# R&S®AREG100A
# Automotive Radar Echo Generator
# Getting Started

1430357202
Version 08

ROHDE & SCHWARZ

Make ideas real

This document describes the R&S®AREG100A, stock no. 1430.3508K02.

# Contents

# 1    Safety and regulatory information

The product documentation helps you use the product safely and efficiently. Follow the instructions provided here and in the following chapters.

**Intended use**

The product is intended for the development, production and verification of electronic components and devices in industrial, administrative, and laboratory environments. Use the product only for its designated purpose. Observe the operating conditions and performance limits stated in the data sheet.

**Where do I find safety information?**

Safety information is part of the product documentation. It warns you of potential dangers and gives instructions on how to prevent personal injury or damage caused by dangerous situations. Safety information is provided as follows:

- In Chapter 1.1, "Safety instructions", on page 7. The same information is provided in many languages as printed "Safety Instructions". The printed "Safety Instructions" are delivered with the product.

- Throughout the documentation, safety instructions are provided when you need to take care during setup or operation.

## 1.1    Safety instructions

Products from the Rohde & Schwarz group of companies are manufactured according to the highest technical standards. To use the products safely, follow the instructions provided here and in the product documentation. Keep the product documentation nearby and offer it to other users.

Use the product only for its intended use and within its performance limits. Intended use and limits are described in the product documentation such as the data sheet, manuals and the printed "Safety Instructions". If you are unsure about the appropriate use, contact Rohde & Schwarz customer service.

Using the product requires specialists or specially trained personnel. These users also need sound knowledge of at least one of the languages in which the user interfaces and the product documentation are available.

Never open the casing of the product. Only service personnel authorized by Rohde & Schwarz are allowed to repair the product. If any part of the product is damaged or broken, stop using the product. Contact Rohde & Schwarz customer service at http://www.customersupport.rohde-schwarz.com.

**Lifting and carrying the product**

The maximum weight of the product is provided in the data sheet. To move the product safely, you can use lifting or transporting equipment such as lift trucks and forklifts. Follow the instructions provided by the equipment manufacturer.

**Choosing the operating site**

Only use the product indoors. The product casing is not waterproof. Water that enters can electrically connect the casing with live parts, which can lead to electric shock, serious personal injury or death if you touch the casing. If Rohde & Schwarz provides accessories designed for your product, e.g. a carrying bag, you can use the product outdoors.

Unless otherwise specified, you can operate the product up to an altitude of 2000 m above sea level. The product is suitable for pollution degree 2 environments where nonconductive contamination can occur. For more information on environmental conditions such as ambient temperature and humidity, see the data sheet.

**Setting up the product**

Always place the product on a stable, flat and level surface with the bottom of the product facing down. If the product is designed for different positions, secure the product so that it cannot fall over.

If the product has foldable feet, always fold the feet completely in or out to ensure stability. The feet can collapse if they are not folded out completely or if the product is moved without lifting it. The foldable feet are designed to carry the weight of the product, but not an extra load.

If stacking is possible, keep in mind that a stack of products can fall over and cause injury.

If you mount products in a rack, ensure that the rack has sufficient load capacity and stability. Observe the specifications of the rack manufacturer. Always install the products from the bottom shelf to the top shelf so that the rack stands securely. Secure the product so that it cannot fall off the rack.

**Connecting to power**

The product is an overvoltage category II product. Connect the product to a fixed installation used to supply energy-consuming equipment such as household appliances and similar loads. Keep in mind that electrically powered products have risks, such as electric shock, fire, personal injury or even death.

Take the following measures for your safety:

- Before switching on the product, ensure that the voltage and frequency indicated on the product match the available power source. If the power adapter does not adjust automatically, set the correct value and check the rating of the fuse.

- Only use the power cable delivered with the product. It complies with country-specific safety requirements. Only insert the plug into an outlet with protective conductor terminal.

- Only use intact cables and route them carefully so that they cannot be damaged. Check the power cables regularly to ensure that they are undamaged. Also ensure that nobody can trip over loose cables.

- If the product needs an external power supply, use the power supply that is delivered with the product or that is recommended in the product documentation or a power supply that conforms to the country-specific regulations.

- Only connect the product to a power source with a fuse protection of maximum 20 A.

- Ensure that you can disconnect the product from the power source at any time. Pull the power plug to disconnect the product. The power plug must be easily accessible. If the product is integrated into a system that does not meet these requirements, provide an easily accessible circuit breaker at the system level.

**Cleaning the product**

Use a dry, lint-free cloth to clean the product. When cleaning, keep in mind that the casing is not waterproof. Do not use liquid cleaning agents.

**Meaning of safety labels**

Safety labels on the product warn against potential hazards.

| ⚠ | Potential hazard |
|---|---|
|   | Read the product documentation to avoid personal injury or product damage. |
| ⚡ | Electrical hazard |
|   | Indicates live parts. Risk of electric shock, fire, personal injury or even death. |
| ♨ | Hot surface |
|   | Do not touch. Risk of skin burns. Risk of fire. |
| ⏚ | Protective conductor terminal |
|   | Connect this terminal to a grounded external conductor or to protective ground. This connection protects you against electric shock if an electric problem occurs. |

# 1.2　Labels on R&S AREG100A

Labels on the casing inform about:

- Personal safety, see "Connecting to power" on page 9.
- Product and environment safety, see Table 1-1.
- Identification of the product, see the serial number on the rear panel.

*Table 1-1: Labels regarding R&S AREG100A and environment safety*

| 🗑 | Labeling in line with EN 50419 for disposal of electrical and electronic equipment after the product has come to the end of its service life. For more information, see the product user manual, chapter "Disposal". |
|---|---|

# 1.3　Warning messages in the documentation

A warning message points out a risk or danger that you need to be aware of. The signal word indicates the severity of the safety hazard and how likely it will occur if you do not follow the safety precautions.

**WARNING**

Potentially hazardous situation. Could result in death or serious injury if not avoided.

**CAUTION**

Potentially hazardous situation. Could result in minor or moderate injury if not avoided.

**NOTICE**

Potential risks of damage. Could result in damage to the supported product or to other property.

## 1.4    Korea certification class A

이 기기는 업무용(A급) 전자파 적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

# 2    Documentation overview

This section provides an overview of the R&S AREG100A user documentation. Unless specified otherwise, you find the documents on the R&S AREG100A product page at:

www.rohde-schwarz.com/manual/areg100a

## 2.1    Getting started manual

Introduces the R&S AREG100A and describes how to set up and start working with the product. Includes basic operations, typical measurement examples, and general information, e.g. safety instructions, etc. A printed version is delivered with the instrument.

## 2.2    User manuals and help

Contains the description of all instrument modes and functions. It also provides an introduction to remote control, a complete description of the remote control commands with programming examples, and information on maintenance, instrument interfaces and error messages. Includes the contents of the getting started manual.

## 2.3    Service manual

Describes the performance test for checking the rated specifications, module replacement and repair, firmware update, troubleshooting and fault elimination, and contains mechanical drawings and spare part lists.

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

https://gloris.rohde-schwarz.com

## 2.4 Instrument security procedures

Deals with security issues when working with the R&S AREG100A in secure areas. It is available for download on the Internet.

## 2.5 Basic safety instructions

Contains safety instructions, operating conditions and further important information. The printed document is delivered with the instrument.

## 2.6 Data sheets and brochures

The data sheet contains the technical specifications of the R&S AREG100A. It also lists the firmware applications and their order numbers, and optional accessories.

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

See www.rohde-schwarz.com/brochure-datasheet/areg100a

## 2.7 Release notes and open source acknowledgment (OSA)

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

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

See www.rohde-schwarz.com/firmware/areg100a

## 2.8 Application notes, application cards, white papers, etc.

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

See www.rohde-schwarz.com/application/areg100a

# 3    Key features

The R&S AREG100A Automotive Radar Echo Generator sets standards in RF performance and usability. Outstanding key features are:

- Remote frontends supporting up to 4 GHz signal bandwidth and different frequencies, like 24 GHz to 24.25 GHz, 76 GHz to 77 GHz and 76 GHz to 81 GHz

- Simultaneous simulation of up to four objects

    - Up to three individually switchable paths for simulation of fixed object distances from 5 m to 300 m

    - One additional switchable path for fixed short object distance of 4m (including 0.8m air gap)

- Individually controllable amplitude for each path

- Frontend available with single antenna (best for testing MIMO radars) or two antennas (best isolation between Rx/Tx path)

- Optional Doppler frequency offset for simulation of radial velocity

- Remote configuration and operation

For more information, see data sheet.

# 4    Preparing for use

Here, you can find basic information about setting up the product for the first time.

## 4.1    Lifting and carrying

See also "Lifting and carrying the product" on page 8.

► Use the carrying handles at the side for lifting and carrying the
R&S AREG100A.
The handles at the front are only for pushing and pulling the instrument when
mounting in a rack, see Chapter 4.4.2, "Mounting the R&S AREG100A in a
rack", on page 18.

## 4.2    Unpacking and checking

1. Unpack the R&S AREG100A carefully.

2. Retain the original packing material. Use it to protect the control elements and
   connectors when transporting or shipping the R&S AREG100A later.
   See also chapter "Transporting" in the user manual.

3. Using the delivery notes, check the equipment for completeness.

4. Check the equipment for damage.

   If the delivery is incomplete or equipment is damaged, contact
   Rohde & Schwarz.

