, as described in [Chapter 7.3.1, "Merged overview results"](#), on page 230.

8 Measurement examples

The procedure for preparing and executing tests is described in [Chapter 3.6, "Performing a test"](#), on page 45 and [Chapter 7.1, "EMI tests"](#), on page 210. The following example describes how these steps are typically executed in practice.



Note that the [Configuration Wizard](#) can support you by automatically creating various items required for tests.

Example:

For a radiated EMI test in the frequency range of 30 MHz to 1 GHz, prepare the following settings:

- Three **tables**:
 - A **transducer correction table** "corrAnt1" (30 MHz to 1 GHz) for your antenna "Ant1"
 - An **attenuation table** "attCable1" (30 MHz to 1 GHz) for "Cable1"
 - A **limit line** "EMI-rad-30M-1G"
- Three **device list** entries:
 - The radiated transducer "Ant1", containing a reference for "corrAnt1"
 - The signal path "Cable1", containing a reference for "attCable1"
 - The receiver "EMI Test Receiver" (entry created automatically by the **Configuration Wizard**, adjusted by you to your **Type** of receiver, and **connected**)
- One **test template** "EMI-rad1" with a single frequency range (30 MHz to 1 GHz), containing:
 - A reference for the limit line "EMI-rad-30M-1G"
 - The hardware setup diagram with:
 - A reference for receiver "EMI Test Receiver"
 - A reference for signal path "Cable1"
 - A reference for antenna "Ant1"
 - Your specific measurement settings as described in the **test template configuration**

Note that the entries for devices (here: receiver, signal path and antenna transducer) and for the limit line are integrated into the test template as **references** that establish "links" towards the original data sets. **No copies** of these data sets are ever integrated into a test template. Hence, changing the original data set of any such item modifies all test templates that use this item.

- One **report template** "EMI-rad-Report" (optional)

With these preparatory steps completed, create the **test** by selecting "Create test from template" in the test template "EMI-rad1". The test contains:

- A copy of the test template "EMI-rad1"
- A copy of the report template "EMI-rad-Report"
- And more **components** in the test container

To execute the test in **Automated Measurement** mode, click the "Start" button (▶). The software runs the test and displays the results in an **Overview Graphic** and in the **Final Results Table**. You can enhance your test with more results acquired in **Interactive Measurement** mode. Optionally, use **Report Templates** for **Reporting** your results. Save the test, for example as "EMI-rad_001".

To run the same test for another EUT, first select "Create test from template" in the same test template "EMI-rad1" with a different EUT physically in place. The software automatically copies the test template (and report template) into a new test container, together with references for the hardware setup, devices, signal paths and tables in it. Execute this new test and save it, for example as "EMI-rad_002".

9 How to use the software

The following chapters provide practical hints how to use R&S ELEKTRA for product conformance tests according to the applicable EMC standards.

- [Notes for EMI tests](#).....235
- [Determining a monitoring clamp transducer table](#).....238

9.1 Notes for EMI tests

- [Finding and analyzing EMI emissions](#).....235
- [Handling overload conditions in EMI tests](#)..... 236

9.1.1 Finding and analyzing EMI emissions

This description assumes that appropriate hardware setups are available and that you are familiar with the interaction of devices, hardware setups and test templates.

The analysis of RF emissions is divided into several steps:

1. The **automated overview measurement** covers the whole RF spectrum of interest.

Typically, use the peak detector or a combination of peak and average detectors, with narrowband signals showing up in both curves. On the contrary, broadband signals and pulsed signals appear in the peak curve, only.

 - If you use a spectrum analyzer, we recommend a short sweep time and continuous repetition.
 - If you use a test receiver, and if the measurement time is long enough, running a single scan can be sufficient.

In both cases make sure to find the emission maximum, even if the signal is not stable.
2. With automatic data reduction, the software focuses on the most critical frequency points.
3. Some test standards for radiated emission tests require rotating the EUT on a turntable, or varying the antenna height and using both antenna polarizations via an antenna tower. To **maximize** the level over several of these accessory settings, configure the measurement flow in the test template. During the measurement, the result table also stores the accessory parameters that lead to detecting the highest emissions at each frequency point.
4. If you do not know the exact frequency of an emission, or if its frequency changes over time, a **zoom measurement** can focus on a small range around that frequency. It captures the emission in a partial scan or sweep. In the "Zoom" phase, the test template runs continuous repetitions and displays the detectors in "Clear-

Write" and "MaxHold" mode. Automatically, the software positions a marker at the maximum.

In addition, you can vary the scan or sweep time of a measurement. Thus, when comparing the "ClearWrite" curve with the "MaxHold" curve, you can find the dwell time required for recording the complete signal in a single measurement. Moreover you get information about possible modulations, which helps characterizing the signal. You can change the parameters for the single measurements in the "Frequency Control" and "Measurements" dialogs.

5. The **final measurement**, if configured, uses for example a quasi-peak detector to record the levels at the most critical frequencies.
For details, refer to the applicable product standard for your EUT and configure all settings in your [Test Templates](#) .
6. For further analysis of the critical points in the RF spectrum, switch to the **interactive measurement** mode (single measurement). You can drag-and-drop a point or a marker from the test chart directly into the frequency field. The frequency-step buttons (+ and -) change the current frequency in a raster defined by the stepsize in the selected test template. Alternatively, select the critical points or final results list as the source for varying the current frequency according to that list. The "Start" button starts an automatic interactive measurement, the "Record" button stores the measured levels, the measurement parameters and the settings of the accessory devices (antenna tower, turntable).
7. To add notes to the test, use the comments column in the results table.
8. Report templates support you in preparing a **test report**.
9. To keep the results, save the test.
If you want to repeat the measurements, note that a repetition that restarts the test overwrites the results.

