

R&S® SGT100A

SGMA Vector RF Source

Getting Started



1419457602

Version 11

ROHDE & SCHWARZ

Make ideas real



This manual describes R&S®SGT100A, stock no. 1419.4501.02 and its options.

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Throughout this manual, products from Rohde & Schwarz are indicated without the ® symbol, e.g. R&S®SGT100A indicated as R&S SGT.

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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 5. 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.

Reconfigure or adjust the product only as described in the product documentation or the data sheet. Any other modifications can affect safety and are not permitted.

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 <https://www.rohde-schwarz.com/support>.

Lifting and carrying the product

The maximum weight of the product is provided in the data sheet. You can lift or carry the product by yourself, if you can manage the weight on your own. Alternatively, you can use lifting or transporting equipment. 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. Replace parts that are relevant to safety only by original parts, e.g. power cables or fuses.

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 you connect the product to an external power supply, use the one delivered with the product or recommended in the product documentation. The external power supply must conform 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.

Warning messages in the documentation


| | |
|---|---|
|  | 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 SGT

Labels on the casing inform about:

- Personal safety, see "[Connecting to power](#)" on page 7.
- 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 SGT 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 Key features

The key features of the R&S SGT include the following:

- Compact size and low power consumption
- Remote connection via PCI Express, minimizing the setup time
Alternatively, LAN or USB connections available
- Coherent LO input and output connectors, also usable as MIMO input/output and phase coherent I/Q demodulation
- Linux operating system
- Graphical user interface R&S SGMA-GUI to set up and control one or more R&S SGT instruments simultaneously from one remote computer, available for Windows and Linux systems

3 Documentation overview

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

www.rohde-schwarz.com/manual/sgt100a

3.1 Getting started manual

Introduces the R&S SGT 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.

3.2 User manual and help

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

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

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

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

3.3 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>).

3.4 Instrument security procedures

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

3.5 Basic safety instructions

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

3.6 Data sheets and brochures

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

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

See www.rohde-schwarz.com/brochure-datasheet/sgt100a

Application notes, application cards, white papers, etc.

3.7 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/sgt100a

3.8 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/sgt100a.

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 6.

- ▶ Use the carrying handles at the side for lifting and carrying the R&S SGT. 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 SGT in a rack"](#), on page 16.

4.2 Unpacking and checking

1. Unpack the R&S SGT carefully.
2. Retain the original packing material. Use it to protect the control elements and connectors when transporting or shipping the R&S SGT 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.

For safety information, see "[Choosing the operating site](#)" on page 6.

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.

- 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 SGT

See also:

- ["Setting up the product"](#) on page 6
- ["Intended use"](#) on page 5

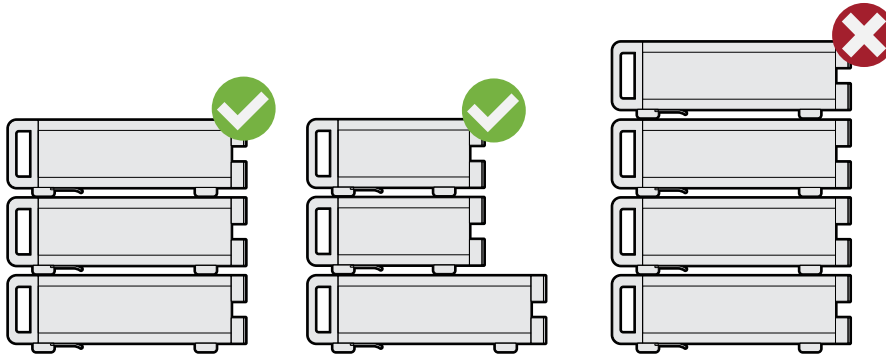
4.4.1 Placing the R&S SGT on a bench top

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. **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.

Setting up the R&S SGT

- 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

3. **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 SGT in a rack

To prepare the rack

1. Observe the requirements and instructions in ["Setting up the product"](#) on page 6.
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 SGT in a rack

1. Use an adapter kit that fits the dimensions of the R&S SGT to prepare the instrument for rack mounting.
 - a) Order the rack adapter kit designed for the R&S SGT. For the order number, see data sheet.

Considerations for test setup

- b) Mount the adapter kit. Follow the assembly instructions provided with the adapter kit.
2. Push the R&S SGT onto the shelf until the rack brackets fit closely to the rack.
3. Tighten all screws at the rack brackets with a tightening torque of 1.2 Nm to secure the R&S SGT in the rack.

To unmount the R&S SGT from a rack

1. Loosen the screws at the rack brackets.
2. Remove the R&S SGT from the rack.
3. If placing the R&S SGT on a bench top again, unmount the adapter kit from the R&S SGT. 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:
 - SMA/SMB
Double-shielded SMA/SMB cables.
How to: [Chapter 4.8, "Connecting to RF 50Ω"](#), on page 19
 - USB
Double-shielded USB cables.
How to: [Chapter 4.13.4, "Connecting a controller via USB"](#), on page 31.
 - LAN
At least CAT6 STP cables.
How to: [Chapter 4.7, "Connecting to LAN"](#), on page 19
- Always terminate open cable ends.
- Ensure that connected external devices comply with EMC regulations.
- Use cables of the same type and equal length for connection to the I/Q and I/Q Bar interfaces of the instrument.

- Use the cable R&S SMU-Z6 for connection to the "DIG I/Q" interface of the instrument. The cable is available under material number 1415.0201.02.

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 SGT and connected devices.

Preventing electrostatic discharge (ESD)

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

- ▶ **NOTICE!** 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.

4.6 Connecting to power

For safety information, see "[Connecting to power](#)" on page 7.

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 SGT.
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.

There is no need to set the voltage manually or change fuses.

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 on the [rear panel](#).

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

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

4.8 Connecting to RF 50Ω

The connector is on the [rear panel](#).

Option R&S SGT-B88: The RF output connector is on the [front panel](#).

To prepare for connecting to RF 50Ω

1. **NOTICE!** Damaged or not clean connections can lead to RF insertion loss and mismatch, and even premature wear of the connectors.

Before connecting to the port, inspect the RF connector visually to check that it is clean, undamaged and mechanically compatible.

See the application note [1MA99](#) for information on how to handle and maintain the RF port, to minimize measurement deviations and ensure its longevity.

Connecting to RF 50Ω

2. **NOTICE!** Risk of instrument damage. Excessive reverse power or DC voltage at the RF 50Ω connector can damage the instrument.

Make sure that the values do not exceed the reverse power and DC limits as given in the data sheet.

3. If switched-on, deactivate the RF output of the R&S SGT, before connecting an RF cable to the RF 50Ω connector.
On the front panel, press the [RF ON] key.

To connect to screwable connectors

Additional to the RF 50Ω connector, the following procedure holds for all screwable connectors of the R&S SGT. Screwable connectors include connector types as listed in [Table 4-1](#).

1. Use a high-quality cable that matches the connector type.
See "[Cable selection and electromagnetic interference \(EMI\)](#)" on page 17.
2. **NOTICE!** Excessive tightening can damage the connectors.
To connect the cable with the connector, proceed as follows:
 - a) Carefully align the connector of the cable and the 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.
For torque limits of the most relevant connector types, see [Table 4-1](#). For more information, see chapter "Handling" of the application note [1MA99](#).
3. Torque the nut to the specified limit using a calibrated torque wrench. Hold the opposite connector part stationary with a spanner.

Table 4-1: Connector types and torque limits

| Type | Torque limit | | Nut opening | |
|------------|--------------|------|-------------|----|
| | lb-Inch | Nm | Inch | mm |
| N | 13.3 | 1.5 | 3/4 | 20 |
| SMA SMB | 5 | 0.56 | 5/16 | 8 |

To prevent RF output switch-off

- ▶ **NOTICE!** If you set a too high output level without a load connected to the instrument, the reverse power can exceed a limit forcing the R&S SGT to switch off the RF output.

Connect a load with sufficient return loss.

4.9 Connecting to non-screwable connectors

Non-screwable connectors of the R&S SGT are BNC type connectors on the [rear panel](#).

- ▶ To connect the RF cable with the RF 50Ω connector, proceed as follows:
 - a) Carefully align the connector of the cable and the RF 50Ω 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 RF 50Ω connector.

4.10 Switching on or off

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

Table 4-2: 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 SGT

The R&S SGT is off but connected to power. See [Chapter 4.6, "Connecting to power"](#), on page 18.

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

The LED of the [POWER ON/STANDBY] key is orange.

2. If equipped with an oven-controlled oscillator (OCXO), option R&S SGT-B1, wait until the OCXO warms up.
For the warm-up time, see data sheet.
3. Press the [POWER ON/STANDBY] key.
Key and LED are on the [front panel](#).
The LED changes to green. The R&S SGT boots.

When starting for the first time, the R&S SGT starts with the default settings. When restarting the instrument, the settings depend on the instrument configuration before shut-down.
See the chapter "File Menu" in the user manual.

To perform functional checks

When the instrument is switched on, it automatically monitors main functions. You can query erroneous functions.

See chapter "Error Messages and Troubleshooting" in the user manual.

In addition to the automatic monitoring, the R&S SGT offers the following capabilities to ensure correct functioning:

- Internal adjustments
In the R&S SGMA-GUI, select the "Instrument > Setup > Internal Adjustments" dialog to access the dialog for performing and configuring the adjustments settings. A maximum level accuracy can be obtained, for instance.
- Selftest
A selftest is provided for service purposes ("SGMA-GUI > Instrument > Diagnostic/Test > Self Test").

To switch between standby and ready state

- ▶ Press the [POWER ON/STANDBY] key briefly to switch the instrument from the standby to ready state or vice versa.