## 4.3    Choosing the operating site

Specific operating conditions ensure proper operation and avoid damage to the
product and connected devices. For information on environmental conditions
such as ambient temperature and humidity, see the data sheet.

See also "Choosing the operating site" on page 8.

**Electromagnetic compatibility classes**

The electromagnetic compatibility (EMC) class indicates where you can operate the product. The EMC class of the product is given in the data sheet under "General data".

- Class B equipment is suitable for use in:
  - Residential environments
  - Environments that are directly connected to a low-voltage supply network that supplies residential buildings
- Class A equipment is intended for use in industrial environments. It can cause radio disturbances in residential environments due to possible conducted and radiated disturbances. It is therefore not suitable for class B environments. If class A equipment causes radio disturbances, take appropriate measures to eliminate them.

# 4.4    Setting up the R&S AREG100A

See also:
- "Setting up the product" on page 8
- "Intended use" on page 7

## 4.4.1    Placing the R&S AREG100A on a bench top

**To place the product on a bench top**

1. Place the product on a stable, flat and level surface. Ensure that the surface can support the weight of the product. For information on the weight, see the data sheet.

2. **CAUTION!** Foldable feet can collapse. See "Setting up the product" on page 8.

   Always fold the feet completely in or out. With folded-out feet, do not place anything on top or underneath the product.

3. **WARNING!** A stack of products can fall over and cause injury. Never stack more than three products on top of each other. Instead, mount them in a rack.

   Stack as follows:

   ● If the products have foldable feet, fold them in completely.
   ● It is best if all products have the same dimensions (width and length). If the products have different dimensions, stack according to size and place the smallest product on top.
   ● Do not exceed the permissible total load placed on the product at the bottom of the stack:
     – 50 kg when stacking products of identical dimensions (left figure).
     – 25 kg when stacking smaller products on top (middle figure).
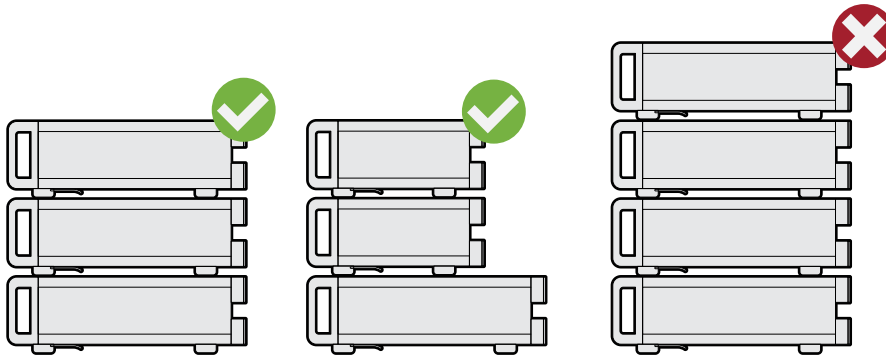


Left      = Stacked correctly, same dimensions
Middle = Stacked correctly, different dimensions
Right    = Stacked incorrectly, too many products

4. **NOTICE!** Overheating can damage the product.

   Prevent overheating as follows:

   ● Keep a minimum distance of 10 cm between the fan openings of the product and any object in the vicinity.
   ● Do not place the product next to heat-generating equipment such as radiators or other products.

## 4.4.2    Mounting the R&S AREG100A in a rack

**To prepare the rack**

1. Observe the requirements and instructions in "Setting up the product" on page 8.

2. **NOTICE!** Insufficient airflow can cause overheating and damage the product.

Design and implement an efficient ventilation concept for the rack.

**To mount the R&S AREG100A in a rack**

1. Use an adapter kit that fits the dimensions of the R&S AREG100A to prepare the instrument for rack mounting.
   a) Order the rack adapter kit designed for the R&S AREG100A. For the order number, see data sheet.
   b) Mount the adapter kit. Follow the assembly instructions provided with the adapter kit.

2. Lift the R&S AREG100A to shelf height.

3. Push the R&S AREG100A onto the shelf until the rack brackets fit closely to the rack.

4. Tighten all screws at the rack brackets with a tightening torque of 1.2 Nm to secure the R&S AREG100A in the rack.

**To unmount the R&S AREG100A from a rack**

1. Loosen the screws at the rack brackets.

2. Bring the lifting equipment to shelf height.

3. Remove the R&S AREG100A from the rack.

4. If placing the R&S AREG100A on a bench top again, unmount the adapter kit from the R&S AREG100A. Follow the instructions provided with the adapter kit.

# 4.5 Considerations for test setup

**Cable selection and electromagnetic interference (EMI)**

Electromagnetic interference (EMI) can affect the measurement results.

To suppress electromagnetic radiation during operation:
- Use high-quality shielded cables, especially for the following connector types:
  – BNC
    Double-shielded BNC cables.
    How to: "To connect to "Ref In"/"Ref Out"" on page 23

- SMA
  Double-shielded SMA cables.
  How to: Chapter 4.10, "Connecting to Aux IF In/Aux IF Out", on page 23
- USB
  Double-shielded USB cables.
  How to: Chapter 4.8, "Connecting USB devices", on page 22.
  See also chapter "Troubleshooting and Error Messages" in the user manual.
- LAN
  At least CAT6 STP cables.
  How to: Chapter 4.7, "Connecting to LAN", on page 21

- Always terminate open cable ends.
- Ensure that connected external devices comply with EMC regulations.

**Signal input and output levels**

Information on signal levels is provided in the data sheet. Keep the signal levels within the specified ranges to avoid damage to the R&S AREG100A and connected devices.

**Preventing electrostatic discharge (ESD)**

Electrostatic discharge is most likely to occur when you connect or disconnect a DUT.

► **NOTICE!** Risk of electrostatic discharge. Electrostatic discharge can damage the electronic components of the product and the device under test (DUT).

  Ground yourself to prevent electrostatic discharge damage:

  a) Use a wrist strap and cord to connect yourself to ground.
  b) Use a conductive floor mat and heel strap combination.

**Over-the-air (OTA) tests**

For over-the-air (OTA) tests, operate R&S AREG100A in shielded environment.

For more information, see data sheet.

## 4.6    Connecting to power

For safety information, see "Connecting to power" on page 9.

1. Plug the AC power cable into the AC power connector on the rear panel of the instrument. Only use the AC power cable delivered with the R&S AREG100A.

2. Plug the AC power cable into a power outlet with ground contact.

   The required ratings are listed next to the AC power connector and in the data sheet.

## 4.7    Connecting to LAN

**Network environment**

Before connecting the product to a local area network (LAN), consider the following:

- Install the latest firmware to reduce security risks.

- For internet or remote access, use secured connections if applicable.

- Ensure that the network settings comply with the security policies of your company. Contact your local system administrator or IT department before connecting your product to your company LAN.

- When connected to the LAN, the product may potentially be accessed from the internet, which may be a security risk. For example, attackers might misuse or damage the product.

**To connect to LAN**

The connector is located on the rear panel.

► Connect the LAN socket via an RJ-45 cable to the LAN.

By default, the R&S AREG100A is configured to use DHCP (dynamic host configuration protocol) and no static IP address is configured.

If switched on and connected to the LAN, the R&S AREG100A displays the address information on the screen.
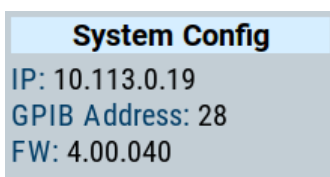
```
System Config
IP: 10.113.0.19
GPIB Address: 28
FW: 4.00.040
```

*Figure 4-1: IP address indication on the screen (example)*

See also the chapter "Connecting the Instrument to the Network (LAN)" in the user manual.

# 4.8    Connecting USB devices

You can connect or disconnect all USB devices from the R&S AREG100A during operation.

**To connect USB storage devices**

USB storage devices, such as memory sticks, allow data transfer from or to the R&S AREG100A. You can also use them for firmware updates.

► Connect the USB storage device to any of the USB connectors.

**To connect USB devices with external power supply**

1. **NOTICE!** Connected devices with external power supply can feed back current into the 5 V power supply of the USB interface and thus damage the R&S AREG100A.

   Ensure that there is no connection between the positive pole of the power supply and the +5 V power pin of the USB interface (VBUS).

2. Connect the USB storage device to any of the USB connectors.

**To connect a keyboard**

► Connect the keyboard to any of the USB connectors.

When connected, the R&S AREG100A detects the keyboard automatically. A detected keyboard has the default layout English – US.

**To connect a mouse**

► Connect the mouse to any of the USB connectors.

When connected, the R&S AREG100A detects the mouse automatically.

**To connect power sensors**

You can connect power sensors of the R&S NRP families to any of the USB connectors.

See chapter "Using Power Sensors" in the user manual.

# 4.9 Connecting to Ref In/Ref Out

The connector is located on the rear panel.

**To connect to "Ref In"/"Ref Out"**

1. Use a high-quality BNC cable that matches the connector type.
   See "Cable selection and electromagnetic interference (EMI)" on page 19.

2. To connect the cable with the "Ref In"/"Ref Out" connectors, proceed as follows:

   a) Carefully align the connector of the cable and the "Ref In"/"Ref Out" connector along a common axis.
   b) Mate the connectors along the common axis until the male pin of the connector of the cable engages with the female socket of the "Ref In"/"Ref Out" connector.