9.1.2 Handling overload conditions in EMI tests

Overload can happen in test receivers and spectrum analyzers, if a test scenario exposes these instruments to high voltage or power levels. There are three types of overload, which lead to erroneous measurement results and can even damage the test instrument:

- **RF overload** is a common type of overload, harmless for the device. It occurs in the analog **RF** hardware of the instrument and results in nonlinear signal processing.
- **IF overload** is a common type of overload, harmless for the device. It occurs in the A/D converter, hence in the instrument's digital hardware that processes the **IF** signal, when it reaches its maximum value. It results in truncation of values above the maximum.
- **Input overload** is a special type of overload, observed at input levels in excess of the instrument's specifications. It can occur with any [Operating Mode](#) when a

strong signal, typically > 30 dBm, appears at the RF input. It can result in damage of the instrument's input electronics.

Each instrument and its A/D converter can operate in a specified level range, for example 60 dB from the minimum detectable signal to the maximum permissible signal. If a signal is too strong or too weak, an RF attenuator or a preamplifier (if available) can shift the signal's level up or down to match the operating range.

Especially older types of test instruments are vulnerable to overload, while instruments like the R&S FSW or R&S ESW have a dedicated threshold detector. This hardware can detect input overload and protect the input circuitry by means of a relay near the RF input. Under normal operating conditions, this relay serves for switching the input circuitry from the RF input to the internal calibration generator, which is active only during self-alignment. But if there is an overload, switching this relay is an emergency reaction, because it disconnects the input circuitry from the RF input. After switching, the instrument or R&S ELEKTRA displays a message, asking you to reduce the signal at the RF input and then to switch the relay back to normal operation.

However, this emergency mechanism does not protect against extremely short and high spikes, because it takes the relay a few milliseconds to disconnect the circuitry. For example, when you accidentally touch an antenna, ESD > 1000 V can occur. If **RF Attenuation** is set to a low value, an ESD spike can destroy the 1st semiconductor component that it reaches: It can destroy either a transistor of the preamplifier or, if it is bypassed, the diode of the 1st mixer, and possibly other components nearby.

To prevent hardware damage in the instrument, R&S ELEKTRA always applies the maximum RF attenuation when tests are paused or stopped (completed).

Overload conditions in different operating modes

- **"Receiver Mode"**

This setting applies, if the **Operating Mode** is "Test Receiver", and the **Scan Mode** is "Stepped Scan" or any type of "Time Domain" (TD) scan. It applies also to "Single Bargraph" measurements in the receiver's "Sweep" menu.

A sophisticated auto-ranging algorithm in the receiver's firmware adapts the operating range to significant variations of the input signal's level. This auto ranging depends on the last valid measurement and on the latest value of the A/D converter. While effectively preventing any overload condition, the firmware repeats the measurement until achieving valid results. Hence, in "Receiver Mode", R&S ELEKTRA does *not* intervene against overload conditions, but auto ranging happens exclusively under control of the device.

- If **RF Attenuation** = "Auto", the firmware adjusts the attenuation to the signal level in steps of 5 dB or 10 dB and restarts the measurement. In TD scan mode, the restart with adjusted attenuation affects the full frequency segment of the TD measurement, which can lead to increased noise at all frequency points in the segment. On the contrary, in a stepped scan, remeasuring with increased attenuation affects only the individual frequency point(s), at which excess signal levels were observed.
- If you disable auto ranging and overloads occur, the instrument's firmware only sets flags in specific status registers, and R&S ELEKTRA provides corresponding indications in the test dialog.

- **"Spectrum Analyzer Mode"**

This setting applies, if the [Operating Mode](#) is "Spectrum Analyzer", and the [Sweep Type](#) is "Sweep" or "FFT", as well as zero-span sweeps.

In spectrum analyzer mode, the instrument's firmware does not provide true auto ranging. If the level of the input signal exceeds the nominal upper end of the operating range (the reference level) by more than a few dB, the firmware indicates an overload condition. Therefore, in this mode, R&S ELEKTRA always intervenes against RF or IF overload by repeating the complete measurement with a modified operating range, until the instrument provides valid results:

It brings up a message and repeats the current sweep measurement in a loop, with the RF attenuation and the reference level increased by 10 dB. It repeats this procedure, until there is no more overload condition, or until the RF attenuation has reached a value of 40 dB. At this point, if the signal is too strong, the instrument screen and R&S ELEKTRA still bring up an overload indication. Hence, the software performs a pure up-ranging. If it succeeds to bring the input signal into the operating range, the applied RF attenuation can be a bit higher than actually needed.

9.2 Determining a monitoring clamp transducer table

This chapter describes how to create a [Transducer Correction](#) table which is required for the calculation of the actual current when the current is measured using a monitoring current clamp.

How R&S ELEKTRA calculates the actual current using a transducer correction table

For measuring the current, a monitoring clamp is connected via a signal path to a sensor device. In the [Device List](#), the RF parameters of the monitoring clamp are defined in the properties dialog of the transducer device, which is assigned to the monitoring clamp.