In ready state, the button is green. The instrument is ready for operation. All modules are power-supplied and the R&S SGT initiates its startup procedure. In standby state, the button is orange. The standby power only supplies the power switch circuits and built-in oscillator to keep it at its operating temperature. The remote control system is **not** active.

To start up and boot

The instrument boots the operating system and starts the instrument firmware. During the booting process, the green [POWER ON/STANDBY] key blinks. If the previous session was terminated regularly, the instrument uses the last setup with the relevant instrument settings.

Once the startup procedure has been terminated, the instrument is ready for operation.



In the R&S SGMA-GUI, select "Instrument > Preset" function to return the instrument to its defined reset/preset state, if the current setup is no longer relevant.

To customize the start settings, use the "SGMA-GUI > File > Save As/Open" function.

To shut down the product

The product is in the ready state.

- ▶ Press the [POWER ON/STANDBY] key.

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

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

To disconnect from power

The R&S SGT 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 [POWER ON/STANDBY] key is switched off.
2. Disconnect the R&S SGT from the power source.

4.11 Checking default settings

When the instrument is switched on, it is not the preset state that is active, but rather the instrument state that was set before the instrument was switched off. It is recommended that you use the "SGMA-GUI > Instrument > Preset" function to return the instrument to its defined preset state every time a new configuration is required or the current setup is no longer relevant.

The R&S SGT offers a two-stage preset concept:

- Preset the instrument to a predefined state.
The "SGMA-GUI > Instrument Name > Preset" function calls up a defined instrument setup. All parameters and switching states are preset. The default instrument settings provide a reproducible initial basis for all other settings. However, functions that concern the integration of the instrument into a measurement setup are not changed.
- Preset the instrument to its factory settings.
The instrument can also be forced to load its default factory settings. To access the corresponding dialog box, select the "SGMA-GUI > Instrument Name > Setup > Factory Preset" function.
For more information and an overview of the settings affected by the factory preset function, see section "Factory Preset" in the R&S SGT user manual.



User-defined instrument states can be stored and called up using the functions "SGMA-GUI > File > Save As/Open".

4.12 Working with Linux operating system

The instrument uses an embedded Linux operating system, optimally adapted to the instrument.



Accessing the operating system

No access to the operating system is required for normal operation. All necessary system settings can be made in the "Setup" dialog.

4.13 Connecting an external PC and devices

For control and operation, the R&S SGT requires a connection to an external device. The external device, e.g. an external PC, controls the R&S SGT via remote control or manual operation via the R&S SGMA-GUI software installed on the external PC.

Both the remote control and the manual operation of the instrument require an external controller. For the prerequisites and the instructions on how to configure an external controller for remote control, refer to the user manual. A brief introduction to the remote control capabilities is provided in [Chapter 7.2, "Network operation and remote control"](#), on page 53.

This section gives an introduction on how to configure the external PC for manual operation. See [Chapter 4.13.1, "Installing the R&S SGMA-GUI software"](#), on page 25.

In addition to connecting an external controller, you can connect other external devices, e.g. a memory stick. The following interfaces are on the [rear panel](#) of the R&S SGT:

- "LAN": [Chapter 4.13.2, "Connecting a remote PC via LAN"](#), on page 27
- "PCIe": [Chapter 4.13.3, "Connecting a controller via PCI Express"](#), on page 31
- "USB IN": [Chapter 4.13.4, "Connecting a controller via USB"](#), on page 31

4.13.1 Installing the R&S SGMA-GUI software

The R&S SGMA-GUI software is a graphical user interface program for one or more instruments. It runs on a remote PC.

The R&S SGMA-GUI software is provided as separate installation package for the different operating systems. The latest version of the software together with the release notes is available for download at:

<http://www.rohde-schwarz.com/product/SGT100A.html> > "Downloads" > "Software"

This page always offers the latest information on your R&S SGMA-GUI.

The R&S SGMA-GUI installation package for Windows 64-bit operating system consists of the file `SGMA-GUI_<version_number>.exe`. The version number

Connecting an external PC and devices

within the file name (`<version_number>=v.vv.vvv.vv`) varies with each update.

To install the R&S SGMA-GUI, check that you PC and drivers fulfill the following hardware and software requirements.

Table 4-3: Hardware and software requirements

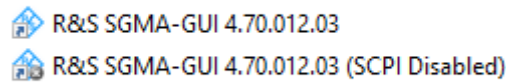
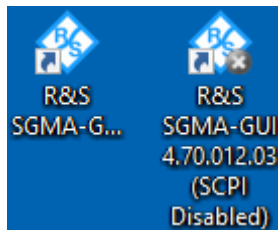
| Requirement | Remark |
|--|---|
| Operating system: Windows 10, 1607 "Anniversary Edition" and later | Install R&S SGMA-GUI on one of the supported operating systems. Also, make sure that Microsoft offers support for the version of the operating system. Note: Any other Windows version or other operating systems are not supported. During installation, the operation system is checked. The installation is terminated if this requirement is not fulfilled. |
| System type: <ul style="list-style-type: none"> 64-bit operating system x64-based or x86-based processor | You can only run the latest software on a 64-bit operating system. |
| R&S VISA | VISA drivers can be obtained on the Rohde & Schwarz website: http://www.rohde-schwarz.com/rsvisa |
| CPU | At least Pentium or compatible, as from 1 GHz (recommended). |
| VGA color display resolution | At least 800*600 pixels |

Installing a new software version

1. Download the R&S SGMA-GUI software.
2. In Windows Explorer, navigate to the download folder of the installation file `SGMA-GUI_v.vv.vvv.vv.exe` (`<version_number>=v.vv.vvv.vv`).
3. Open the installation file using administrator rights.
4. Follow the instructions in the installation wizard.

After the installation of the R&S SGMA-GUI software, two icons will be shown in your Windows menu: one is the standard version and one for which the remote command of the software through SCPIs is disabled. The SCPI disabled version allows you to install and use the R&S SGMA-GUI on other instruments, without interfering with the remote control of the host instrument.

Connecting an external PC and devices



Start the version that is required for your application.

Uninstalling an old software version

You can uninstall a previous version of the software before the installing a new software version, but this step is not mandatory.

1. To uninstall this version, go to "Start > Settings > Control Panel > Add/Remove Programs".
2. Select the entry `SGMA-GUI_v.VV.VVV.VV`.

The script file identifies and removes all currently installed R&S SGMA-GUI software items.

4.13.2 Connecting a remote PC via LAN

The R&S SGT is equipped with a network interface and can be connected to an Ethernet LAN (local area network). The interface can be used, for example:

- To connect an external computer for manual control of the instrument by the R&S SGMA-GUI software.
- To operate the device by a remote control program.
See [Chapter 7.2, "Network operation and remote control"](#), on page 53.

This section describes how to configure the LAN interface. It covers the following topics:

- [Connecting to the network](#)..... 27
- [Assigning the IP address](#)..... 29
- [Adding instruments to R&S SGMA-GUI](#)..... 30

4.13.2.1 Connecting to the network

There are two methods to establish a LAN connection to the instrument:

Connecting an external PC and devices

- A non-dedicated network (Ethernet) connection from the instrument to an existing network.
- A dedicated network connection (Point-to-point connection) between the instrument and a single computer.

In both cases, an IP address has to be assigned to the instrument and the computer, see [Chapter 4.13.2.2, "Assigning the IP address"](#), on page 29.

Setting up a non-dedicated network (LAN) connection

- ▶ See [Chapter 4.7, "Connecting to LAN"](#), on page 19.

Setting up a dedicated network connection

If your network does not support DHCP, set a dedicated network connection between a stand-alone PC and a R&S SGT.


Prerequisite: The external PC and the R&S SGT are turned on and running.

1. Start the R&S SGMA-GUI.
2. **NOTICE!** Risk of network failure.
Consult your network administrator before performing the following tasks:
 - Connecting the instrument to the network
 - Configuring the network
 - Changing IP addressesErrors can affect the entire network.
Connect the computer and the R&S SGT with a LAN network cable.
3. Wait for about one minute for the automatic assignment of IP addresses to complete.
4. R&S SGMA-GUI main panel, select "Setup > Instruments".
5. In the "Configure Instruments" dialog, click "Scan".
The new instrument appears with a Zeroconf IP address 169.254.xx.yy.
6. To assign a static IP address to the instrument, see ["Assigning a static IP address to the R&S SGT"](#) on page 29.
7. To assign a static IP address to the PC, see ["Assigning a static IP address to your Windows-PC network card"](#) on page 29.

4.13.2.2 Assigning the IP address

Depending on the network capacities, the TCP/IP address information for the instrument can be obtained in different ways.

- If the network supports dynamic TCP/IP configuration using the Dynamic Host Configuration Protocol (DHCP), all address information can be assigned automatically.
- If the network does not support DHCP, the instrument tries to obtain the IP address via Zeroconf (APIPA) protocol. If this attempt does not succeed or if the instrument is set to use, alternate TCP/IP configuration, the addresses must be set manually, see "[Setting up a dedicated network connection](#)" on page 28.

 The R&S SGT uses the Zeroconf IP addresses 169.254.xxx.yyy, where xxx takes values from 1 to 254 and yyy the values from 1 to 255. The subnet mask is always 255.255.0.0. The IP address of the host must be within the same address area for Zeroconf.

Assigning a static IP address to the R&S SGT

Prerequisites: A connection is established between the R&S SGT and the controller with installed SGMA-GUI.

For how to set up a LAN connection, see [Chapter 4.13.2.1, "Connecting to the network"](#), on page 27.

For how to set up a USB connection, see "[Setting up a USB connection from a PC to the R&S SGT](#)" on page 31.