# 4.10 Connecting to Aux IF In/Aux IF Out

1. Use a high-quality cable that matches the SMA connector.
   See "Cable selection and electromagnetic interference (EMI)" on page 19.

2. **NOTICE!** Risk of instrument damage and connector damage. Excessive tightening can damage the cables and the connectors. However, if you do not tighten the connectors enough, the measurement results can be inaccurate.

To connect the cable with the "Aux IF In"/"Aux IF Out" connectors, proceed as follows:

a) Carefully align the connector of the cable and the "Aux IF In"/"Aux IF Out" connector along a common axis.

b) Mate the connectors along the common axis until the male pin of the inner connector engages with the female socket of the outer connector.

c) Turn the nut of the outer connector until the connectors are firmly coupled.

d) Torque the nut to the specified limit using a calibrated torque wrench. Hold the opposite connector part stationary with a spanner.

Also follow the instructions in chapter "Handling" of the application note 1MA99.

## 4.11    Connecting the Frontend

The frontend is delivered with two IF cables (IF TX CBL/IF RX CBL) and one control cable (TRX CRTL Cable). These cables are calibrated and dedicated to the particular frontend. Each cable has its own serial number, printed on it.

**To connect the base unit and the frontend with the "IF TX CBL"/"IF RX CBL" cables**

1. Take the **"IF TX CBL"** cable delivered with the frontend.
   See "To check the serial number of the cables" on page 26.

2. Connect the "Tx IF Out" connector of the base unit to "Tx IF In" connector of the frontend.
   Follow the instructions in Chapter 4.10, "Connecting to Aux IF In/Aux IF Out", on page 23.

   This connection carries the IF signal for the transmitting antenna and the reference signal for the frontend.

3. Take the **"IF RX CBL"** cable delivered with the frontend.

4. Connect the "Rx IF Out" connector of the frontend to "Rx IF In" connector of the base unit.
   Follow the instructions in Chapter 4.10, "Connecting to Aux IF In/Aux IF Out", on page 23.

   This connection carries the IF signal of the receiving antenna for the base unit.

5. **NOTICE!** Excessive bending can damage the cables.

   Bend the "IF TX CBL"/"IF RX CBL" to a max. bending radius of 50 mm.

**To connect the base unit and the frontend with the TRX CRTL Cable**

1. **NOTICE!** If you connect or disconnect the control cable while the base unit is powered on, you can damage the R&S AREG100A.

   Switch off the base unit.
   See "To shut down the product" on page 27.

2. Take the **TRX CRTL Cable** cable delivered with the frontend.
   See "To check the serial number of the cables" on page 26.

3. Hold the connector at the sleeve so that the red dot is upwards.

4. Align the connector of the cable along a common axis.

5. Plug the control cable at the "Control" connector at the base unit.

   The sleeve locks.

6. Plug the control cable at the "Control" connector at the frontend.

   The sleeve locks.

7. **NOTICE!** Excessive bending can damage the cables.

   Bend the "TRX CRTL Cable" to a mix. bending radius of 50 mm.

**Operating the frontend**

1. Switch on the base unit.
   See "To shut down the product" on page 27.

2. **CAUTION!** Hot surface, see "Meaning of safety labels" on page 9.

   Hold the frontend by its sides.
   Do not touch the waveguide surface. Depending on the ambient temperature, this surface can become hot.

3. **NOTICE!** Overheating can damage the product.

   Prevent overheating as follows:

   ● Do not cover the frontend module with thermally insulating material while the R&S AREG100A is switched on.
   ● See also "To place the product on a bench top" on page 17.

   See also: chapter "Typical Use Cases" in the user manual.

**To disconnect the frontend**

1. **NOTICE!** If you connect or disconnect the control cable while the base unit is powered on, you can damage the R&S AREG100A.

   Switch off the base unit.
   See "To shut down the product" on page 27.

2. To disconnect the "IF TX CBL"/"IF RX CBL" cables, proceed as follows for each of the four connections:

   a) Untorque the nut using a calibrated torque wrench. Hold the opposite connector part stationary with a spanner.
   b) Turn the nut of the outer connector until the connectors are detached.

3. To disconnect the "TRX CRTL Cable":

   a) Hold the connector at the sleeve.
   b) To release the lock, pull the sleeve without turning.
      Do not pull the cable.

**To check the serial number of the cables**

1. Switch on the base unit.
   See Chapter 4.12, "Switching on or off", on page 26.

2. On the front panel, press [Setup].

3. Select "Setup" > "Instrument Assembly" > "Hardware Config" > "RF Assembly".

4. For each cable, compare the displayed serial number with the serial number printed on the cable.

# 4.12    Switching on or off

The following table provides an overview of power states, LEDs and power switch positions.

*Table 4-1: Overview of power states*

| State | LED | Position of power switch |
|-------|-----|--------------------------|
| Off | ⚪ gray | [0] |
| Standby | 🟠 orange | [I] |
| Ready | 🟢 green | [I] |

**To switch on the R&S AREG100A**

The R&S AREG100A is off but connected to power. See Chapter 4.6, "Connecting to power", on page 21.

1. Set the switch on the power supply to position [I].
   The switch is located on the rear panel.

   The LED of the [On/Standby] key is orange.

2. Press the [On/Standby] key.
   Key and LED are located on the front panel.

   The LED changes to green. The R&S AREG100A boots.

   When starting for the first time, the R&S AREG100A starts with the default settings. When restarting the instrument, the settings depend on the instrument configuration before shut-down.
   See the chapter "Saving and Recalling Instrument Settings" in the user manual.

When the instrument is switched on, it automatically monitors main functions. You can query erroneous functions. In addition to automatic monitoring, you can perform maintenance tasks.

See:
- Chapter "Querying Error Messages" in the user manual.
- Chapter "Performing Maintenance Tasks" in the user manual.

**To shut down the product**

The product is in the ready state.

► Press the [On/Standby] key.

   The operating system shuts down. The LED changes to orange.

In the standby state, the power switch circuits are active. To deactivate them, disconnect the instrument from the power supply.

**To disconnect from power**

The R&S AREG100A is in the standby state.

1. **NOTICE!** Risk of data loss. If you disconnect the product from power when it is in the ready state, you can lose settings and data. Shut it down first.

   Set the toggle switch on the power supply to position [0].

   The LED of the [On/Standby] key is switched off.

2. Disconnect the R&S AREG100A from the power source.

# 5    Instrument tour

The following topics help you to get familiar with the instrument and perform the first steps:

- Chapter 5.1, "Front panel tour", on page 29
- Chapter 5.2, "Rear panel tour", on page 35
- Chapter 5.3, "Frontend", on page 37

This section explains the control elements and the connectors of the R&S AREG100A with the aid of the front and rear views. For specifications of the interfaces, refer to the data sheet.

The meanings of the labels on the R&S AREG100A are described in Chapter 1.2, "Labels on R&S AREG100A", on page 10.

## 5.1    Front panel tour

This section provides an overview of the control elements at the front panel of the R&S AREG100A. Most of the connectors are at the rear panel and are described in Chapter 5.2, "Rear panel tour", on page 35.
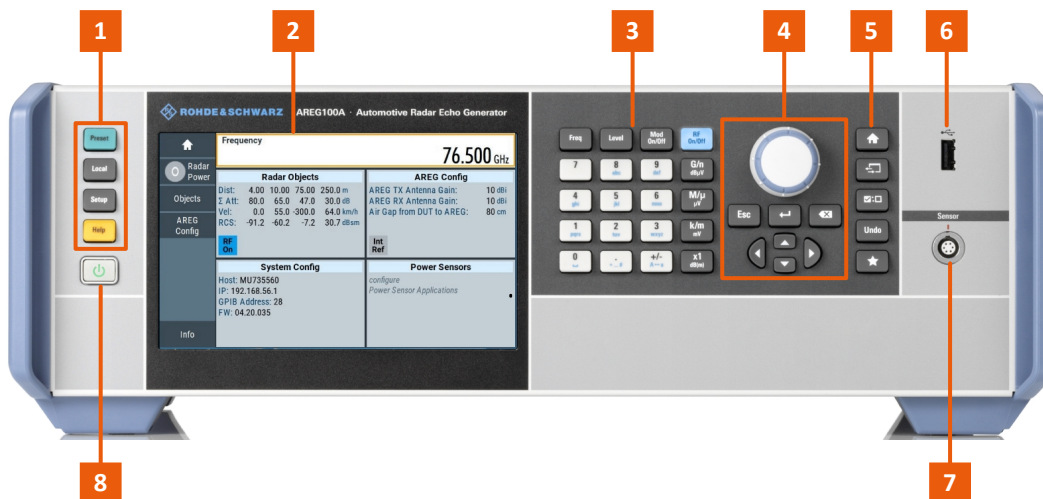


*Figure 5-1: Front panel view of the R&S AREG100A*

1 = Utility keys
2 = Touchscreen
3 = Function keys and Keypad
4 = Navigation controls

5 = Display keys
6 = USB
7 = Sensor
8 = On/Standby

## 5.1.1    Utility keys

The utility keys set the R&S AREG100A to a defined state, and provide access to basic settings and information on assistance.