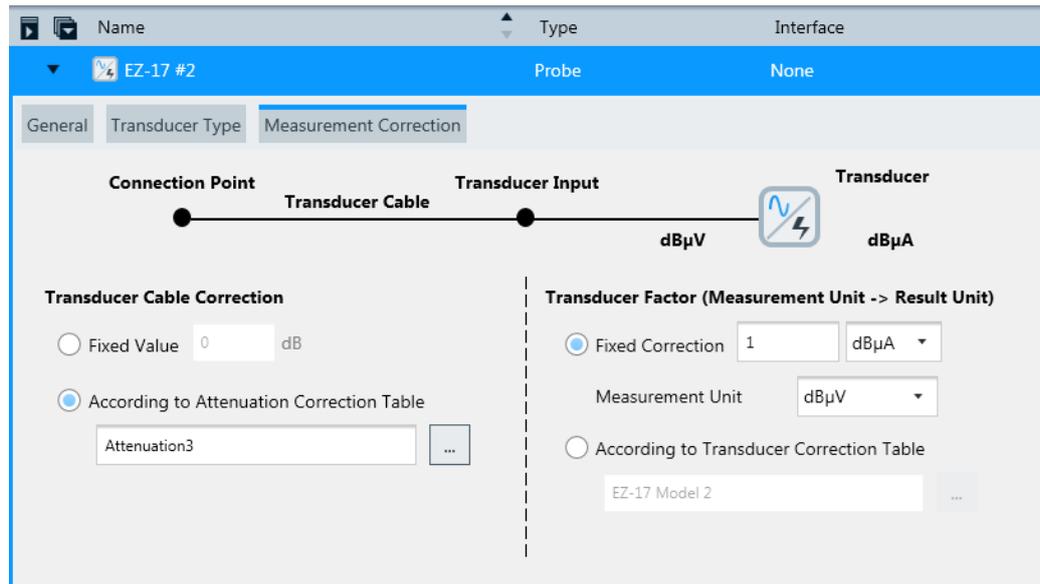


Figure 9-1: Transducer properties dialog

The calculation is done as follows:

1. Measure the signal level at the sensor input.
2. Add the signal path attenuation.
3. Add the input attenuation from the transducer properties dialog.
4. Convert the signal level to the source unit stored in the transducer correction table.
5. Add the transducer table correction value for the current frequency.
6. Change the unit of the measured signal to the destination unit in the transducer correction table.

Get the correction values from a clamp's specifications

This chapter describes how you can create the transducer correction table using the values from the specifications of the clamp. Typically the transducer factor is shown in the specifications as a plot of transfer impedance over frequency. The unit of the Y-axis is typically dB_{Ohm} .

The value to be inserted into the transducer correction table for each frequency depends on the source unit, which must be equal to the measurement unit of the sensor device. The current is calculated using the following formula:

$$I_c = U_m / Z_t$$

with I_c = cable current, $[U_m]$ = clamp output voltage, Z_t = transfer impedance.

Convert this equation to dB units:

$$I_c [\text{dB}\mu\text{A}] = U_m [\text{dB}\mu\text{V}] - Z_t [\text{dB}_{\text{Ohm}}] \quad (1)$$

Use the source unit dB μ V in the transducer table, if you use the current clamp also for EMI measurements.

Example:

Calculation example 1, clamp parameter:

$$Z_t = 1 \text{ Ohm} = 20 * \log(1) = 0 \text{ dB}_{\text{Ohm}} \text{ (at the current frequency)}$$

This parameter corresponds to an insertion loss in the 50 ohms system = $20 \log(50) = 34 \text{ dB}_{\text{Ohm}}$.

Formula used in R&S ELEKTRA:

$$I_c [\text{dB}\mu\text{A}] = U_m [\text{dB}\mu\text{V}] + T_f \text{ (} T_f \text{ = transducer factor, taken from the table) (2)}$$

Comparing formula (1) with formula (2) gives the conversion for the transfer impedance to the value in the transducer table:

$$T_f = - Z_t [\text{dB}_{\text{Ohm}}] \text{ (3)}$$

Formula (3) requires to set the source unit to dB μ V.

Calculation example 2, monitoring-clamp output measured in dBm:

$$I_c [\text{dB}\mu\text{A}] = P_m [\text{dBm}] + 107 - Z_t [\text{dB}_{\text{Ohm}}] \text{ (4)}$$

Comparing formula (4) with (2) gives the conversion for the transfer impedance to the value in the transducer table:

$$T_f \text{ dBm} = 107 - Z_t [\text{dB}_{\text{Ohm}}] \text{ (5)}$$

Formula (5) requires to set the source unit to dBm.

Calibrating the clamp using the R&S ELEKTRA signal path calibration utility

10 Getting help

Rohde & Schwarz would like to give you the best possible product experience. The following chapters are a guide to finding a solution, if help is required:



For **context-sensitive** help, press **[F1]** from any dialog in the software, as described in the chapter [Embedded help](#).

For an overview of the available **shortcut keys**, see [Chapter 6.5, "Keyboard shortcuts"](#), on page 206.

- [Embedded help](#).....241
- [Log information](#)..... 243
- [VISA trace tool](#)..... 244
- [Troubleshooting information](#).....245
- [Product information](#).....247
- [R&S ELEKTRA on the internet](#)..... 248
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10.1 Embedded help

The help system embedded in R&S ELEKTRA is available in Microsoft Windows HTML help format.



To display the help dialog and open it in the chapter "Getting Help", click the help button  in the program menu.



To display a **context-sensitive** help dialog, press the **help key [F1]** from any dialog in the software. This selection brings up a help topic with information about the current menu or the currently opened dialog and its functions.



For efficiently using the context sensitivity, set the focus to the relevant part of the user interface that interests you. For example, set the cursor into an entry field or select a checkbox.

If you set the focus appropriately, you avoid opening the help content at a superordinate theme or chapter.

Contents of the help dialog

The help dialog is split into two main areas.

- In the left-hand part of the dialog, you can select one of the following functions:
 - "Contents" opens a navigation tree of help subjects

- "Index" provides an index table of help contents
- "Find" allows searching for arbitrary text and keywords
- The right-hand part of the dialog displays the contents of the selected help topic.

A navigation bar on top of the help dialog with "Back", "Previous" and "Next" buttons allows navigating between the help topics.

Navigating in the table of contents

1. To navigate within the table of contents, click entries or use the [Up/Down] keys.
2. Entries that contain subsections have a plus sign. To expand the navigation tree at this point, click the plus sign or press the [Right] arrow key.
3. To display a help topic, click it (in the "Index", double-click it) or press the [ENTER] key.

The corresponding help topic is displayed.

Navigating in the help topics

1. To scroll through a page, use the mouse wheel, a scrollbar or the [Up/Down] arrow keys.
2. To follow a cross-reference, click the link.
3. To return to the previous page, select "Back".
This function follows back all steps that you have gone before.
4. Use the horizontal scrollbar to shift the content of the navigation window to the left or right.
5. You can "Hide" the navigation window or minimize it by shifting the separation line with the "Topics" window.