1. Open "SGMA-GUI > Instrument > Setup > Network Settings" dialog.
2. Set the "Address Mode" to "Static".
3. Enter the "IP Address", for example *192.168.0.1*.
4. Enter the "Subnet mask", for example *255.255.255.0*.
5. Enter the "Default Gateway", for example *192.168.0.1*.

Assigning a static IP address to your Windows-PC network card

1. Obtain the IP address and subnet mask for the R&S SGT and the IP address for the local default gateway from your network administrator. If necessary, also obtain the name of your DNS domain and the IP addresses of the DNS

Connecting an external PC and devices

and WINS servers on your network. If you use more than one LAN connector, you need separate address information for each connector.

2. Press the "Windows" key to access the operating system.
3. Open the "Control Panel" by selecting "Start > Settings > Control Panel".
4. Select "Network and Sharing Center".
5. In the left panel, click "Change adapter settings".
6. Select the network adapter that you want to change. Click "Change settings of this connection".
7. On the "Networking" tab, click "Internet Protocol Version 4 (TCP/IPv4)". Select "Properties".
8. Select "Use the following IP address".
9. Enter the address information as obtained from the network administrator.
10. If necessary, you can also select "Use the following DNS server addresses" and enter your own DNS addresses.

For more information, refer to your Windows system help.

4.13.2.3 Adding instruments to R&S SGMA-GUI



For information on how to install the R&S SGMA-GUI software, refer to [Chapter 4.13.1, "Installing the R&S SGMA-GUI software"](#), on page 25.

1. For each new instrument perform the following steps:
 - a) Connect the instrument to the network.
 - b) Press the [POWER ON/STANDBY] key to switch on the instrument.
 - c) Wait until the [POWER ON/STANDBY] LED is green and not blinking.
 - d) Press the [ID] key on the front panel of the instrument.
2. Start the SGMA-GUI on a computer connected to the same network.
3. Open the "Instruments" dialog.
4. Select "Scan".

Connecting an external PC and devices

Note: This step is performed automatically on the first start and can also be omitted for instruments with a direct LAN connection to the computer.

All instruments are added automatically to the main panel of the SIGMA-GUI.

4.13.3 Connecting a controller via PCI Express

Using the "PCIe" interface for remote control of the R&S SGT requires extended knowledge. See section "Advanced Remote Control Using PCIe" in the user manual.

4.13.4 Connecting a controller via USB

The USB interface on the rear panel of the R&S SGT allows you to connect either a USB device or use the R&S SGT as a device and connect it to a controller.

Connecting a controller (host PC or compatible signal generator)

If you connect a controller (host PC or compatible signal generator) to the R&S SGT, the R&S SGT acts as a USB device.

To connect the controller to the USB interface of the R&S SGT, always connect the **USB type Micro-B** connector to the R&S SGT. Refer to the documentation of the controller to find out which USB connector type you can connect to the controller.

The [Figure 4-1](#) illustrates schematically the required connector type to emphasize on the different connector shape.

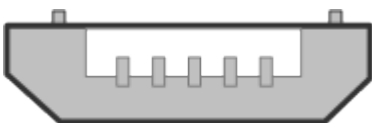


Figure 4-1: USB type Micro-B connectors

An external PC with installed R&S SIGMA-GUI is required for manual operation of the R&S SGT.

Setting up a USB connection from a PC to the R&S SGT

If your network does not support DHCP, you can set a USB connection between a PC and a R&S SGT.

Connecting an external PC and devices

Prerequisite: the computer and the R&S SGT are turned on and running.

1. Start the R&S SGMA-GUI.
2. Connect the computer and the R&S SGT with a USB cable.
In the "Setup > Instruments > Configure Instruments" table, the new instrument appears automatically.
If it does not appear, open the "Setup > Instruments > Configure Instruments" dialog and select "Scan".
3. If your network does not support DHCP, you can now set a static IP address to your computer.
 - a) To assign a static IP address to the instrument, see ["Assigning a static IP address to the R&S SGT"](#) on page 29.
 - b) To assign a static IP address to the PC, see ["Assigning a static IP address to your Windows-PC network card"](#) on page 29.

Connecting a USB device

If you connect a USB device (memory stick, CD-ROM, an instrument) to the R&S SGT, the R&S SGT acts as a host.

To connect a USB device to the interface of the R&S SGT, always connect the **USB type Micro-A** connector to the R&S SGT. Refer to the documentation of the USB device to find out which USB connector type you can connect to the USB device.

The [Figure 4-2](#) illustrates schematically the required connector type to emphasize on the different connector shape.

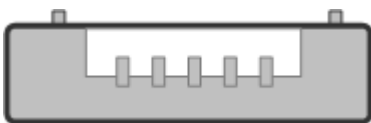


Figure 4-2: USB type Micro-A connectors

5 Instrument tour

This chapter explains the control elements and the connectors of the R&S SGT. The views of the front panel and the rear panel help you to get familiar with the instrument and to perform first steps. For specifications of the interfaces, see the data sheet.

The meanings of the labels on the R&S SGT are described in [Chapter 1.2, "Labels on R&S SGT"](#), on page 8.

5.1 Front panel tour

This section provides an overview of control elements on the front panel of the R&S SGT. The front panel contains LEDs to inform you about the status of the instrument, in particular for remote control of the R&S SGT.

The connectors of the R&S SGT are on the [rear panel](#).

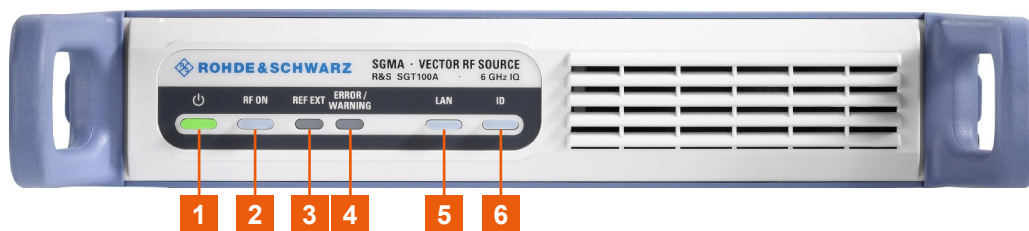


Figure 5-1: R&S SGT front panel controls

- 1 = [POWER ON/STANDBY]
- 2 = [RF ON]
- 3 = [REF EXT]
- 4 = [ERROR / WARNING]
- 5 = [LAN]
- 6 = [ID]

[POWER ON/STANDBY]

The [POWER ON/STANDBY] key switches the instrument from the standby to the ready state or vice versa.

The LED above the [POWER ON/STANDBY] key indicates the instrument state, see [Table 4-2](#).

How to:



- [Chapter 4.10, "Switching on or off"](#), on page 21

- ["To switch between standby and ready state"](#) on page 22

[RF ON]

The [RF ON] key switches the RF signal on or off. If activated, the key is green.

Table 5-1: Overview of RF signal states

| [RF ON] state | LED | Remark |
|---------------|---|---|
| On |  green | RF signal output at the RF 50Ω connector. |
| Off |  gray | No RF signal output. |




How to: [Chapter 4.8, "Connecting to RF 50Ω"](#), on page 19

[REF EXT]

The [REF EXT] key activates synchronization to an external reference signal.

Use the "USER 1/2" on the rear panel for input of the external reference signal.




Table 5-2: Overview of external reference signal states

| [REF EXT] state | LED | Remark |
|-----------------|---|--|
| Synchronized |  green | R&S SGT synchronizes to the external clock signal. |
| Error |  red | R&S SGT cannot synchronize to the external clock signal. |
| Off |  gray | The internal reference signal is used. |

[ERROR / WARNING]

The [ERROR / WARNING] LED indicates the status of the R&S SGT.

Table 5-3: Overview of [ERROR / WARNING] key states

| [ERROR / WARNING] state | LED | Remark |
|-------------------------|---|---|
| Error |  red | Error occurred, e.g. temperature exceeded or power failure. |
| Running process |  blinking orange | Indicates a running process (e.g calibration, self-test). |
| No error |  gray | No errors or warnings occurred. |

See also section "Error Messages and Troubleshooting" in the R&S SGT user manual.

[LAN]

The [LAN] key indicates the LAN connection state.

Pressing the [LAN] key resets the network settings, e.g., "IP Address Mode" is reset to "DHCP".

Table 5-4: Overview of LAN connection states

| [LAN] state | LED | Remark |
|-----------------|-------------------|--|
| Connected | ● green | Connected to the network. |
| Running process | ✳ blinking orange | Resets the network settings, applies the default settings. |
| Error | ● red | Network error occurred. |
| Off | ● gray | Disconnected from the network. |

How to:

- [Chapter 4.7, "Connecting to LAN"](#), on page 19
- [Chapter 4.13.2, "Connecting a remote PC via LAN"](#), on page 27

[ID]

The [ID] key allows you to identify your R&S SGT, e.g. in complex test setups with more instruments.

The following applies if the R&S SGT is connected to a remote controller with R&S SGMA-GUI installed:

- Press the [ID] key identify your R&S SGT on the remote controller. In the dialog "SGMA-GUI > Setup > Instruments > Configure Instruments > Edit Instrument", the R&S SGT is active.
- Set "Edit Instrument > Device Identify > On" to identify your R&S SGT from the remote controller. The LED of the [ID] key is orange and blinking.