*Table 5-1: Utility keys*

| Utility key | Assigned functions |
|---|---|
| [Preset] | Sets the instrument to a defined state |
| [Local] | Switches from remote control to local (manual) control |
| [Setup] | Accesses the general instrument settings |
| [Help] | Displays context-sensitive help text |

## 5.1.2    Touchscreen

The screen at the front panel is the graphical user interface. It shows the settings dialogs and parameters, and the current configuration at a glance, see Chapter 7.3, "Understanding the display information", on page 48.
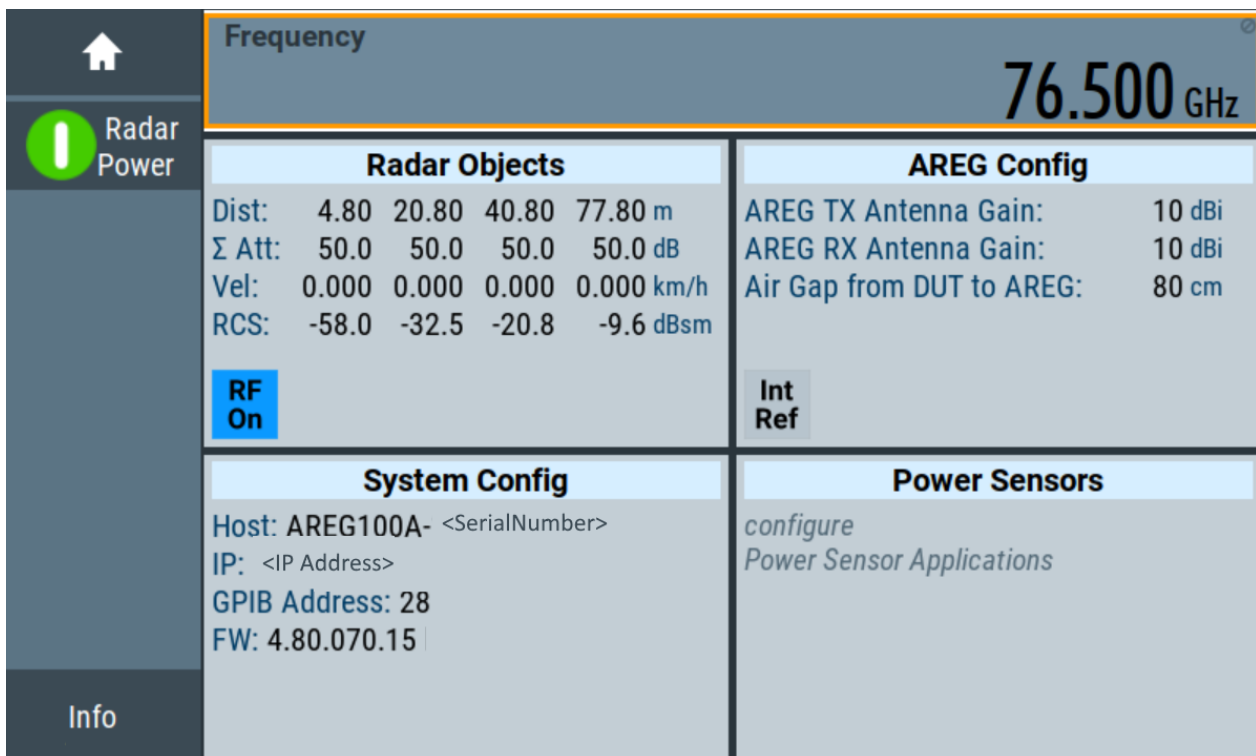
*Figure 5-2: Touchscreen*

The touch-sensitive panel provides an alternative means of user interaction for quick and easy handling of the instrument, see Chapter 7.2, "Means of manual interaction", on page 48.

See also:

- Chapter 7, "Instrument control", on page 47, for operating the touchscreen.
- "Maintenance, Storage and Disposal" in the user manual, for instructions on cleaning the screen.

### 5.1.3    Function keys

Function keys provide access to the most common generator settings and functions. You can find a detailed description of the corresponding functions in the user manual.

*Table 5-2: Function keys*

| Function key | Assigned functions |
|---|---|
| [Freq] | Activates frequency entry. |
| [Level] | Activates level entry. |

| Function key | Assigned functions |
|---|---|
| [Mod on/off] | Switches the modulation on and off. |
| [RF on/off] | Switches the RF output on and off. |

## 5.1.4    Keypad

The keypad enables you to enter alphanumeric parameters, including the corresponding units. It contains the following keys:

*Table 5-3: Keys on the keypad*

| Type of key | Description |
|---|---|
| Alphanumeric keys | Enter numbers and (special) characters in edit dialog boxes. |
| Decimal point | Inserts a decimal point "." at the cursor position. |
| Sign key | Changes the sign of a numeric parameter. For an alphanumeric parameter, inserts a "-" at the cursor position. |
| Unit keys<br>(G/n dBµV, M/µ µV, k/m mV and x1 dB(m)) | These keys add the selected unit to the entered numeric value and complete the entry.<br>For level entries (e.g. in dB) or dimensionless values, all units have the value "1" as multiplying factor. Thus, they have the same function as an [Enter] key. |

## 5.1.5    Navigation controls

The navigation controls include a rotary knob, navigation keys, and the display keys. They allow you to navigate within the display or within dialog boxes.

### 5.1.5.1    Rotary knob

The rotary knob has several functions:

- For a numeric entry, increments (clockwise direction) or decrements (counterclockwise direction) the instrument parameter at a defined step width.
- Moves the selection, e.g. to a function block in the block diagram
- Shifts the selection bar within focused areas (e.g. lists).
- Acts like the [Enter] key, when it is pressed.

### 5.1.5.2   Editing keys

Editing keys enable you to confirm an entry, delete individual characters, or exit the current operation.

*Table 5-4: Editing keys*

| Type of key | Description |
| --- | --- |
| [Esc] key | Closes all kinds of dialog boxes, if the edit mode is not active. Quits the edit mode, if the edit mode is active. In dialog boxes that contain a "Cancel" button it activates that button. |
| | For "Edit" dialog boxes, the following mechanism is used: |
| | • If data entry has been started, it retains the original value and closes the dialog box. |
| | • If data entry has not been started or has been completed, it closes the dialog box. |
| [Enter] key | Has the same effect as pressing the rotary knob |
| | • Concludes the entry of dimensionless entries. The new value is accepted. |
| | • With other entries, this key can be used instead of the default unit key. |
| | • In a dialog box, selects the default or focused element. |
| | • Calls the next dialog level. |
| | • Confirms and closes open input windows. |
| [Backspace] key | Deletes the character to the left of the cursor in editing mode. |

### 5.1.5.3   Navigation keys

As an alternative to the rotary knob or the touchscreen, you can use the navigation keys to navigate through dialog boxes, diagrams, or tables.

*Table 5-5: Navigation keys*

| Type of key | Description |
|---|---|
| [Up/Down] key | The [Up] and the [Down] key does the following:<br>• In a numeric edit dialog box, increase or decrease the instrument parameter.<br>• In a list, scroll forward and backward through the list entries.<br>• In a table, move the selection bar vertically.<br>• In windows or dialog boxes with vertical scrollbar, move the scrollbar. |
| [Left/Right] key | The [Left] and the [Right] key does the following:<br>• In an alphanumeric edit dialog box, move the cursor.<br>• In a list, scroll forward and backward through the list entries.<br>• In a table, move the selection bar horizontally.<br>• In windows or dialog boxes with horizontal scrollbar, move the scrollbar. |

## 5.1.6 Display keys

The display keys arrange different windows on the display.

*Table 5-6: Display keys*

| Display key | Assigned functions |
|---|---|
| [Home] | Returns to the initial feature screen. |
| [Next window] | Toggles between the entry fields in the taskbar. |
| [On/Off] | • Switches highlighted elements or a function block on and off.<br>• Switches between two or more settings, e.g. items of selection lists. At the end of a list, the cursor is set on the first entry again. |
| [Undo] | Reverts the last operation. |
| [User] | Adds a parameter to the user menu for quick access. |

## 5.1.7 USB

Female USB type A connector, to connect devices like a keyboard, a mouse, a memory stick, or the R&S NRP-Z3/Z4 cable for the R&S NRP power sensors.

How to: Chapter 4.8, "Connecting USB devices", on page 22

### 5.1.8 Sensor

Connector for R&S NRP sensors.

A power sensor is connected to the R&S AREG100A by inserting the male connector. To disconnect, pull the connector by its sleeve. You cannot disconnect the sensor simply by pulling at the cable or the rear part of the connector.

The R&S AREG100A supports the use of R&S NRP power sensors in various ways including the use as a power viewer.

How to: Chapter "Using Power Sensors" in the user manual

### 5.1.9 On/Standby

The [On/Standby] key switches the instrument from the standby to the ready state or vice versa.

The LED above the [On/Standby] key indicates the instrument state, see Chapter 4.12, "Switching on or off", on page 26.