Using the index

1. Select the "Index" tab.
2. Enter the first characters of the topic that you are interested in.
The index jumps to the first entry that starts with these characters.
3. Use the [Up/Down] keys to navigate to the suitable keyword.
4. Press the [ENTER] key to display the help topic.
The help dialog displays the corresponding topic.

Closing the help window

- ▶ Click the "X" button (top right of the dialog) or press [Alt + F4] to close the help window.



The `Documentation` subfolder in the `R&S ELEKTRA Program Files` folder contains a PDF copy of the user manual and other documents, including the Open Source Acknowledgment (OSA).

Find the `Documentation` subfolder in the local drive, in which R&S ELEKTRA is installed, at the path "`C:\Program Files\Rohde-Schwarz\ELEKTRA\x.xx.x`", where "`x.xx.x`" represents the software version.



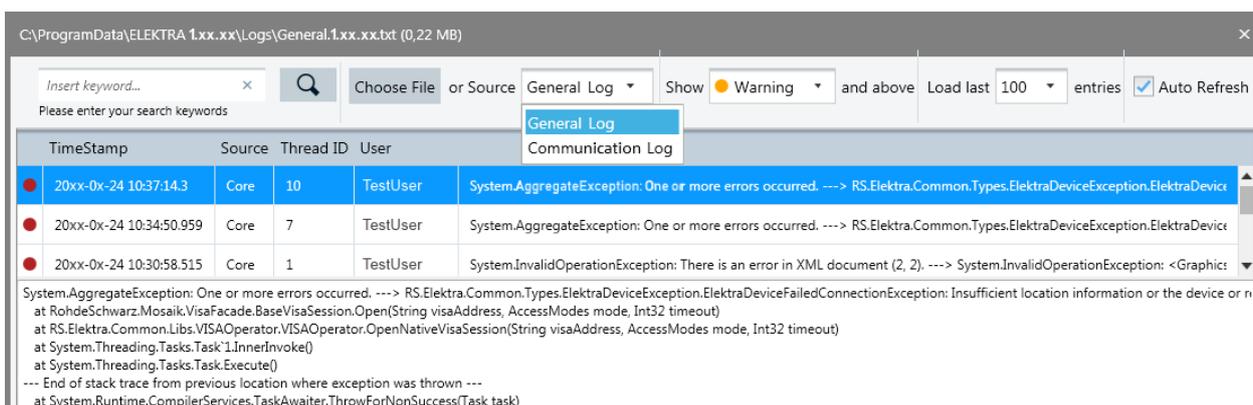
The [R&S License Key Manager](#) in the navigation menu [Administration](#) has its own help system.

10.2 Log information



Access: "Home" > "Administration" > [Settings](#) > [Log](#) > "View Logs" button 

The "View Logs" button brings up a separate dialog:



TimeStamp	Source	Thread ID	User	Message
20xx-0x-24 10:37:14.3	Core	10	TestUser	System.AggregateException: One or more errors occurred. ---> RS.Elektra.Common.Types.ElektraDeviceException.ElektraDevice
20xx-0x-24 10:34:50.959	Core	7	TestUser	System.AggregateException: One or more errors occurred. ---> RS.Elektra.Common.Types.ElektraDeviceException.ElektraDevice
20xx-0x-24 10:30:58.515	Core	1	TestUser	System.InvalidOperationException: There is an error in XML document (2, 2). ---> System.InvalidOperationException: <Graphics

Figure 10-1: Example of a log entries dialog



You can also open this dialog for viewing the log entries by the keyboard shortcut **[Alt]+[L]**.

The dialog shows the existing log entries and offers the following options:

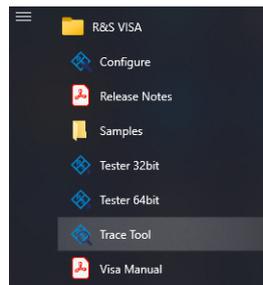
- "Search"
Searches for log information.
- "Choose File"
Opens an Explorer window for selecting a log file (in `TXT` format) to be displayed in the log entries dialog. Per default, log files are saved at
`C:\ProgramData\Rohde-Schwarz\ELEKTRA\x.xx.xx\Logs`
- "Choose Source"
Selects the source of the displayed log entries. Available log sources are:
 - "General Log"
 - "Communication Log"

- "Show"
 - Selects the type of log information to be displayed, with significance increasing from "Info" to "Warning" to "Error". Available log information types are:
 - Show "Info" and above (includes "Warning" and "Error").
 - Show "Warning" and above (includes "Error").
 - Show "Error".
- "Load last ... entries"
 - Sets the maximum number of entries to be loaded.
- "Auto Refresh" automatically updates the view, if "Source" or "Show" settings are changed

10.3 VISA trace tool

Allows tracking and recording VISA commands during activities of R&S ELEKTRA.

Access: outside of R&S ELEKTRA, go to "Windows Start" > "R&S VISA" > "Trace Tool".



When you click "Trace Tool", the following dialog opens:

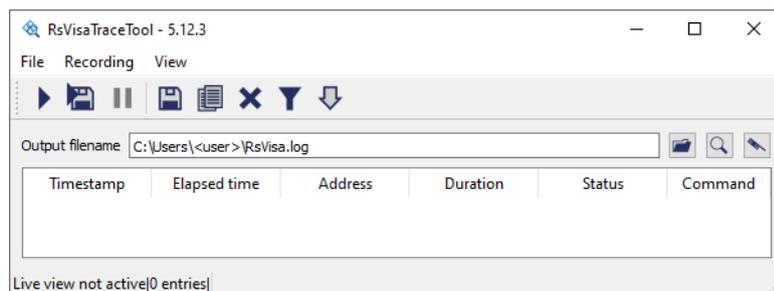


Figure 10-2: Trace tool dialog started, no entries yet

- ▶ To track VISA commands, click "Start recording" ▶ (button at top left of [Figure 10-2](#)). During a recording, the "Trace Tool" creates a log table of all VISA commands that occur upon operating other software, including R&S ELEKTRA. For example, when you start an EMI test, the recording can look as follows:

	Timestamp	Elapsed time	Address	Duration	Status	Command
0	11:48:12.417	1720.417576 s	TCPIP0:10.102....	12.8 µs	VI_SUCCESS	viSetAttribute(vi=11,attribute=VI_ATTR_TERMCHAR,attrState=10(0xa))
1	11:48:12.417	1720.417593 s	TCPIP0:10.102....	3.1 µs	VI_SUCCESS	viSetAttribute(vi=11,attribute=VI_ATTR_TERMCHAR_EN,attrState=1(0x1))
2	11:48:12.417	1720.417601 s	TCPIP0:10.102....	2.6 µs	VI_SUCCESS	viGetAttribute(vi=11,attribute=VI_ATTR_INTF_TYPE,attrState(0000007C25FFE3A0)=6(0x6))
3	11:48:12.417	1720.417609 s	TCPIP0:10.102....	2.1 µs	VI_SUCCESS	viGetAttribute(vi=11,attribute=VI_ATTR_INTF_TYPE,attrState(0000007C25FFE3B8)=6(0x6))
4	11:48:12.417	1720.417615 s	TCPIP0:10.102....	3.3 µs	VI_SUCCESS	viGetAttribute(vi=11,attribute=VI_ATTR_TCPIP_JS_HISLIP,attrState(0000007C25FFE380)=0(0x0))
5	11:48:12.417	1720.417623 s	TCPIP0:10.102....	2.1 µs	VI_SUCCESS	viSetAttribute(vi=11,attribute=VI_ATTR_SUPPRESS_END_EN,attrState=0(0x0))
6	11:48:12.417	1720.417638 s	TCPIP0:10.102....	3.1 µs	VI_SUCCESS	viSetAttribute(vi=11,attribute=VI_ATTR_TMO_VALUE,attrState=10000(0x2710))
7	11:48:12.422	1720.422526 s	TCPIP0:10.102....	893.4 µs	VI_SUCCESS	viWrite(vi=11,buf=""CLS\n",cnt=5,retCnt(0000007C267FE3A8)=5)
8	11:48:12.423	1720.423545 s	TCPIP0:10.102....	734.2 µs	VI_SUCCESS	viWrite(vi=11,buf=":SYSTEM:DISPLAY:UPDATE ON\n",cnt=26,retCnt(0000007C2C7FEE88)=26)
9	11:48:12.424	1720.424315 s	TCPIP0:10.102....	700.1 µs	VI_SUCCESS	viReadSTB(vi=11,spb(0000007C2C7FED98)=0x0000)
10	11:48:12.425	1720.425091 s	TCPIP0:10.102....	737.4 µs	VI_SUCCESS	viWrite(vi=11,buf=""IDN?\n",cnt=6,retCnt(0000007C2C7FEE88)=6)

Live view active|269 entries|

Figure 10-3: Example of entries in the trace tool

- To finish the acquisition of VISA commands, click "Stop recording" ■ (button in same position as "Start recording" before the recording). Optionally, you can save the list of recorded commands to a file.

You can use the recording of tracked VISA commands, for example, for diagnosing problems with the control of devices, especially during the configuration of generic device drivers.

For more information, refer to the user documentation at "Windows Start" > "R&S VISA" > "Visa Manual".

10.4 Troubleshooting information

If you have a problem with R&S ELEKTRA that requires assistance from Rohde & Schwarz, we recommend including a troubleshooting file into your communication with our [support team](#).

The troubleshooting file is a zip archive with the following default filename, which includes a time stamp:

```
TroubleshootingInfo yyyy-mm-dd hh-mm.zip
```

To create troubleshooting information



1. If an error message allows creating troubleshooting information:
 - a) Click the button shown in the lower left of [Figure 10-4](#):

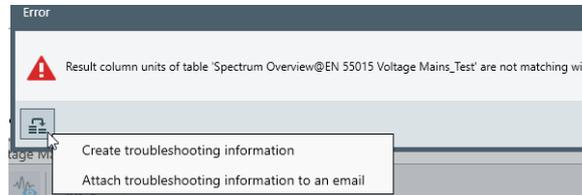
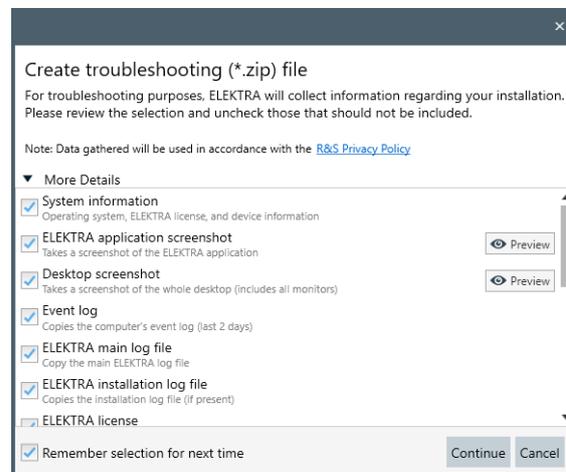


Figure 10-4: Creating specific troubleshooting information

- b) Select "Create troubleshooting information" or "Attach troubleshooting information to an email".
2. If this button is not available, hit the keyboard shortcut **[Alt]+[X]**.
 If [Show troubleshooting info selection screen](#) is enabled in the [general settings](#), the dialog in [step 3](#) comes up to let you select options.
 If [Show troubleshooting info selection screen](#) is not enabled, you cannot select options. Instead, the software proceeds with [step 6](#) for saving a troubleshooting zip file with a default selection of content.
 3. In the dialog that comes up, click "More Details".

A list of selectable details unfolds:



You can do a quick check on some of the content by clicking the "Preview" button, if it is available.