Table 5-5: Overview of [ID] key states

| [ID] state | LED | Remark |
|----------------|-------------------|--------------------------------|
| Identification | ✳ blinking orange | Identification of the R&S SGT. |
| Off/Inactive | ● gray | No identification. |

5.2 Rear panel tour

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

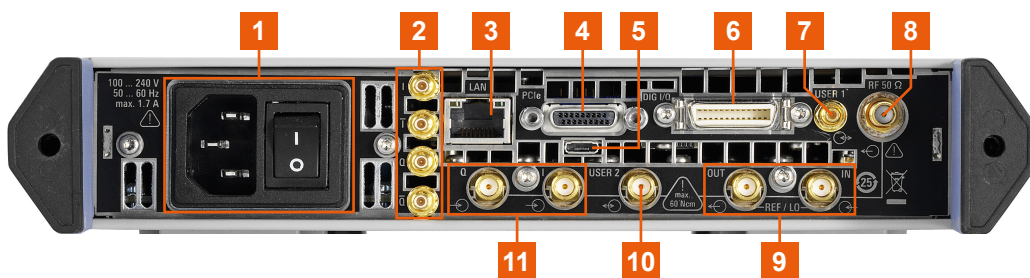


Figure 5-2: R&S SGT rear panel controls and connectors

- 1 = AC power supply connector and power switch
- 2 = I/Q, I/Q Bar
- 3 = LAN
- 4 = PCIe
- 5 = USB IN
- 6 = DIG I/Q
- 7, 10 = USER 1/2
- 8 = RF 50Ω
- 9 = LO IN, LO OUT, REF IN, REF OUT
- 11 = I/Q

AC power supply connector and power 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 18

I/Q, I/Q Bar

SMB male connectors for output of direct (single-ended) or analog I/Q signals.

How to: [Chapter 4.8, "Connecting to RF 50Ω"](#), on page 19

LAN

RJ-45 connector to connect the R&S SGT to a LAN for remote control.

How to:

- [Chapter 4.7, "Connecting to LAN"](#), on page 19
- [Chapter 4.13.2, "Connecting a remote PC via LAN"](#), on page 27

PCIe

PCIe (Peripheral Component Interconnect Express) single lane interface for remote control with optimized speed.

How to: "Connecting the Controller and the Instrument" in the R&S SGT user manual.

USB IN

USB (universal serial bus) type Micro-B connector for remote control via various external devices.

How to: [Chapter 4.13.4, "Connecting a controller via USB"](#), on page 31

DIG I/Q

Connector for the input of a digital I/Q signal from a Rohde & Schwarz instrument, like a signal generator.

USER 1/2

"USER 1" is an SMB connector, "USER 2" is an SMA female connector.

Both connectors are multipurpose connectors for input signals and output signals, e.g., for the following signals: "Trigger", "Marker 1/2", "Clock In/Out", "Sync In/Out". Also, use the "USER 2" connector for input of an external pulse modulator signal.

How to: [Chapter 4.8, "Connecting to RF 50Ω"](#), on page 19

RF 50Ω

SMA female connector for output of the RF signal.

How to: [Chapter 4.8, "Connecting to RF 50Ω"](#), on page 19

LO IN, LO OUT, REF IN, REF OUT

SMA female type connectors, for reference or local oscillator signals, and alternatively also in MIMO setups.

Reference input and output:

- "REF IN": Input for external reference signal.
- "REF OUT": Output of internal reference signal.

Local oscillator input and output connectors:

- "LO IN": Input for external LO signals
- "LO OUT": Output of internal LO signals.

How to: ["To connect to screwable connectors"](#) on page 20

I/Q

SMA female connectors for input of external I/Q signals. The signals are fed directly into the I/Q modulator.

How to: ["To connect to screwable connectors"](#) on page 20

5.3 Connector extension unit (R&S SGT-B88)

This chapter provides an overview of control elements and connectors of the R&S SGT connector extension unit.

 Order the R&S SGT connector extension unit R&S SGT-B88 together with a new R&S SGT instrument.

You cannot extend an existing R&S SGT unit.

5.3.1 Front panel

This section provides an overview of the connectors on the front panel of the extension unit. For an overview of the front panel connectors of the R&S SGT, refer to [Chapter 5.1, "Front panel tour"](#), on page 33.

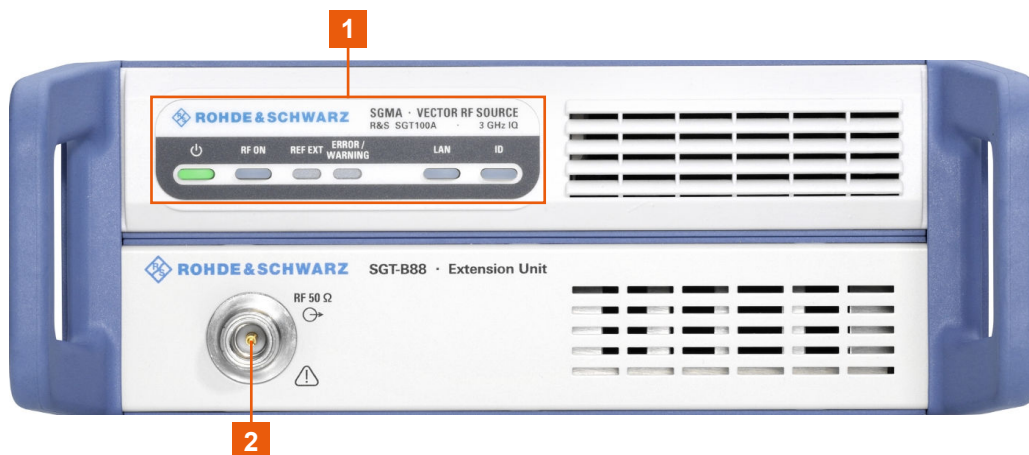


Figure 5-3: R&S SGT connector extension unit: controls and connectors

1 = R&S SGT front panel controls, page 33

2 = RF 50Ω, page 38

RF 50Ω

N-type connector for a 50 Ohm RF signal output.

How to: [Chapter 4.8, "Connecting to RF 50Ω"](#), on page 19

Connector extension unit (R&S SGT-B88)

5.3.2 Rear panel

This section provides an overview of the connectors on the rear panel of the extension unit.

For an overview of the connectors of the rear panel of R&S SGT, refer to [Chapter 5.2, "Rear panel tour"](#), on page 35.

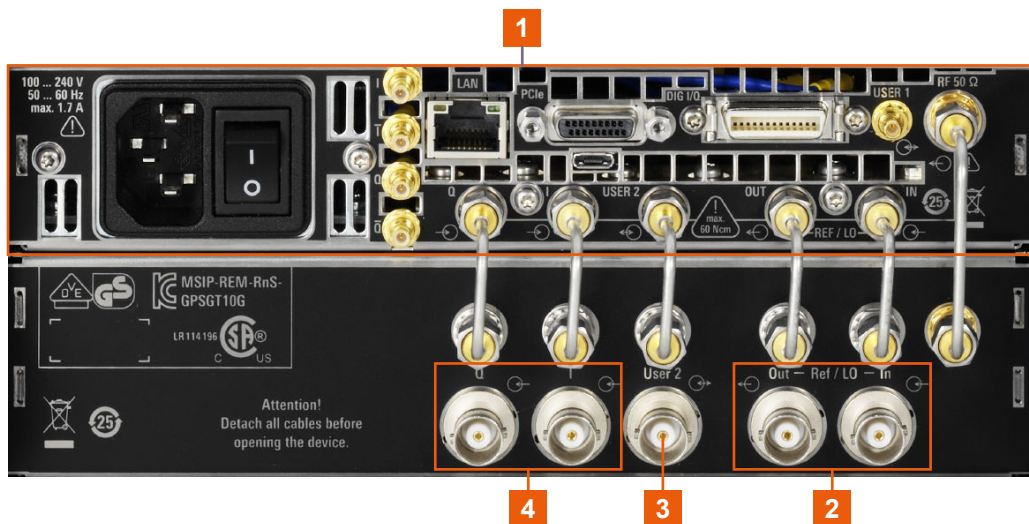


Figure 5-4: Rear panel view of the R&S SGT and the connector extension unit

1 = R&S SGT rear panel, page 35

4 = REF IN, REF OUT, LO IN, LO OUT, page 39

3 = User 2, page 39

2 = I/Q, page 40

REF IN, REF OUT, LO IN, LO OUT

BNC type connectors, for reference signals or local oscillator signals, and alternatively also in MIMO setups.

Reference input and output:

- "REF IN": Input for external reference signal.
- "REF OUT": Output of internal reference signal.

Local oscillator input and output connectors:

- "LO IN": Input for external LO signals
- "LO OUT": Output of internal LO signals.

How to: ["To connect to screwable connectors"](#) on page 20

User 2

BNC multipurpose connector for input and output signal, e.g., for the following signals: "Trigger", "Marker 1/2", "Clock In/Out", "Sync In/Out".

Connector extension unit (R&S SGT-B88)

Also, use the connector for input of external pulse modulator signal.

How to: [Chapter 4.9, "Connecting to non-screwable connectors"](#), on page 21

I/Q

BNC connectors for input of an external I/Q modulator. The signal is fed directly into the I/Q modulator.

How to: [Chapter 4.9, "Connecting to non-screwable connectors"](#), on page 21

6 Trying out the instrument

This chapter introduces the most important functions and settings of the R&S SGT step by step.

The complete description of the functionality and its usage is given in the R&S SGT user manual.

Prerequisites

Before you try out the following tasks, connect the R&S SGT to a remote PC. Install the R&S SGMA-GUI software on this PC and add the R&S SGT to the list of "Available Instruments".