## 5.2 Rear panel tour

This section provides an overview of the connectors at the rear panel of the instrument. For technical data of the connectors, refer to the data sheet.
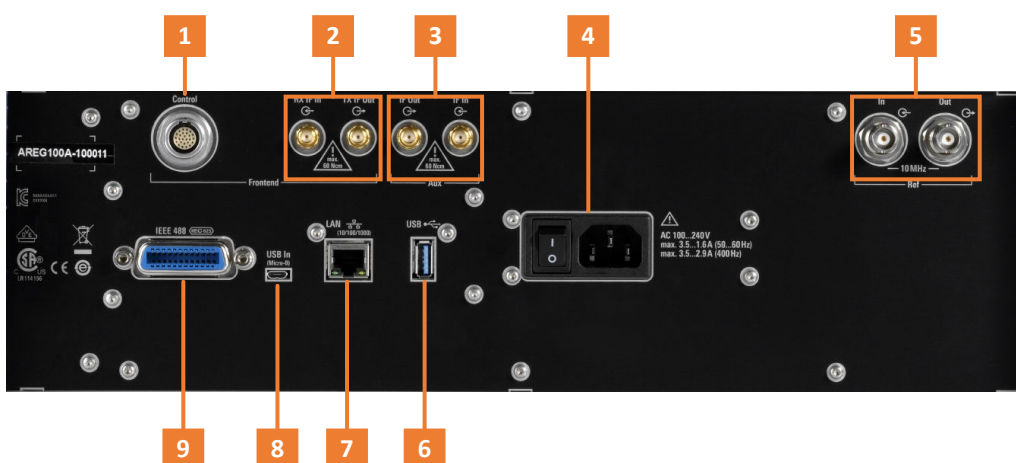


*Figure 5-3: Rear panel view of the R&S AREG100A*

1 = Frontend Control
2 = Rx IF In/Tx IF Out (SMA)
3 = Aux IF Out/Aux IF In (SMA)
4 = AC power supply connector and switch
5 = Ref In/Ref Out (BNC)
6 = USB/USB In (Type A)
7 = LAN
8 = USB/USB In (type micro-B)
9 = IEEE 488

## 5.2.1 Connectors

**Control**

Connector for connecting the frontend with the supplied control cable.

How to: Chapter 4.11, "Connecting the Frontend", on page 24.

**Rx IF In/Tx IF Out**

SMA connector for connecting the frontend with the supplied IF cables.

How to: Chapter 4.11, "Connecting the Frontend", on page 24.

**Aux IF Out/Aux IF In**

Option:R&S AREG-B17

SMA connector for output of IF signals for signal analysis and input of an additional interferer to the generated echo signal.

How to: Chapter 4.10, "Connecting to Aux IF In/Aux IF Out", on page 23.

**AC power supply connector and switch**

Mains power switch for performing the following tasks:
- Connecting the internal power supply to the power source
- Disconnecting the internal power supply from the power source

How to: Chapter 4.6, "Connecting to power", on page 21.

**Ref In/Ref Out**

Input/output for external reference signal.

BNC connectors for 10 MHz reference signals.

How to: Chapter 4.9, "Connecting to Ref In/Ref Out", on page 23

**USB/USB In**
- Female USB (universal serial bus) 2.0 connector of type A (host USB), to connect devices like a keyboard, a mouse, a memory stick, or the R&S NRP-Z3/Z4 cable for the R&S NRP power sensors
- Option: R&S AREG-B86
  Female USB 3.0 connector of type Micro-B (USB In), for example, for remote control.

How to: Chapter 4.8, "Connecting USB devices", on page 22

**LAN**
RJ-45 connector to connect the R&S AREG100A to a LAN for remote control, remote operation, and data transfer.

How to: Chapter 4.7, "Connecting to LAN", on page 21

**IEEE 488**
Option: R&S AREG-B86

General purpose interface bus (GPIB) interface for remote control of the instrument. The interface is in compliance with the standards IEC 625, IEEE 488 and SCPI.

Use this interface to connect a computer for remote control of the R&S AREG100A. To set up the connection, use high-quality shielded cables. See "Cable selection and electromagnetic interference (EMI)" on page 19.

See also "Annex: Hardware Interfaces" and chapter "Network and Remote Control" in the user manual.

## 5.3    Frontend

This section provides an overview of the connectors of the frontend of the instrument. For technical data of the connectors, refer to the data sheet.
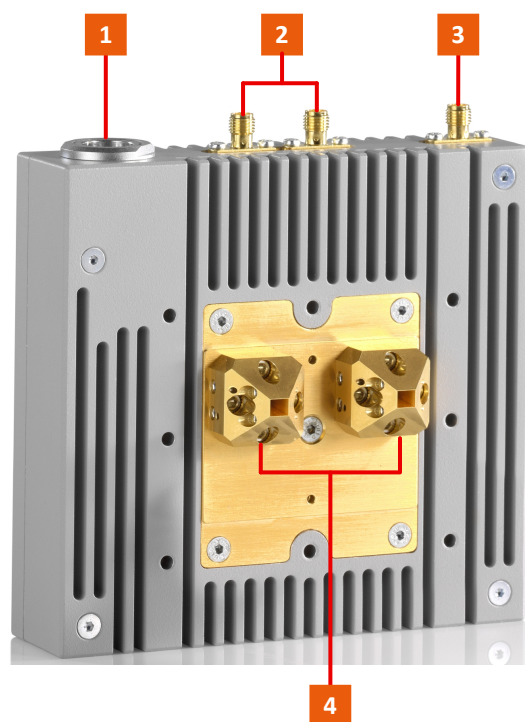
*Figure 5-4: Frontend of R&S AREG100A*

1 = Control
2 = Rx IF Out/Tx IF In (SMA)
3 = Rx Power (SMA)
4 = Waveguide port (2 x)

## 5.3.1 Connectors

**Control**

Connector for connecting to the base unit with the supplied TRX CRTL Cable.

How to: Chapter 4.11, "Connecting the Frontend", on page 24.

**Rx IF Out/Tx IF In**

SMA connectors for connecting to the base unit with the supplied "IF TX CBL"/"IF RX CBL" cables.

How to: Chapter 4.11, "Connecting the Frontend", on page 24.

**Rx Power**

SMA connector for connecting power sensors, for example for EIRP power measurements.

How to: See chapter "Typical Use Cases" in the user manual.

**Waveguide port (2 x)**
Ports for antenna connection.

Supported are different frequency ranges: 24 GHz to 24.25 GHz, 76GHz to 77GHz or 76 GHz to 81 GHz.

The R&S AREG100A is delivered with one or two antennas mounted to the wave-guide ports. The antenna type, single or dual, depends on the options you have purchased.

You can detach the included antennas and connect your own antennas.

How to: See chapter "Using Custom Antennas" in the user manual.

## 5.3.2    Cables

The frontend is delivered with two IF cables (IF TX CBL/IF RX CBL) and one control cable (TRX CRTL Cable). These cables are calibrated and dedicated to the particular frontend. Each cable has its own serial number, printed on it.

The serial numbers of the supplied cables are saved in the frontend module. You can check the serial numbers and compare them with the serial number printed on the cables. See "To check the serial number of the cables" on page 26.

**IF TX CBL/IF RX CBL**
Two IF cables for connecting the base unit and the frontend, where:
- TX|RX - transmitting and receiving direction, in respect to the base unit

How to: Chapter 4.11, "Connecting the Frontend", on page 24.

**TRX CRTL Cable**
One control cable for connecting the base unit and the frontend via the "Control" connector.

How to: Chapter 4.11, "Connecting the Frontend", on page 24.

# 6    Trying out the instrument

This chapter introduces the first steps with the R&S AREG100A. It shows how to operate and configure the instrument using simple examples. The complete description of the functionality and its usage is given in the R&S AREG100A user manual.

Basic instrument operation is described in Chapter 7, "Instrument control", on page 47.

**Prerequisites**

The instrument is set up, connected to the power supply, and started up as described in Chapter 4, "Preparing for use", on page 16.

The instrument is manually operated via the touchscreen. Try out the following:

## 6.1    Generating radar echo signals

The core element of a measurement setup is the R&S AREG100A base unit with connected frontend.

**To generate a radar echo signal**

1. In the block diagram, select "Radar Objects".

2. Select a radar object. Use the object with the range that fulfills your test requirement.

| Objects | Base Attenuation<br>*0 dB* | Units | | ✕ |
|---|---|---|---|---|
| **Object 1** | **Object 2** | **Object 3** | **Object 4** | |
| 0 | I | I | I | |
| Range   ⊘<br>      4.0 m | Range   ⊘<br>  100.0 m | Range   ⊘<br>    5.0 m | Range   ⊘<br>  300.0 m | |
| Attenuation<br>   50.0 dB | Attenuation<br>   50.0 dB | Attenuation<br>   50.0 dB | Attenuation<br>   50.0 dB | |
| Doppler Speed<br>0.000 0 km/h | Doppler Speed<br>0.000 0 km/h | Doppler Speed<br>0.000 0 km/h | Doppler Speed<br>0.000 0 km/h | |
| RCS   ⊘<br>  -61.2 dBsm | RCS   ⊘<br>  -5.2 dBsm | RCS   ⊘<br>  -57.3 dBsm | RCS   ⊘<br>  13.8 dBsm | |

3. Modify the attenuation until the display shows the appropriate value for the radar cross section (RCS), which indicates the size of the simulated radar object.

   Examples for RCS values at 79 GHz (can vary in reality):
   ● Truck: RCS =20 dBsm
   ● Car: RCS = 5 dBsm
   ● Pedestrian: RCS = −4 dBsm

4. If the attenuation range of the specific radar object is not enough to reach the appropriate RCS value, modify the base attenuation.