4. Select the information that you want to include in the troubleshooting zip file.

The following options are available:

- System information (operating system, R&S ELEKTRA license, and device information)
- R&S ELEKTRA application screenshots (R&S ELEKTRA_YYYY-mm-dd.jpg)

- Full desktop screenshots of all connected displays (PrintScreen_YYYY-mm-dd.jpg)
 - The computer's event log of the last two days
 - R&S ELEKTRA main log file, see [Log information](#)
 - R&S ELEKTRA installation log file (if present)
 - R&S ELEKTRA [license](#) information
 - User configuration (UserOptions.xml and DeactivatedOptions.xml)
 - An auto-saved copy of the active test
 - SCPI commands and responses (contents of the command buffer), see [Log](#)
 - Test execution log file (if present)
 - VISA communication log file, see [Log information](#)
 - Content of the active tab (if present, filename depends on context)
 - An optional video clip of R&S ELEKTRA's window, showing what happened in the last few minutes
 - Device messages showing errors and warnings that occurred when working with devices
 - Memory consumption of R&S ELEKTRA when running a test
5. Click "Continue".
 6. Select a location for saving the zip file.

If you have selected "Attach troubleshooting information to an email", a new email message opens with the zip file attached, but requiring to update at least the "From" and "To" email addresses.

Note: Instrument security.
The troubleshooting zip file, backup files or other information that you intend to provide to technical support personnel can contain company confidential or personal information. Releasing this information can violate Instrument Security Procedures installed in your organization. Therefore, before you send the files to any recipient outside of your organization, open the files and remove any sensitive information.
 7. Optionally, include also the following data in your communication:
 - [Export](#) files of objects that you suspect being the cause of a problem
 - A [Backup](#) of the database
 8. Proceed as described in [Chapter 10.7, "Support"](#), on page 249.

10.5 Product information

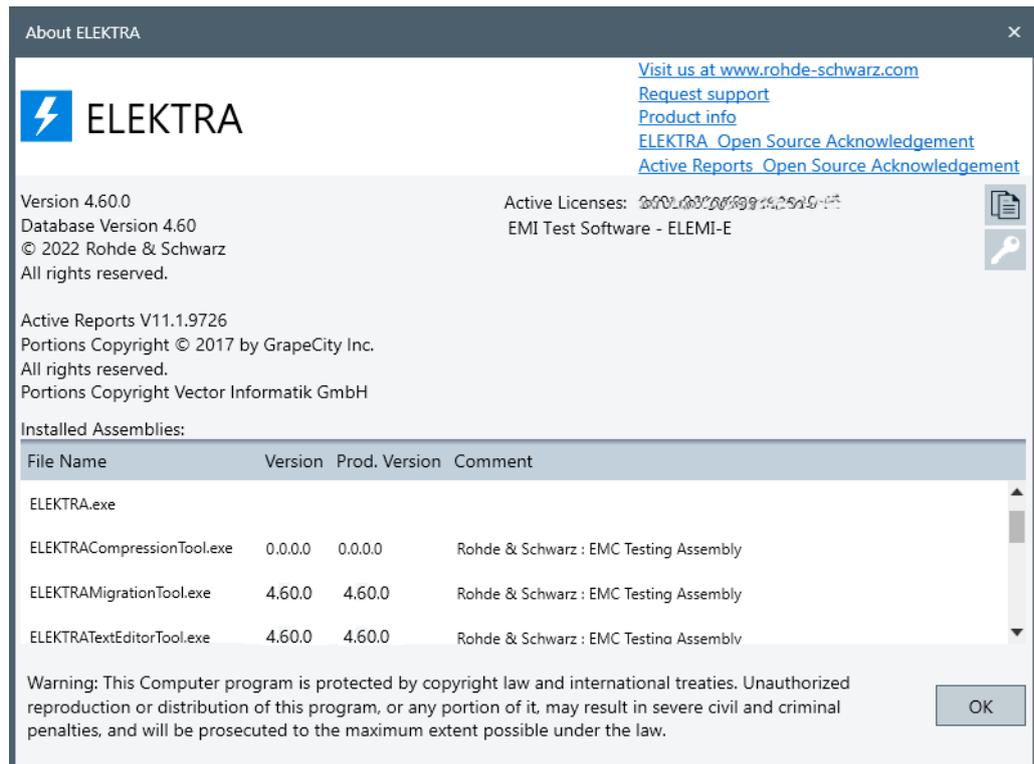


To display product information about R&S ELEKTRA, click the info button  in the program menu.

This selection brings up a dialog that provides the following information:

- Software version details
- Links for the following online targets:

- The Rohde & Schwarz homepage
- An email message to the Rohde & Schwarz customer [Support](#) center
- The R&S ELEKTRA product start page
- The open-source acknowledgment for open source software components used by R&S ELEKTRA
- The open-source acknowledgment for open source software components used by the "Active Reports" application
- A list of the installed software components



The "Copy to Clipboard" button copies the full content of this dialog to the clipboard of your computer. Use the keyboard shortcut [CTRL+V] to paste the content into any editor.



The "Install personal license key" button opens a dialog for activating your license key: Enter the email address of your license account and the 30-digit license key, then click "OK". Alternatively, use the "Home" > [Administration](#) > [License Management](#) dialog.

Click "OK" to close the "About ELEKTRA" product information dialog.

10.6 R&S ELEKTRA on the internet

The R&S ELEKTRA product start page www.rohde-schwarz.com/product/elektra provides the most recent information, as detailed in [Chapter 1.3, "Documentation over-](#)

[view](#)", on page 13. The online content also includes updates for current software versions.

For easy access to the R&S ELEKTRA product start page, click the info button  and select "Product info".

Refer also to the "FAQs for Product R&S ELEKTRA" at www.rohde-schwarz.com/faq/elektra-emc.

10.7 Support

For all service requests, or if you need immediate help, contact the Rohde & Schwarz support center. To send an email message, click the info button  and select "Email support". Regional contact details are available as described in [Chapter 10.7.1, "Contacting customer support"](#), on page 249.