For information on how to fulfill these requirements, refer to:

- [Chapter 4.13.2.1, "Connecting to the network"](#), on page 27
 - [Chapter 4.13.1, "Installing the R&S SGMA-GUI software"](#), on page 25
 - [Chapter 4.13.2.3, "Adding instruments to R&S SGMA-GUI"](#), on page 30
-
- [How to generate a CW signal](#)..... 42
 - [How to create and load a waveform file](#)..... 43

6.1 How to generate a CW signal

Configuring the R&S SGT to generate a CW signal

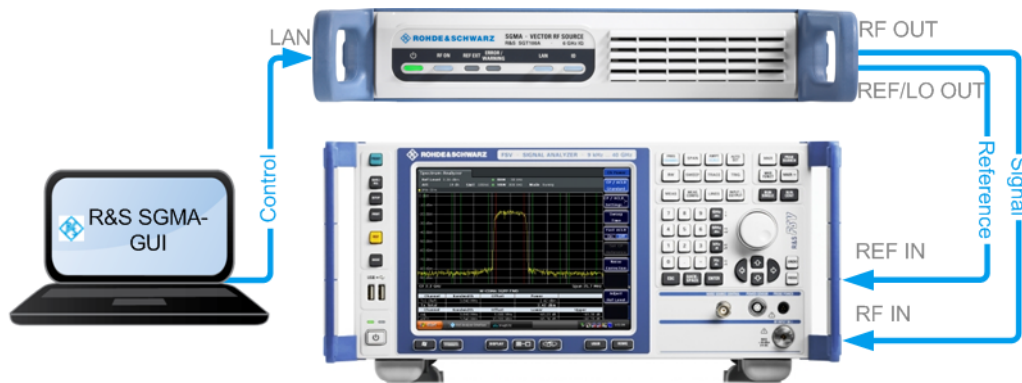
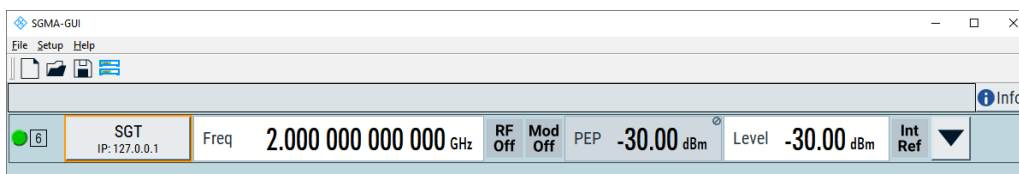


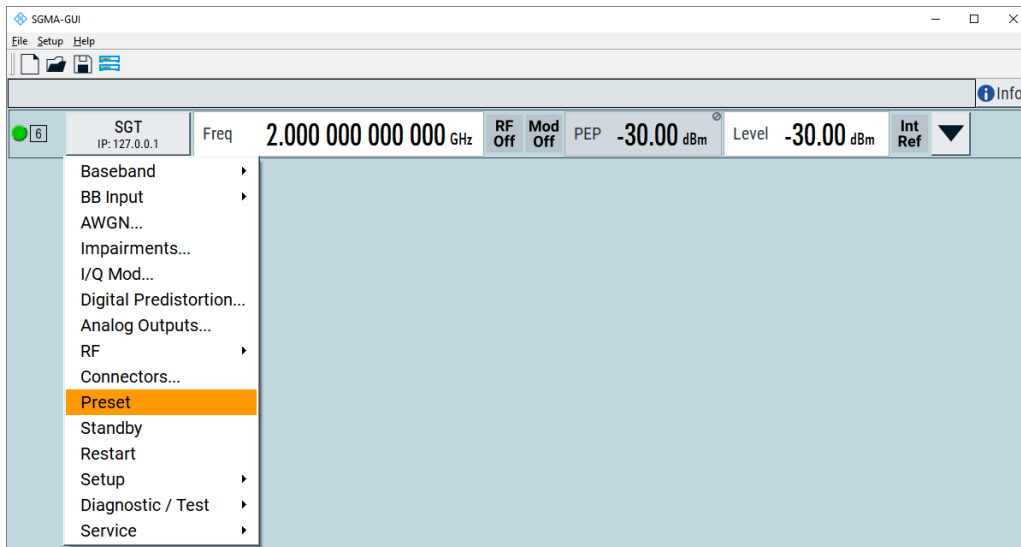
Figure 6-1: Example of the setup

1. Check, that [POWER ON/STANDBY] key is green. The key is on the front panel of the R&S SGT.
2. On the connected remote PC, start the R&S SGMA-GUI software application. The main panel of the application opens. The panel provides a quick access to the main settings of the configured and activated instruments. The display shows one row per instrument with the instrument-specific settings. The rows comprise the instrument, the connection state, the used frequency and power level, the state of the RF output and the modulator and the used reference frequency source.

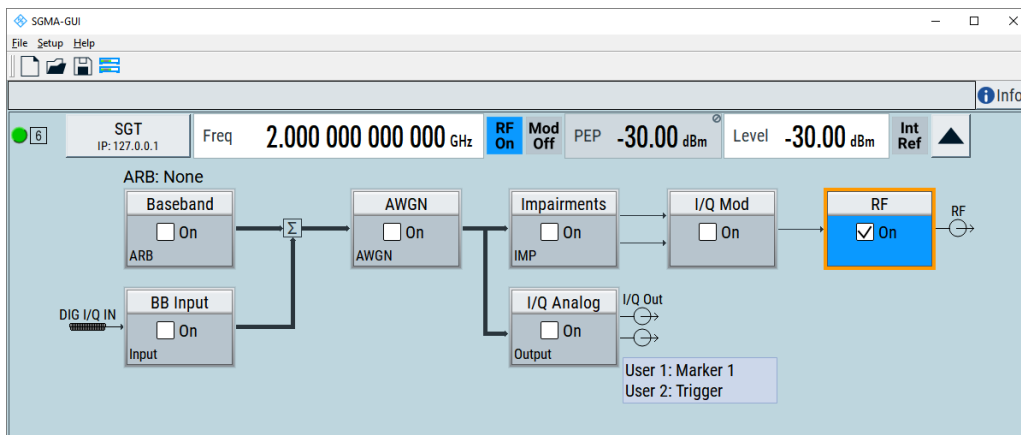


3. In the R&S SGMA-GUI main panel, the green indicator in front of the name of the instrument confirms an active connection. The software recognizes the instrument and displays the connection state between the instrument and the remote PC.
4. In the R&S SGMA-GUI main panel, select the row of the instrument, that you want to configure.
5. Select "Instrument Name > Preset" to restore the predefined instrument's settings.

How to create and load a waveform file



6. In the R&S SGMA-GUI main panel, select the row of the instrument that you want to configure.
7. Set the "Frequency" as required.
8. Select "SGMA-GUI > RF On" to enable the output of the CW signal.



The 2 GHz signal is output at the [RF OUT] connector at the rear panel of the R&S SGT.

6.2 How to create and load a waveform file

The following is an example of how to use the R&S WinIQSIM2 to generate a waveform and load it in the ARB of the R&S SGT.


How to create and load a waveform file

The workflow consists of three main steps, each described in a separate step-by-step instruction:

- Configuring the connection between the R&S WinIQSIM2 and the R&S SGT.
- Generating a waveform file with the required settings.
- Transferring the waveform file and playing it with the R&S SGT.

 This section does not describe the R&S WinIQSIM2 but focuses only the task-related settings.

For more information on configuration and working with the R&S WinIQSIM2, refer to description "software manual R&S WinIQSIM2".

 You cannot remotely control the instrument via the R&S SGMA-GUI and R&S WinIQSIM2 from the same controller computer, if the instrument is connected to the computer through USB.

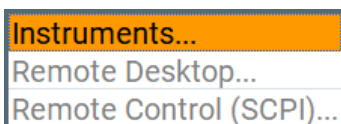
You can connect the R&S SGT and the computer via LAN and assign different SCPI socket port numbers for the remote control through the two software applications.

To configure the R&S SGT as destination instrument in the R&S WinIQSIM2

In this example, we assume that the R&S WinIQSIM2 is installed on a remote controller. This remote controller is connected over LAN to the R&S SGT.

The general instrument settings of the destination instrument affect various functions, like, the maximum size of the file the waveform is stored in. It is recommended that you configure the destination instrument before you generate the waveform with the R&S WinIQSIM2.

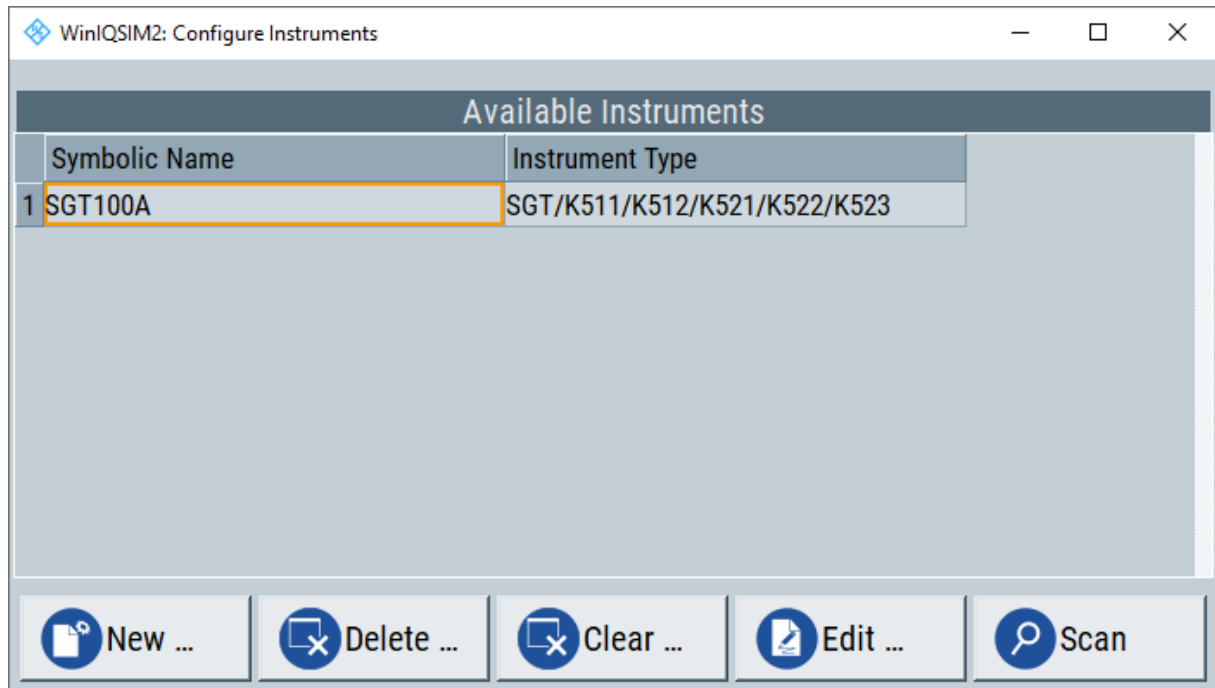
1. In the R&S WinIQSIM2, select "File > New" to preset the software to a defined state.
2. In the block diagram, select "Vector Sig Gen > Config > Instruments".