5. Switch on your radar object.



6. Switch "RF On".
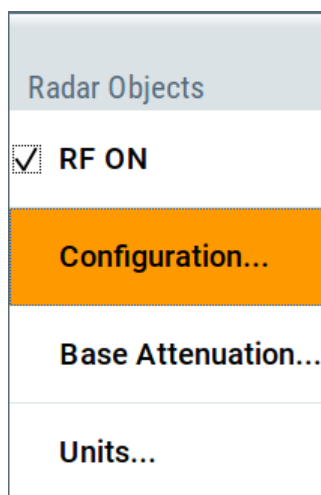


The RUT reports the range and the radar cross section of the target.
Compare these values with the pre-configured values in the R&S AREG100A.

## 6.2    Saving and recalling settings

To restore the results of our measurements later, we save the instrument settings in a file.

**To save the instrument settings in a file**

We assume, a test configuration as described in Chapter 6.1, "Generating radar echo signals", on page 40.

1.  Press the [Setup] key on the front panel.

2.  In the "Setup" menu, select "Settings > Save/Recall".

3.  In the "Save/Recall" dialog, select "Operation Mode > Save".
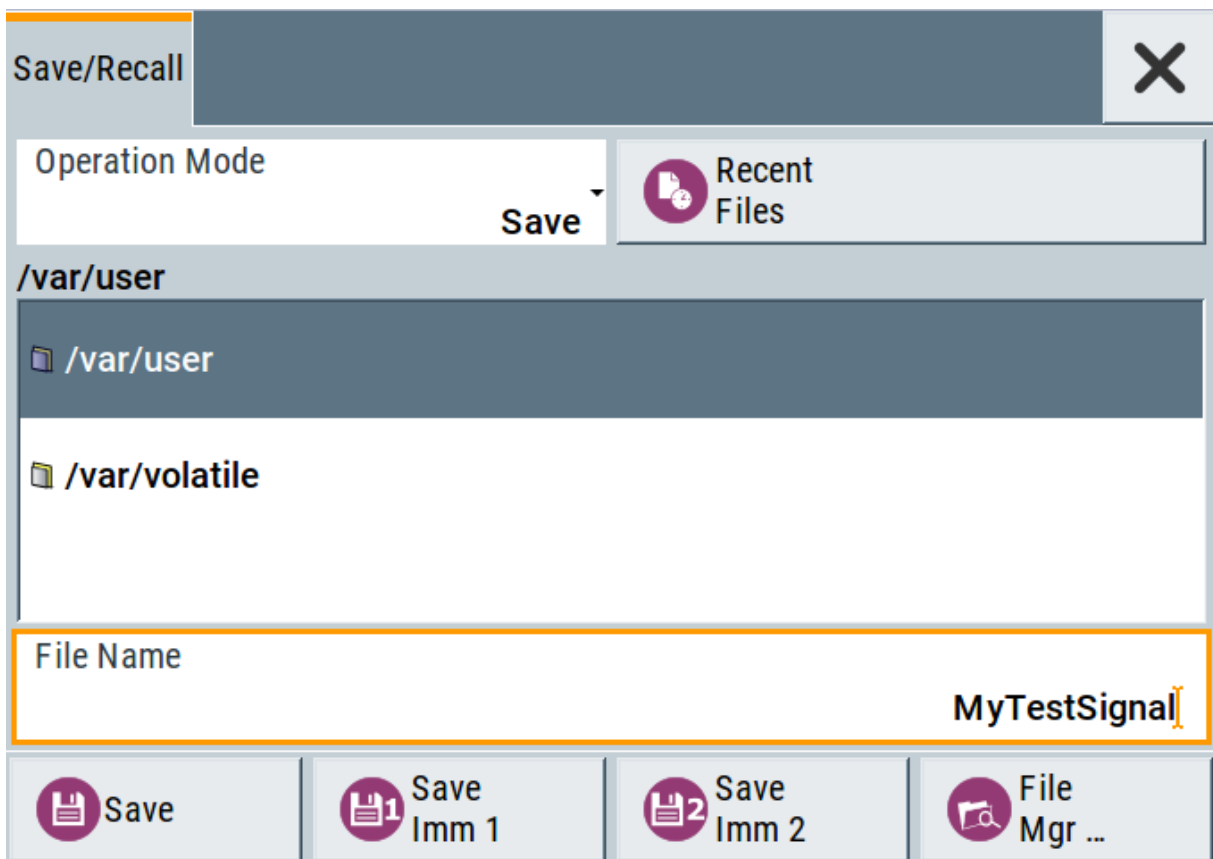


4.  Tap the "Filename", use the on-screen keyboard, and enter *MyTestSignal*.

5.  Tap the "Save" button.

    The file `MyTestSignal.savrcltxt` is stored in the default directory `/var/user/`.

**To load saved instrument settings**

You can restore the settings to the instrument at any time using the settings file.

1. Press the [Preset] button to restore the default instrument settings so you can check that the stored user settings are restored afterwards.

2. Press the [Setup] key on the front panel.

3. In the "Setup" menu, select "Settings > Save/Recall".

4. In the "Save/Recall" dialog, select "Operation Mode > Recall".
   Navigate to the directory the file is saved in and select the `MyTestSignal` file.
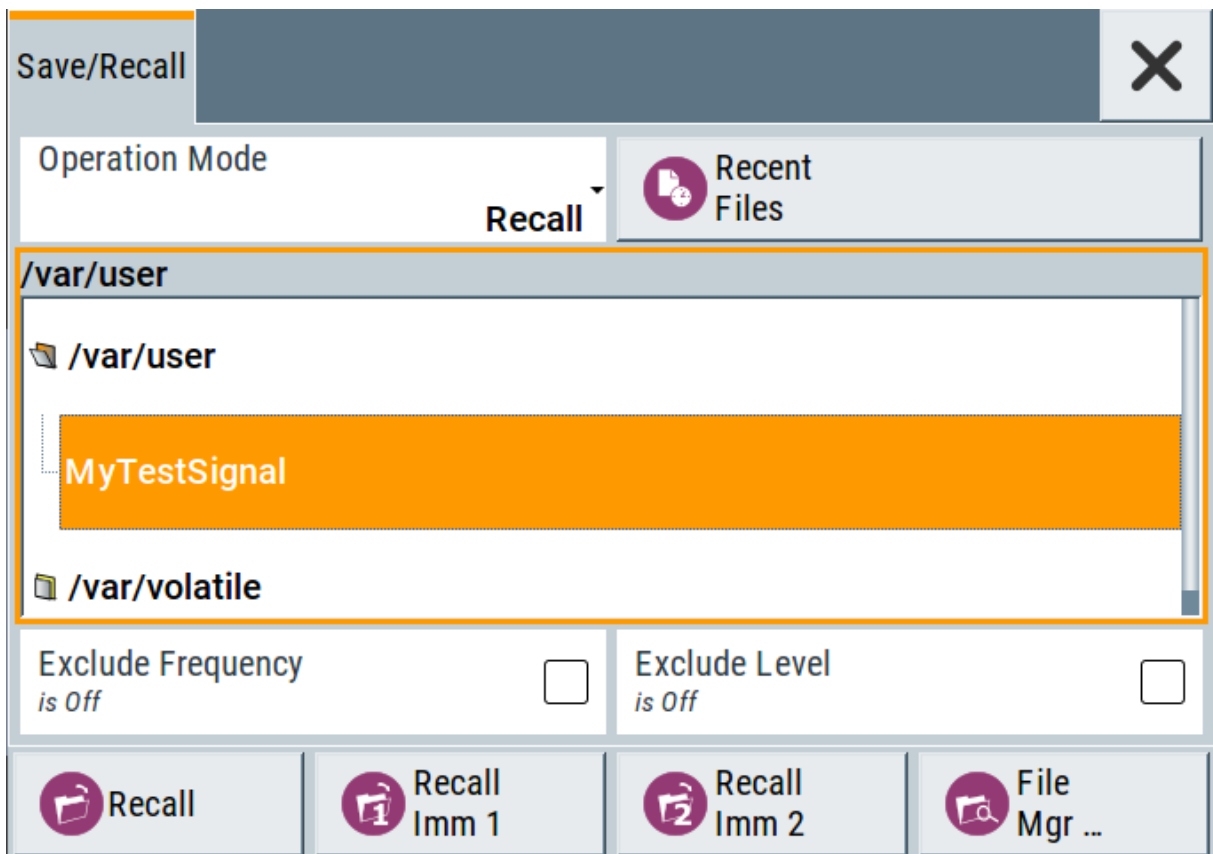


5. Tap the "Recall" button.

   All instrument settings are restored and the display resembles Chapter 6.1, "Generating radar echo signals", on page 40, which shows the instrument display right before the settings were saved.

💡 **How to display all parameters with values different to their preset values**

When you load a file to your instrument, you do not have enough information on the changed settings. In such case, it is useful to visualize all parameters that have been changed from their default state.