Before you contact the support team, we recommend reading the corresponding chapter in the user manual or in the context-sensitive [Embedded help](#). If you contact the support team, have the product license information available.

10.7.1 Contacting customer support

Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz product, contact our customer support center. A team of highly qualified engineers provides support and works with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz products.

Contact information

Contact our customer support center at www.rohde-schwarz.com/support, or follow this QR code:



Figure 10-5: QR code to the Rohde & Schwarz support page

10.8 Training

The Rohde & Schwarz training services offer in-depth customer seminars and intensive training courses for the application of R&S ELEKTRA. Course schedules are available at www.training.rohde-schwarz.com. Some courses are made available on demand.

Glossary: Frequently Used Terms and Abbreviations

A

AC: Alternating current (or > [Anechoic chamber](#))

ACA: Absorbing clamp assembly

ACV: [Video bandwidth](#)

AF: Antenna factor, the ratio of the electromagnetic field strength (E or H) to the voltage U induced across the terminals of an antenna. For an electric field antenna, field strength E is in units of V/m, and the resulting antenna factor E/U is in units of 1/m. For a magnetic field antenna, field strength H is in units of A/m, and the resulting antenna factor H/U is in units of A/(Vm).

AFC: Automatic frequency control, a tracking mechanism to keep a monitoring device tuned to a signal with a frequency that is drifting over time, typically due to thermal or mechanical effects.

AMN: Artificial mains network

Anechoic chamber: A room lined with absorbing material that does not reflect electromagnetic waves.

ANSI: American National Standards Institute

AVG: Average, a [detector](#) type

B

BB: Broadband

BCI: Bulk current injection / bulk cable injection, conducted susceptibility tests according to various standards as for example: ISO 11451-4 (EMI tests for continuous narrowband EM fields interfering with electronic components in vehicles), MIL-STD-461, CS114 (electrical disturbances from radiated EM energy at 10 kHz to 200 MHz)

BER: Bit error rate, the number of bit errors divided by the total number of transferred bits

BNC: Bayonet Neill-Concelman connector for coaxial cables that transmit RF signals, limited to frequencies <4 GHz and <500 V.

C

CAV: CISPR average, a [detector](#) type.

CC: Current clamp

CD-ROM: Compact disc read-only memory, an optical data storage medium

CDN: Coupling/decoupling network

CE: Conducted emission (cable-based EMI tests)

CEE: Commission for Electrical Equipment, former name of a standardization organization; since 1985 the IEC

CF: Clamp factor (current injecting or absorbing clamp)

CISPR: International special committee on radio interference (in French: Comité International Spécial des Perturbations Radioélectriques), a standardization organization (part of the IEC) for controlling electromagnetic interference in electrical and electronic devices

Corner frequency: The pulse repetition frequency above which the RMS-average detector behaves like an RMS detector and below which the RMS-average detector has the slope of a linear average detector.

CW: Continuous wave, a narrow bandwidth signal of constant amplitude and frequency

D

D-Sub: Electrical D-subminiature connector, surrounded by a D-shaped metal support

dB: Decibel, 10 times the common (decadic) logarithm of the ratio of two power quantities, or of the ratio of the squares of two field amplitude quantities. See also our application note at www.rohde-schwarz.com/apnote/1MA98

dBm: Decibel milliwatt, the power level based on a power ratio in decibels (dB) of the measured power, referenced to 1 mW

DC: Direct current

Detector: An algorithm that specifies how to weight the envelope of the measured IF signal, see [Table 5-2](#).

DUT: Device under test

E

EIRP: Equivalent (or effective) isotropically radiated power

EMC: Electromagnetic compatibility (with both EMI and EMS requirements)

EMI: Electromagnetic interference is a disturbance in the RF spectrum. EMI testing of electrical appliances searches for unwanted signals or noise emitted by these appliances, which can disturb their environment.

EMS: Electromagnetic susceptibility: Property of an electrical appliance to tolerate a disturbance of a particular level without showing any faults.

ERP: Equivalent (or effective) radiated power

ESD: Electrostatic discharge

EUT: Equipment under test

F

FAR: Fully anechoic room

FC: Ferrule connector for optical fibers

FCC: Federal Communications Commission, the government agency that regulates telecommunications the USA

FFT: Fast Fourier transform, an algorithm for time-domain scans

FSMA: Fiber Sub-Miniature Assembly, a connector for optical fibers, developed based on the SMA connector.

G

Gain: The increase in power or amplitude of a signal, typically generated by an amplifier. In decibel (dB) calculus, power gain is $10 \log (P_{\text{out}} / P_{\text{in}})$.

Gasket: A mechanical seal

GHz: Gigahertz, a frequency of $10^9/\text{s}$

GPI: Ground plane interference

GPIB: General-purpose interface bus according to standard IEEE-488

I

IEC: International Electrotechnical Commission, a standardization organization for electrical, electronic and related technologies. One of IEC's groups is CISPR.

IEEE: Institute of Electrical and Electronics Engineers, among other activities an important publisher of standards that are produced by the IEEE's standardization committees.

IF: Intermediate frequency, in heterodyne signal processing the resulting sum or difference frequency when a carrier signal is mixed with a local oscillator signal.

Impedance: Electrical impedance Z is the complex ratio of AC voltage over current, representing a circuit's opposition towards a current under an applied voltage.

IP: Internet protocol, a network communication technology for routing data packets from a source to a destination, based on IP addresses in the packet headers.

ISO: International standardization organization, based in Geneva, Switzerland, and composed of representatives from national standards authorities. ISO and IEC have joint committees.

ITU: International Telecommunication Union

ITU-R: International Telecommunication Union Radiocommunication sector, one of the divisions of the [ITU](#), responsible for radio communication. Formerly known as the CCIR (Consultative Committee on International Radio).