The "Configure Instruments" dialog opens. The list of configured instruments is empty.

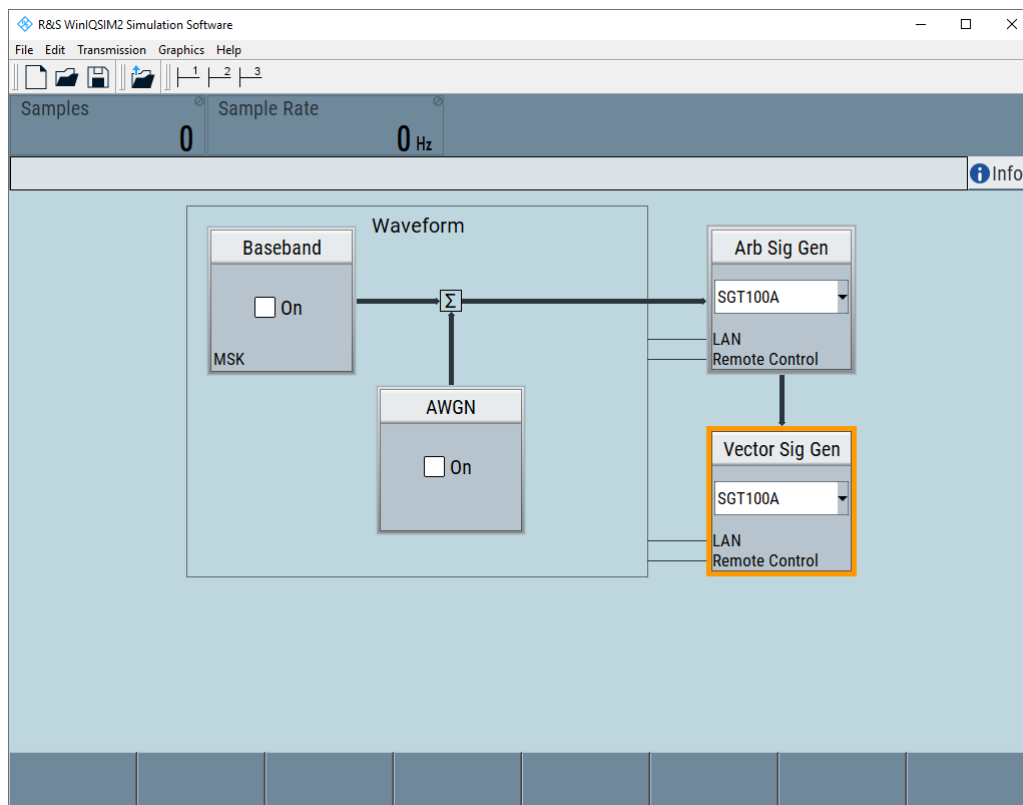
3. Select "Configure Instruments > Scan".

How to create and load a waveform file



The software scans the network for connected and active instruments. Alternatively, use the "New" function to add the R&S SGT manually to the list of instruments.

4. Close the dialog.
5. In the block diagram, select "Vector Sig Gen" block and select the R&S SGT form the list.
6. In the block diagram, select "Arb Sig Gen" block and select the R&S SGT form the list.

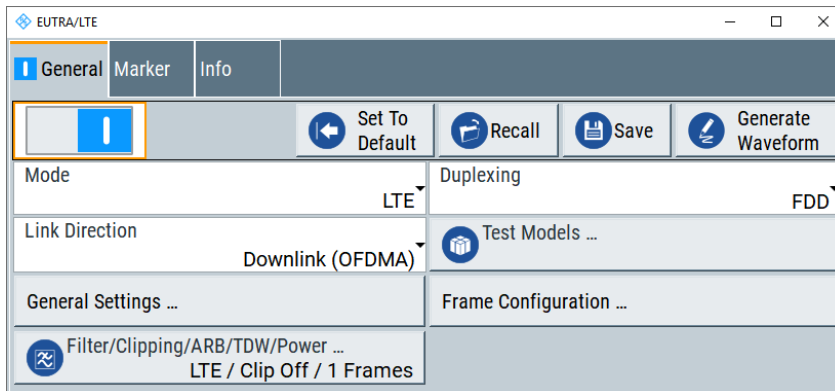


The two lines to the "Vector Sig Gen" and "Arb Sig Gen" blocks on the block diagram confirm that a remote connection to the R&S SGT is established.

To generate an LTE example waveform file with the R&S WinIQSIM2

1. In the R&S WinIQSIM2, select "Block diagram > Baseband > Config. > EUTRA/LTE".
2. Adjust the settings as required, for example:
 - a) Select "Link Direction > Downlink"
 - b) Select a predefined test model, "Test Setups/Models > E-TM1_1__10MHz".
3. Enable "EUTRA/LTE > State > On".

How to create and load a waveform file



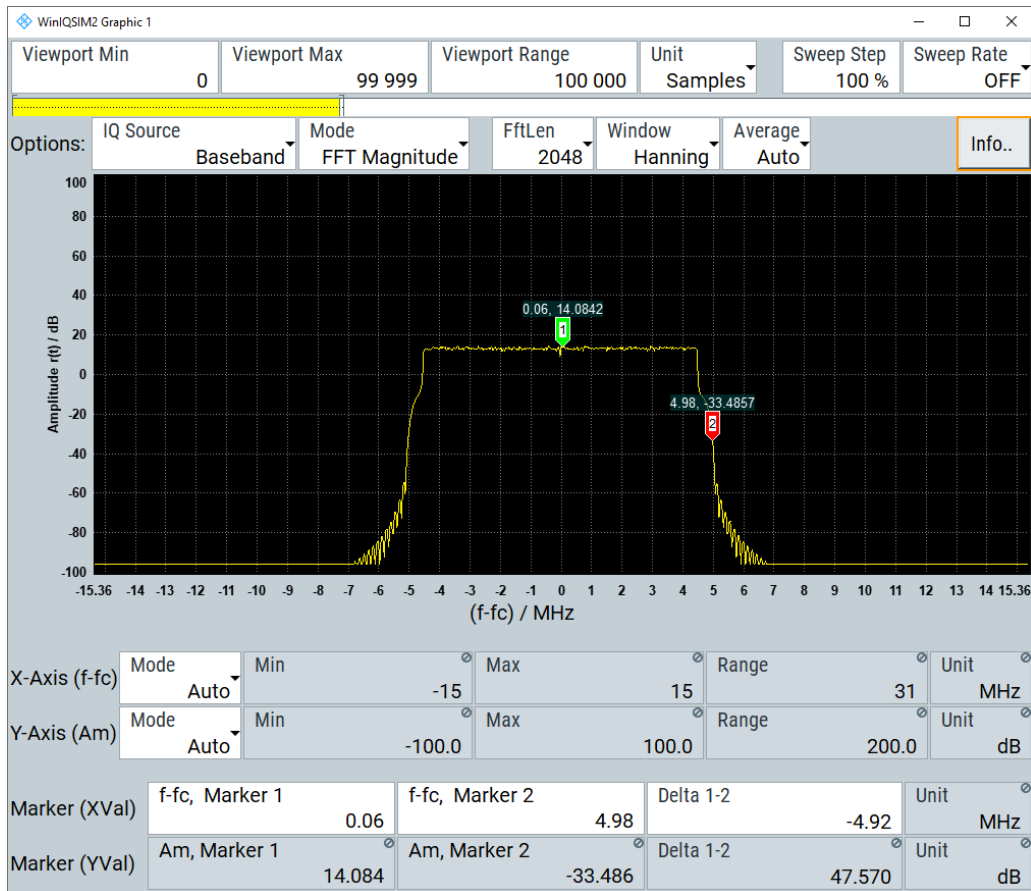
The R&S WinIQSIM2 calculates the signal and displays important signal parameters, like the used "Sample Rate" and "Number of Samples".

| Samples | Sample Rate |
|---------|----------------|
| 307 200 | 30.720 000 MHz |

How to create and load a waveform file



Use "Graphics > Graphic 1" view to retrieve more information on the generated signal.

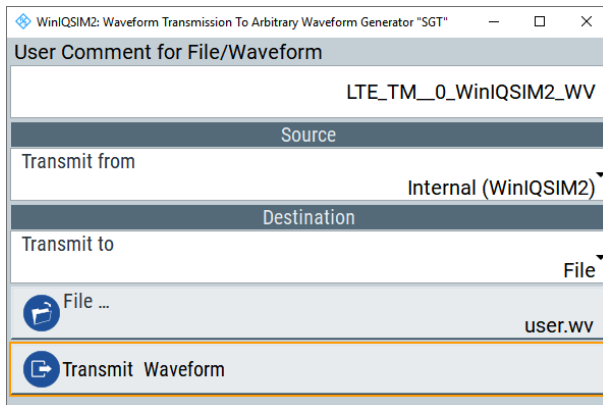


The display confirms the expected EUTRA/LTE 10 MHz spectrum.