Try out the following:

- Touch and hold a spot in the tile diagram for at least 1 second to access the context-sensitive menu.
- Select "Mark All Parameters Changed from Preset".

| | Mark All Parameters Changed from Preset |
|---|---|
| | Start SCPI Recording |
| | Add to User Menu |
| | Undo |
| | Redo |
| | Help ... |
| | Key Emulation ... |
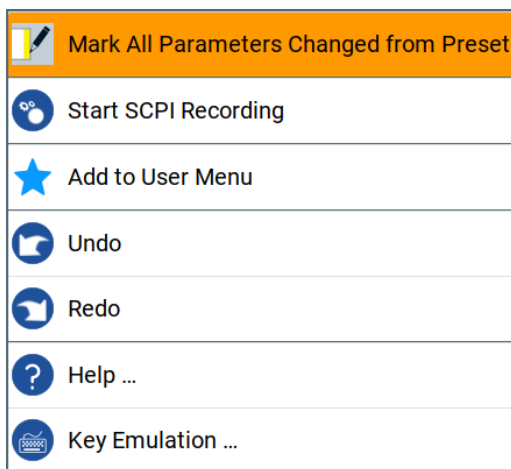
- All changed parameters are highlighted.

## 6.3 Use case example - testing radar sensors against interferers

The R&S AREG100A provides an input interface in the IF domain ("Aux IF Out" ), which allows in combination with any analog or vector signal generator the simulation of a wide range of interferers together with the wanted echoes.
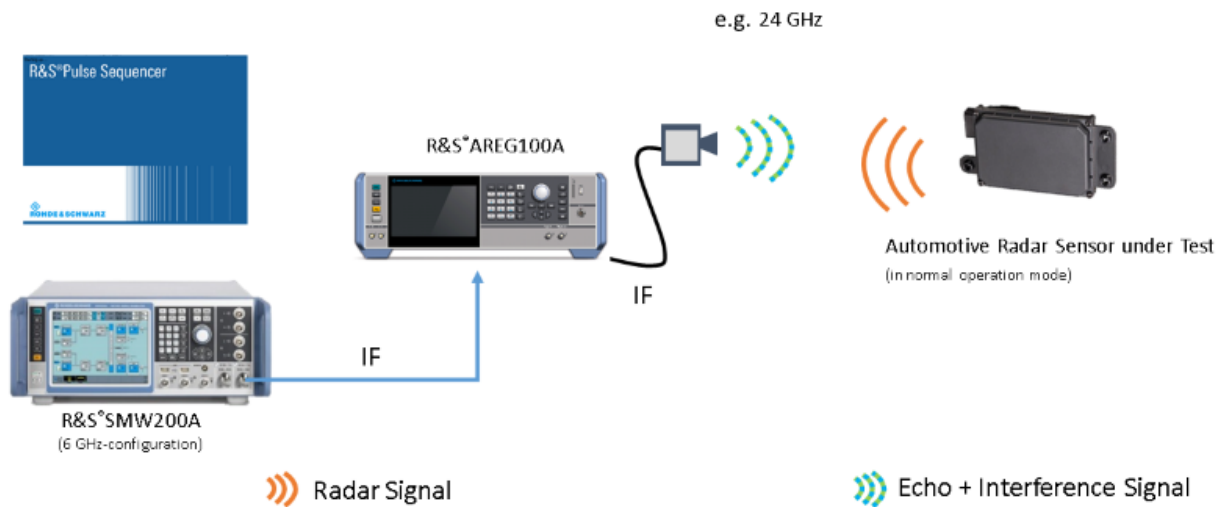
*Figure 6-1: Testing radar sensors against interferers*

1. Connect R&S SMW to the "Aux IF Out" connector of the R&S AREG100A base unit.
   See also Chapter 4.10, "Connecting to Aux IF In/Aux IF Out", on page 23.

   The generated interfering signal is superimposed and upconverted into the E-band together with the delayed echo signal from the simulated radar objects.

2. Observe and evaluate the interferer signals.

# 7    Instrument control

This chapter provides an overview on how to work with the R&S AREG100A.

It covers the following topics:

## 7.1    Possible ways to operate the instrument

There are three ways to operate the R&S AREG100A:

● Manual operation:
  Use the touchscreen, hard keys and rotary knob, or an optional mouse and/or keyboard.
  The following description shows how to operate the instrument manually.

● Remote control:
  Create programs to automatize repeating settings, tests and measurements. The instrument is connected to a computer running the program.
  This way of operation is described in the user manual, chapter "Network and Remote Control Operation".

● Remote operation from a computer:
  Remote monitoring and control of the instrument from a connected computer is based on the common cross-platform technology VNC (Virtual Network Computing). On the remote computer, any standard web browser (supporting Java) or a dedicated VNC client (like Ultr@VNC) can be used. See also Chapter 7.8, "Remote operation over VNC", on page 56.

# 7.2    Means of manual interaction

For the manual interaction with the R&S AREG100A, you have several methods that you can use as an alternative to perform a task:

● Touchscreen:
  Touchscreen operation is the most direct way to interact. Almost all control elements and actions on the screen are based on the standard operating system concept. You can tap any user interface element to set parameters in dialog boxes, enter data, scroll within a dialog etc., as if you work with a mouse pointer.

  Tapping the screen works like clicking mouse buttons:
  – Touch quickly = click: Selects a parameter or provokes an action.
  – Touch and hold = right-click: Opens a context-sensitive menu.
  – Touch and swipe = drag: Scrolls through the contents of a display element larger than the screen, e.g. a list or a table.

● Function keys and rotary knob:
  The front panel provides nearly all functions and controls to operate the instrument in the classic way, without touchscreen.

● Optional mouse and/or keyboard:
  These devices work like known from PCs. The navigation keys on the front panel correspond to the keys on the keyboard.

This manual describes the manual interaction with the instrument via the touchscreen. It mentions the alternative methods using the keys on the instrument or the on-screen keypads if it deviates from the standard operating procedures. The usage of the touchscreen and navigation keys is described in Chapter 7.4, "Accessing the functionality", on page 50.

Throughout the manual, the term "select" refers to any of the described methods, i.e. using a finger on the touchscreen, a mouse pointer in the display, or a key on the instrument or on a keyboard.

# 7.3    Understanding the display information

The home screen of the R&S AREG100A displays all main settings and generator states, divided into three main operation areas.

## 7.3.1    Additional display characteristics

The following section provides a short insight on the indication of the screen in general, and significant elements that you see under specific operating modes, in dialogs or settings.

- **Appearance of active elements**
  - *Active* elements like On/Off switches, state buttons have a **blue** background.
  - *Selected* elements are framed or highlighted **orange**.
  - *Inactive* elements are **gray**.

- **On-Screen keypads**
  As additional means of interacting with the instrument without having to connect an external keyboard, either a numerical or alphanumerical on-screen keypad appears when you activate an entry field (see Chapter 7.5, "Entering data", on page 51).

- **Info line**
  The "Info line" shows brief status information and error messages. It appears when an event generates a message. If selected, the R&S AREG100A shows information on static errors and the error history.
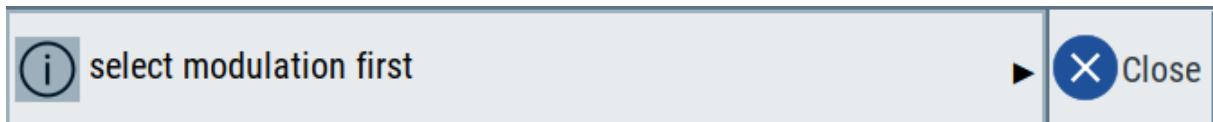


- **Key parameters indicated in tab labels**
  Most dialogs are divided into tabs with logically grouped parameters. The tab label expresses the content and can also contain status indicators or the set value of a key parameter.

- **Scroll bar handle**
  An arrow icon that appears when you touch a scroll bar helps you to scroll in a dialog or list.

- **Progress indicators**
  A busy icon indicates a currently running process. If a process takes some time, a progress bar shows the current state.

- **Context-sensitive menus**
  Within the entire screen display, including single parameters, you can access context-sensitive menus that provide some additional functions.
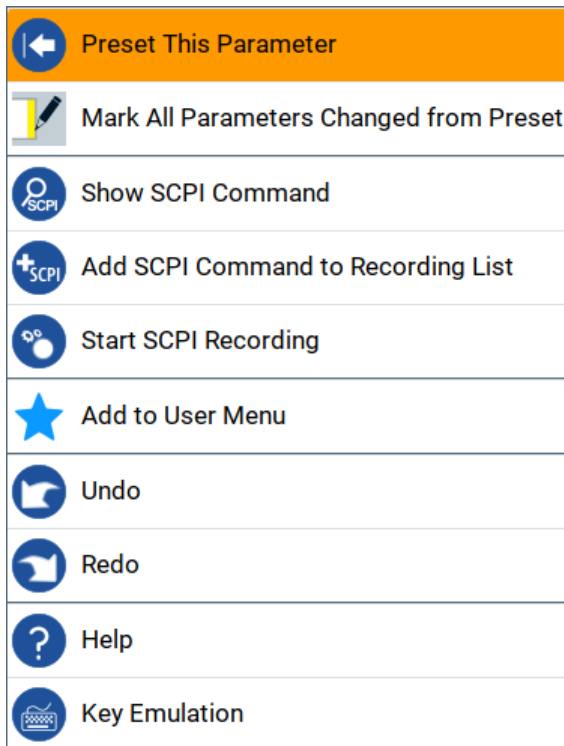
## 7.4     Accessing the functionality

All functionalities are provided in dialog boxes as known from computer programs. You can control the instrument intuitively with the touchscreen. This section provides an overview of the accessing methods.