ITU-T: International Telecommunication Standardization Sector, one of the divisions of the [ITU](#), an organization that coordinates standards for telecommunications and information communication technology. Formerly known as the CCITT (International Telegraph and Telephone Consultative Committee).

K

kHz: Kilo Hertz, a frequency of $10^3/s$

L

L.O.: Local oscillator, a component of a mixer that is used for frequency conversion, for example in a heterodyne receiver

LAN: Local area network within a limited space, such as an office building. LAN connects computers or electronic equipment with processing capability. It uses network media technologies such as Ethernet (over electric or fiber-optic cables, according to the IEEE 802.3 standards) or wireless LAN (Wi-Fi, according to IEEE 802.11).

Laser: LASER is the acronym for Light Amplification by Stimulated Emission of Radiation. Coherence, which allows monochromatic laser light to be focused and collimated,

is among a laser's most special qualities. Spatial coherence enables high power densities, especially when modulated to be emitted in short pulses.

Level: The power level of RF radiation, typically specified in dBm, or in watts.

Limit Line: In all EMI standards, maximum permissible levels for any interference signal generated by the EUT are defined, depending on the EUT class. A table containing these limit values over frequencies for an EUT class is called a "Limit Line" in R&S ELEKTRA.

LNA: Low Noise Amplifier, typically a solid-state preamplifier

M

M2M: Machine-to-machine ("M2M") communication, aiming at means to facilitate communication among wireless or wire-bound devices.

MHz: Mega-Hertz, a frequency of $10^6/s$

Modulation Depth: In amplitude modulation, the modulation depth is the ratio M/A (in %) of the modulation amplitude M to the unmodulated carrier amplitude A . In this relation, M is the peak change (positive or negative) in the RF amplitude from its unmodulated value. For example, 80% modulation depth represents a signal with an envelope that oscillates between 100% and 20% of A . (20% of A is an amplitude 80% down from the unmodulated signal level A .)

N

NB: Narrowband

NIST: National Institute of Standards and Technology (USA)

Noise Factor: The noise factor (F) is a measure of the SNR degradation due to components in an RF signal chain. Lower F values indicate better system performance, with F being the ratio of input SNR to output SNR: $F = \text{SNR}_{\text{input}} / \text{SNR}_{\text{output}}$.

Noise Figure: The noise figure (NF) is equivalent to the noise factor (F) given in dB:
 $\text{NF} = 10 \log F$

NSA: Normalized site attenuation, a measurement of test chamber characteristics (typically with a transmitting and a receiving antenna), in comparison with theoretical free-space attenuation at an OATS.

NTIA: National Telecommunications and Information Administration (USA)

O

OTA: Over-the-air (tests)

Overload: The appearance of signal levels greater than the specified maximum, especially at the input port of a test instrument. Overload leads to wrong measurement results and can damage or destroy sensitive components of the instrument.

P

P-: Minimum peak, a [detector](#) type

P+: Maximum peak, a [detector](#) type

PC: Personal computer

Q

QPK: Quasi-peak, a [detector](#) type

R

RC: Reference calibration (table)

RE: Radiated emission (antenna-based EMI tests)

RF: Radio frequency, electromagnetic oscillation in the frequency range of around 3 kHz to 300 GHz

RFID: Radio frequency identification, a (typically near-field) technology for automatic identification and tracking of objects

RMS: Root mean square, a statistical measure defined as the square root of the arithmetic mean of the squares of the original values.
Also a [detector](#) type.

Rx: Receiving, reception

S

SC: Standard connector for optical fibers

Scan: A scan is a measurement run, during which the receiver or the signal generator is tuned step by step over the whole frequency range (as opposed to a sweep). The definition parameters for a scan are the start and stop frequency, the step width (absolute, or in percent of the current frequency) and the dwell time at each frequency.

SMA connector: Sub-Miniature Assembly, a coaxial RF connector, version A (standard)

SMP connector: Sub-Miniature Precision assembly, a coaxial RF connector, version P (precision)

SNR: Signal-to-noise ratio is the ratio of the level of a desired signal to the level of background noise (measured in quantities of power). $SNR > 1$ (or $SNR > 0$ dB) indicates more signal than noise.

ST: Straight tip bayonet connector for optical fibers

Sweep: A sweep is an EMI measurement run, during which the frequency analyzer is tuned (quasi) continuously over the whole frequency range (as opposed to a scan). The definition parameters for a sweep are the start frequency, the stop frequency and the sweep time that it takes the analyzer to cover the whole frequency range.

T

TEM: Transverse electromagnetic, as in a TEM waveguide or GTEM cell, for example.

TPL: Short for template, R&S ELEKTRA distinguishes between [test templates](#) and [report templates](#).

TRD: Also written as "Trd", short for transducer

TRP: Total radiated power, the sum of all RF power radiated by an antenna (source power included in the measurement).

TT: [Test template](#)

TTL: Transistor–transistor logic, a class of integrated circuits with transistors performing both logic and amplifying functions

Tx: Transmitting, transmission

U

UA: Uniform area

UE: User equipment, for example a mobile device to be tested

USB: Universal Serial Bus, industrial connector standard for a serial interface

V

VA: Volt-Ampere = voltage (RMS) * current (RMS), is the unit for apparent power in an electrical AC circuit with sinusoidal voltages and currents of the same frequency. In DC circuits, VA is the real power in watts.

Video bandwidth: The video signal or (DC) video voltage is the envelope of a modulated RF signal. A lowpass filter that removes the higher frequency components of the IF signal and outputs the envelope, only, is called the video filter. The video bandwidth is hence the bandwidth of the filtered signal envelope.

"AC Video" (ACV) and "AC Video Sine" (ACS) are also [detector](#) types.

VISA: Virtual instrument software architecture, an application programming interface for communicating with instruments used in test and measurement tasks

VSWR: Voltage standing wave ratio, ratio of the maximum standing wave amplitude over the minimum standing wave amplitude

X

XML: Extensible markup language, a simple and generality usable text format code that can be read easily both by humans and machines.

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