To transfer the generated file to the R&S SGT

1. In the R&S WinIQSIM2, select "Transmission > Transmit".
2. In the "Waveform Transmission to Arbitrary Waveform Generator" dialog, select:
 - a) "Source > Internal (WinIQSIM2)"
 - b) "Destination > Instrument" and define the file name for the transmitted file.
 - c) Enable "Automatically Load and Start Waveform > On".
 - d) Select the required baseband, e.g. "Path A".
 - e) Add a comment to the waveform.
 - f) Select "Transmit".

How to create and load a waveform file



The waveform is transmitted to the default directory of the R&S SGT.

3. In the R&S SGT, select "Baseband > ARB".

The dialog confirms that the ARB is enabled and plays the transmitted waveform.

7 Instrument control

As a rule, the R&S SGT is operated exclusively via programmatic remote control from a connected PC. For service and diagnostic tasks, and for manual configuration, a graphical user interface (R&S SGMA-GUI) is provided which runs on the remote PC.

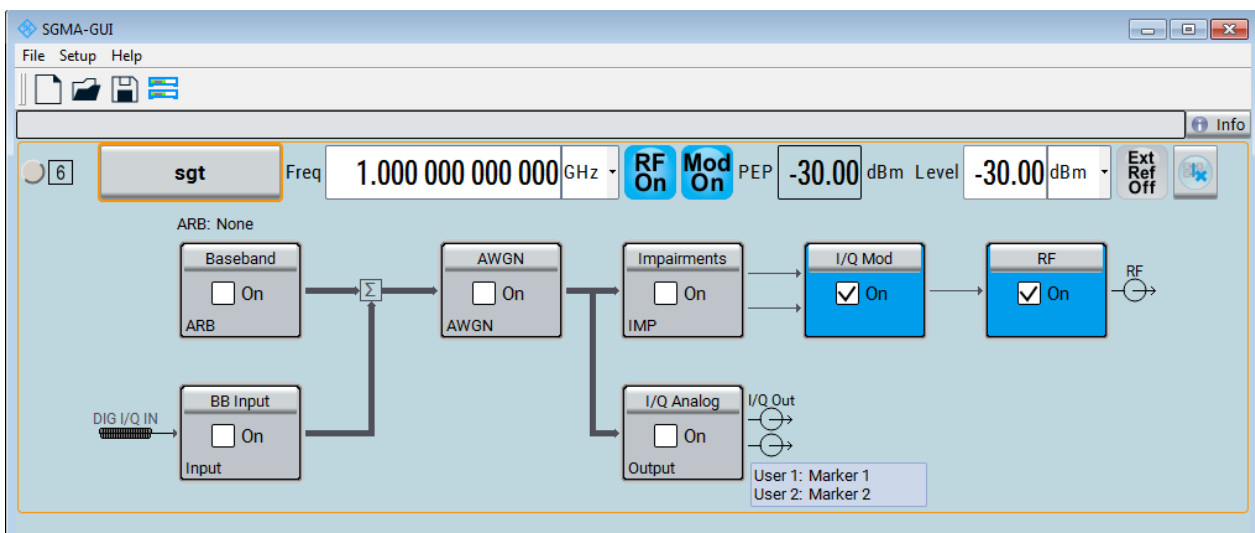
Also, some basic functionality is provided via the keys on the front panel of the instrument (see [Chapter 5.1, "Front panel tour"](#), on page 33).

7.1 Manual operation via R&S SGMA-GUI

The R&S SGMA-GUI software application can be installed on a PC with Windows or Linux operating system. This program allows you to control several devices of the SGMA product family at the same time and to monitor the device status during remote control. R&S SGMA-GUI requires one of the external interfaces described in [Chapter 4.13, "Connecting an external PC and devices"](#), on page 25.

7.1.1 Introduction to the user interface

After the start of R&S SGMA-GUI, the main dialog of the application is displayed.



Manual operation via R&S SGMA-GUI

The main dialog with an overview of the configured instruments is the operating and control interface for the whole program. From here, all program functions are accessible.

The menus and dialogs are built using elements like selection lists, check boxes, and entry fields. A blue frame indicates that the selected item is active. Entries can be made in the highlighted element.

The main dialog comprises two main areas:

- On the top of the main panel, there are bars: the menu bar, the tool bar and the info bar with the corresponding "Info" button.
The menu bar provides access to the functions related to the software application itself, like saving current configurations, retrieving information about the installed software version or configuring the connected instruments.
The messages displayed in the info line indicate information, warnings, and errors. They are displayed in different colors depending on their importance and display duration. Use the "Info" button to open a dialog with information on the messages in greater detail.
- The central part of the R&S SGMA-GUI main dialog is the main panel that shows the list of all active instruments.
The main panel is the core element for the manual operation and provides quick access to the main settings of the configured instruments. The display shows one row per active instrument. Each row comprises the instrument's name and state, the used frequency and level, the state of the RF output and the modulator and the kind of used frequency reference.
The buttons with the instrument's symbolic name on it provides access to menus and dialogs for further instrument configuration. Refer to the user manual for a detailed description of all parameters and functions provided for configuration.



A detailed description of the R&S SGMA-GUI, in-depth information on how to work with the application and on how to operate the R&S SGT is provided in the user manual.

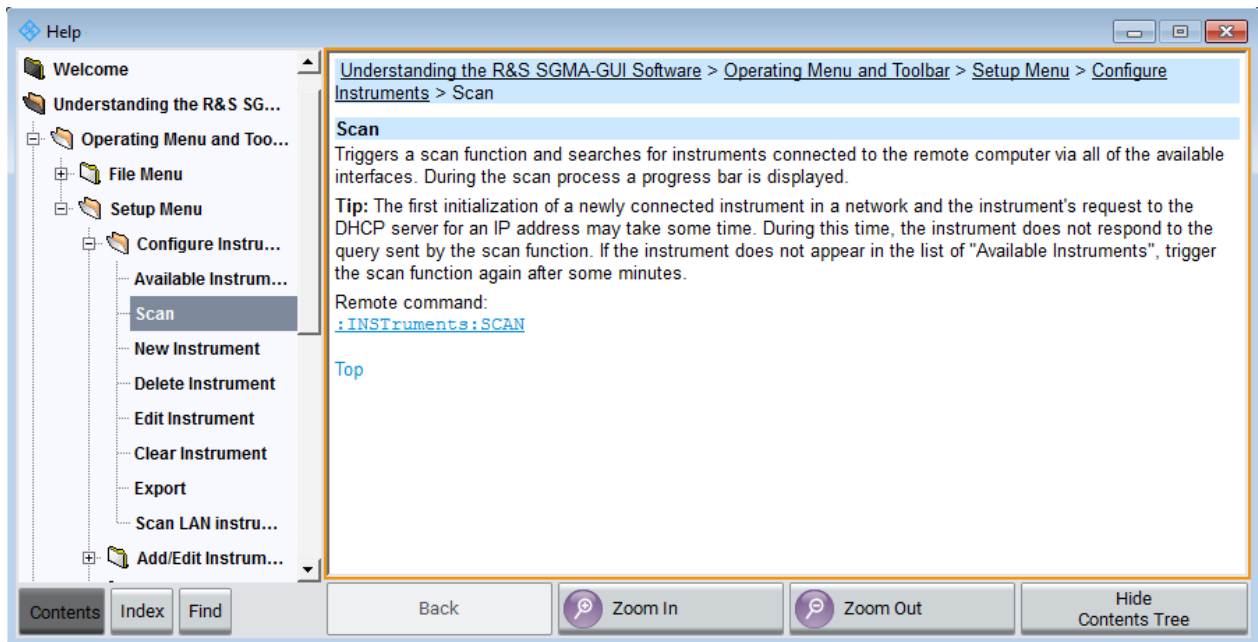
7.1.2 How to use the help system

The R&S SGMA-GUI is equipped with a context-sensitive help function. A help page is available for each parameter and can be called anytime during instrument operation.

Calling context-sensitive and general help

- ▶ To display the general help dialog box, select the "SGMA-GUI > Help > Contents" or use the F1 key.

The help dialog is displayed. A topic containing information about the current menu or the currently opened dialog box and its function is displayed.



Contents of the help dialog box

The help dialog box contains two main areas:

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

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

Navigating in the table of contents and in the help topics

1. To move through the displayed contents entries, use the mouse or the [Up/Down] keys. Entries that contain further entries are marked with a plus sign.
2. To display a help topic, double click on the topic name or press the [ENTER] key.
3. To jump to the linked topic, press the link text.
4. Use the "Previous" or "Next" links to jump to the corresponding topic.

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5. Use the "Scroll Right" or "Scroll Left" buttons to shift the indicated area of the navigation window to the left or right.

Using the index

1. Select "SGMA-GUI > Help > Index" or use the "Go to Index" button in the "Help" display.
2. Enter the first characters of the topic that you are interested in. The entries starting with these characters are displayed.
3. Press the [ENTER] key to display the help topic.

The corresponding help topic is displayed.

7.2 Network operation and remote control

As an alternative to operating the R&S SGT interactively via the R&S SGMA-GUI, you can operate the R&S SGT also from a remote location.

**Information on network operation and remote control**

The following descriptions provide information required for operating the R&S SGT remotely. The information applies to all applications and operating modes supported by the instrument. Definitions specified in the SCPI standard are not provided.

For basic knowledge on remote control operation and additional information, see the following documents, available on the Rohde & Schwarz website:

- [Remote control via SCPI](#)
- [1GP72: Connectivity of Rohde&Schwarz Signal Generators](#)
- [1MA208: Fast Remote Instrument Control with HiSLIP](#)

- [Remote control interfaces and protocols](#).....53
- [Remote control over LAN using VXI-11 protocol](#).....60

7.2.1 Remote control interfaces and protocols

The instrument supports several interfaces for remote control. The following table gives an overview.