The instrument's functions and settings can be accessed by selecting one of the following elements:

- System and function keys on the front panel of the instrument
- Taskbar/softkeys on the touchscreen
- Context-sensitive menus for specific elements on the touchscreen, or with the rotary knob (press and hold).
- Elements on the status bar in the touchscreen
- Displayed setting on the touchscreen, that means block diagram and all settings available in dialogs.

**To open a dialog box**

► Perform one of the following actions:

- Tap the required tile, and then the menu entry.
- Tap the minimized view (button) on the taskbar.

Some of the utility keys access a dedicated dialog, too.

**To minimize a dialog box**

► To return to the home screen, tap the "Home" button.

**To close a dialog box**

To close a dialog box, you have the same controls as you know from computers or devices with touchscreen.

► Perform one of the following actions:
- Tap the "Close" icon in the upper right corner.
- Press the [Esc] key on the front panel.
- Drag and drop a minimized dialog from the taskbar to the tile diagram.

**To select an option in a dialog box**

► Tap the required option.


## 7.5     Entering data

Some parameters have their own key on the front panel.

For data input in dialog boxes, the instrument provides on-screen keypads for entering numeric and alphanumeric values. Thus, you can always set the parameters via the touchscreen, the front panel, or an external keyboard.

**To correct an entry**

1. Using the arrow keys, move the cursor to the right of the entry you want to delete.

2. Press the [Backspace] key.

3. Deletes the entry to the left of the cursor.

4. Enter your correction.

**To complete the entry**

► Press the [Enter] key or the rotary knob.

**To abort the entry**

► Press the [Esc] key.
The dialog box closes without changing the settings.

## 7.5.1 Entering numeric parameters

**To enter values with the on-screen keypad**

For numeric settings, the instrument displays the numeric keypad. The units specified correspond to the units of the parameter.

1. Enter the numeric value.

   **Tip:** For quick entry, you can enter a value in exponential representation, e.g. *1e7* for *10000000*.

2. Tap the unit button to complete the entry.

   The unit is added to the entry.

   **Tip:** For quick unit change, you can enter shortcuts, e.g. for a frequency value *1e8h* for *100 MHz*.
   For an overview of shortcuts supported by the R&S AREG100A, see chapter "Unit Shortcuts" in the appendix of the user manual.

3. If the parameter does not require a unit, confirm the entered value by pressing "Enter".

**To enter values by using the front panel controls**

1. Change the currently used parameter value by using the rotary knob or the [Up/Down] keys.

2. If the parameter does not require a unit, confirm the entered value by pressing the [Enter] key or any of the unit keys.
   The instrument highlights the editing line to confirm the entry.

If you edit numeric data in tables, the entry field must be in edit mode: Press [Enter], or the rotary knob to activate the edit mode.

### 7.5.2     Entering alphanumeric parameters

If a field requires alphanumeric input, you can use the on-screen keyboard to enter letters and (special) characters.

### 7.5.3     Undo and redo actions

Accessed via the context-sensitive menus, "Undo" allows you to restore one or more actions on the instrument. Depending on the available memory, the "Undo" steps can restore all actions.
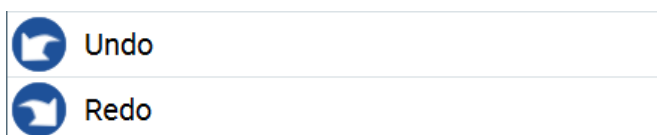


"Redo" restores a previously undone action.

## 7.6     Getting information and help

In some dialog boxes, graphics are included to explain the way a setting works.

For further information, you can use the following sources:

- Tooltips give the value range of the parameter.
- The context help provides functional description on a setting.
- The general help explains a dialog box, provides instructions, and general information.

**To display context help**

► To access a help topic, perform one of the following:
  a) Tap and hold the parameter for which you need information and tap "Help" in the context menu.
  b) Tap the parameter and press the [Help] key.

  The "Help" dialog opens. You can browse the help for further information.
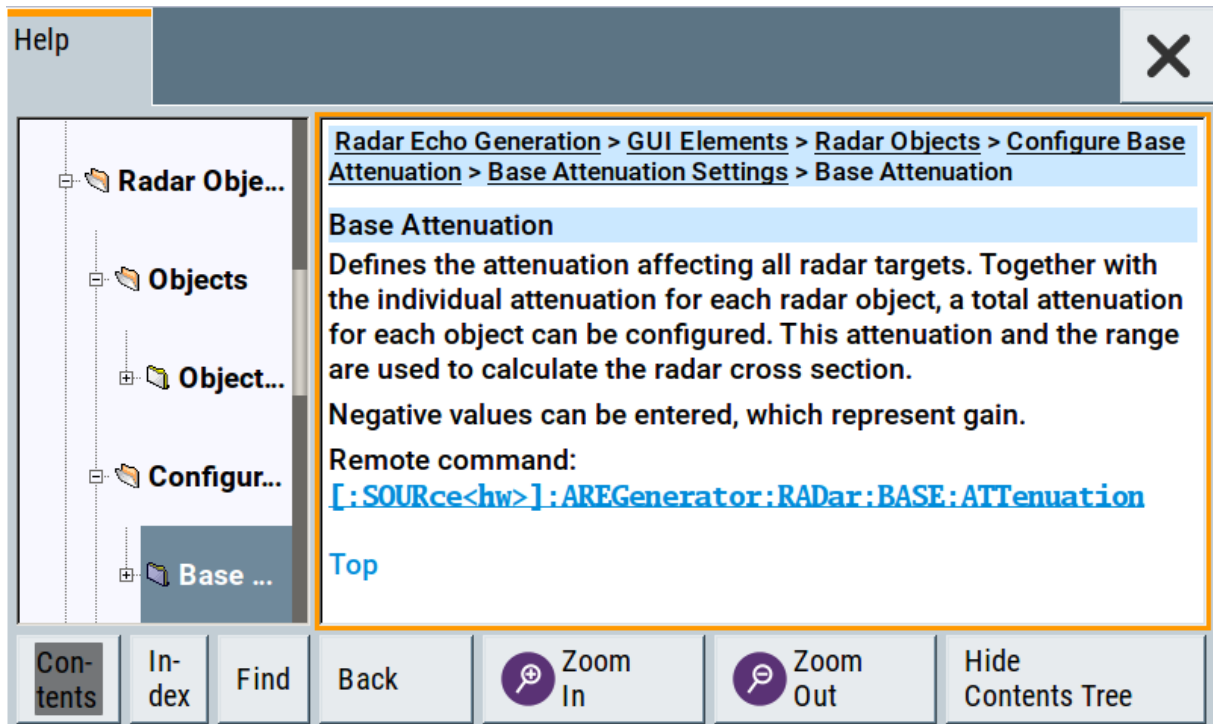
## Contents of the help dialog box

The help dialog box covers two main areas:

- "Contents" - contains a table of help contents
- "Topic" - contains a specific help topic

The help system also provides an "Index" and a "Find" area, and "Zoom" functions that are accessed via the corresponding buttons.

## To open general help

► Press the yellow [Help] key on the front panel.

If a dialog box is opened, the help topic for the current tab is shown. Otherwise the "Contents" page appears.

## Navigating in the table of contents and in the help topics

1. To move through the displayed contents entries, tap on an entry and scroll or use a connected mouse or the [Up/Down] keys.
   Entries with a plus sign contain further entries.

2. To display a help topic, tap on the topic name or double-click the topic name or press the [Enter] key.

3. To follow a cross-reference, tap on the link text.

4. To return to the previous page, select "Back".
   This function scrolls back all steps you have performed before.

5. Use the "scroll bars" to shift the visible section of content shown.

6. To maximize the "Topics" area, tap the "Hide Contents Tree" button to hide the contents tree.

**Using the index**

1. Select the "Index" button.

2. Enter the first characters of the topic you are interested in.
   The entries starting with these characters are displayed.

3. Tap on the index entry.

   The corresponding help topic is displayed.

## 7.7 Remote control

In addition to working with the R&S AREG100A interactively, located directly at the instrument, it is also possible to operate and control it from a remote PC.

The R&S AREG100A supports various methods for remote control:
● Connecting the instrument to a LAN (see Chapter 4.7, "Connecting to LAN", on page 21)
● Using the LXI browser interface in a LAN
● Connecting a PC via the IEC-bus (IEEE 488) interface
● Remote control via the USB interface

For remote control over LAN or USB, you can use the R&S VISA (Virtual Instrument Software Architecture) library provided for download at the Rohde & Schwarz website http://www.rohde-schwarz.com/rsvisa.

How to configure the remote control interfaces is described in the user manual, chapter "Network and Remote Control Operation".

## 7.8    Remote operation over VNC

The VNC is an application which can be used to access and control the instrument from a remote computer through a LAN connection. While the instrument is in operation, the instrument screen contents are displayed on the remote computer, and VNC provides access to all applications, files, and network resources of the instrument. Thus, remote operation of the instrument is possible.

💡 **Instrument control from a remote computer**

To access the basic utility functions of the R&S AREG100A, perform a right mouse click the block diagram and select "Key Emulation".

A key panel to the right of the block diagram gives access to the utility functions provided by the front panel keys.

The VNC is an add-on program, included in operating system Linux/Unix, and available as a free-of-charge download on the internet.

For more information, refer to the R&S AREG100A user manual, chapter "How to Set Up Remote Operation via VNC".

# 8     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 8-1: QR code to the Rohde & Schwarz support page*

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