Table 7-1: Remote control interfaces and protocols

| Interface | Protocols | Remarks |
|-------------------------------|---|---|
| Local Area Network (LAN) | <ul style="list-style-type: none"> • HiSLIP High-Speed LAN Instrument Protocol (IVI-6.1) • VXI-11 • socket communication (Raw Ethernet, simple Telnet, Fast Socket) | <p>A LAN connector is located on the rear panel of the instrument.</p> <p>The interface is based on TCP/IP and supports various protocols.</p> <p>For details, see Chapter 7.2.1.1, "LAN interface", on page 54</p> |
| USB | USBTMC | <p>A USB connector is located on the rear panel of the instrument.</p> <p>For details, see Chapter 7.2.1.2, "USB interface", on page 58</p> |
| PCIe | Proprietary | <p>A PCIe connector is located on the rear panel of the instrument.</p> <p>For details, see Chapter 7.2.1.3, "PCI Express interface", on page 58</p> |
| GPIB (IEC/IEEE Bus Interface) | – | <p>The instrument is not equipped with GPIB bus interfaces. Use a GPIB-to-LAN or GPIB-to-USB adapter instead.</p> <p>For details, see Chapter 7.2.1.4, "GPIB interface (IEC/IEEE bus interface)", on page 59</p> |

SCPI (Standard Commands for Programmable Instruments)

SCPI commands are used for remote control. Commands that are not taken from the SCPI standard follow the SCPI syntax rules. The instrument supports the SCPI version 1999. The SCPI standard is based on standard IEEE 488.2 and aims at the standardization of device-specific commands, error handling and the status registers. The tutorial "Automatic Measurement Control - A tutorial on SCPI and IEEE 488.2" from John M. Pieper (R&S order number 0002.3536.00) offers detailed information on concepts and definitions of SCPI.

7.2.1.1 LAN interface

To be integrated in a LAN, the instrument is equipped with a LAN interface, consisting of a connector, a network interface card and protocols.

For remote control via a network, the PC and the instrument must be connected via the LAN interface to a common network with TCP/IP network protocol. They are connected using an RJ45 cable (shielded or unshielded twisted-pair category

Network operation and remote control

5). The TCP/IP network protocol and the associated network services are preconfigured on the instrument. Software for instrument control and (for specified protocols only) the VISA program library must be installed on the controller.

Identifying instruments in a network

If several instruments are connected to the network, each instrument has its own IP address and associated resource string. The controller identifies these instruments by the resource string.

VISA resource strings

The VISA resource string is required to establish a communication session between the controller and the instrument in a LAN. The resource string is a unique identifier, composed of the specific IP address of the instrument and some network and VISA-specific keywords.

```
TCPIP::host address[::LAN device name][::INSTR]
```

- **TCPIP** designates the network protocol used
- **Host address** is the IP address or host name of the device
- **[::LAN device name]** defines the protocol and the instance number of a sub-instrument:
- **[::INSTR]** indicates the instrument resource class (optional)

The **IP address** (host address/computer name) is used by the programs to identify and control the instrument. It is automatically assigned by the DHCP server the first time that the device is registered on the network. Alternatively, you can also assign its **LAN device name**.

You can find the IP address in the "SGMA-GUI > Instrument Name > Setup > Remote" dialog, and also adjust it manually, if necessary.

See below the characteristics of the VISA resource strings for the corresponding interface protocols. The highlighted characters are crucial.

HiSLIP

```
TCPIP::host address::hislip0[::INSTR]
```

- **hislip0** HiSLIP device name, designates that the interface protocol HiSLIP is used (mandatory).

hislip0 is composed of [::HiSLIP device name[,HiSLIP port]] and must be assigned.

For details of the HiSLIP protocol, refer to "[HiSLIP protocol](#)" on page 56.

VXI-11

TCPIP::host address [::inst0] [::INSTR]

- **[::inst0]** LAN device name, indicates that the VXI-11 protocol is used (optional).

inst0 currently selects the VXI-11 protocol by default and can be omitted.

For details of the VXI-11 protocol, refer to "[VXI-11 protocol](#)" on page 57.

Socket communication

TCPIP::host address::port::SOCKET

- **Port** determines the used port number
- **SOCKET** indicates the raw network socket resource class

Socket communication requires the specification of the port (commonly referred to as port number) and of "SOCKET" to complete the VISA resource string with the associated protocol used.

The registered port for socket communication is port 5025.

See also "[Socket communication](#)" on page 57.

Example:

- Instrument has the IP address *10.113.11.91*; the valid resource string using VXI-11 protocol is:

```
TCPIP::10.113.11.91::INSTR
```

- The DNS host name is *rssgt100a100021*; the valid resource string is:

```
TCPIP::rssgt100a100021::hislip0 (HiSLIP)
```

```
TCPIP::rssgt100a100021::inst0 (VXI-11)
```

- A raw socket connection can be established using:

```
TCPIP::10.113.11.91::5025::SOCKET
```

HiSLIP protocol


The High Speed LAN Instrument Protocol (HiSLIP) is the successor protocol for VXI-11 for TCP-based instruments specified by the IVI foundation. The protocol

Network operation and remote control

uses two TCP sockets for a single connection - one for fast data transfer, the other for non-sequential control commands (e.g. `Device Clear` or `SRQ`).

HiSLIP has the following characteristics:

- High performance as with raw socket network connections
- Compatible IEEE 488.2 support for Message Exchange Protocol, Device Clear, Serial Poll, Remote/Local, Trigger, and Service Request
- Uses a single IANA registered port (4880), which simplifies the configuration of firewalls
- Supports simultaneous access of multiple users by providing versatile locking mechanisms
- Usable for IPv6 or IPv4 networks

 Using VXI-11, each operation is blocked until a VXI-11 instrument handshake returns. However, using HiSLIP, data is sent to the instrument using the "fire and forget" method with immediate return. Thus, a successful return of a VISA operation such as `viWrite()` guarantees only that the command is delivered to the instrument's TCP/IP buffers. There is no confirmation, that the instrument has started or finished the requested command.

For more information see also the application note:

[1MA208: Fast Remote Instrument Control with HiSLIP](#)

VXI-11 protocol

The VXI-11 standard is based on the ONC RPC (Open Network Computing Remote Procedure Call) protocol which in turn relies on TCP/IP as the network/transport layer. The TCP/IP network protocol and the associated network services are preconfigured. TCP/IP ensures connection-oriented communication, where the order of the exchanged messages is adhered to and interrupted links are identified. With this protocol, messages cannot be lost.

Socket communication

An alternative way for remote control of the software is to establish a simple network communication using sockets. The socket communication, also referred to as "Raw Ethernet communication", does not require a VISA installation on the remote controller side.

Network operation and remote control

The simplest way to establish socket communication is to use the built-in telnet program. The telnet program is part of every operating system and supports communication with the software on a command-by-command basis.

Socket connections are established on a specially defined port. The socket address is a combination of the IP address or the host name of the instrument and the number of the port configured for remote-control. All instruments use port number 5025 for this purpose. The port is configured for communication on a command-to-command basis and for remote control from a program running on a connected PC.

7.2.1.2 USB interface

For remote control via USB connection, the PC and the instrument must be connected via the USB interface. A USB connection requires the VISA library to be installed. VISA detects and configures the R&S instrument automatically when the USB connection is established. You do not have to install a separate driver.

You can retrieve the USB resource string from the "SGMA-GUI > Instrument Name > Setup > Remote" dialog.

Example:

```
USB::0x0AAD::0x00EC::100021::INSTR
```

0x0AAD is the vendor ID for Rohde & Schwarz.

0x00EC is the product ID for the R&S SGT.

100021 is the serial number of the particular instrument.

7.2.1.3 PCI Express interface

A PCI Express (PCIe) connector is provided on the rear panel of the instrument.

Refer to chapter "Advanced Remote Control via PCIe" of the user manual for a description of how to set up a remote control connection via PCIe and the permitted cables.

Via PCI Express some commands can be sent to the instrument with optimized speed (memory-mapped remote control), e.g. frequency or level settings. Speed optimization allows minimum setup time.

You can retrieve the PCIe resource string from the "SGMA-GUI > Instrument Name > Setup > Remote" dialog.

Example:

```
PCIe::0x162f::0x1336::100021::INSTR
```

0x162f is the vendor ID for Rohde & Schwarz.

0x1336 is the product ID for the R&S SGT.

100021 is the serial number of the particular instrument.



Using the PCIe interface for remote control of the instrument requires extended knowledge and is described in section "Advanced Remote Control via PCIe" in the user manual.

7.2.1.4 GPIB interface (IEC/IEEE bus interface)

The R&S SGT is not equipped with an IEC/IEEE bus interface.

To be able to control the instrument via the GPIB bus:

1. Connect a GPIB-to-LAN or a GPIB-to-USB adapter to the instrument.
2. Use a GPIB bus cable to connect the instrument and the controller.
3. Provide the GPIB bus card, the card drivers and the program libraries for the programming language in the controller.
4. In the "SGMA-GUI > Setup > Instruments > instrument name > Remote Control", set the "GPIB Address".
5. If the controller has several GPIB bus cards, define the used "Board Number".

GPIB address


The controller must address the instrument with the GPIB bus channel. GPIB provides channel addresses from 0 to 30.

The GPIB resource string is `GPIB::<address>[::INSTR]`, where:

- **GPIB** denotes the used interface.
- **<address>** indicates the used channel.
- **[::INSTR]** indicates the instrument resource class (optional).

Note: If the VISA implementation supports the GPIB interface, you can optionally define the VISA instrument control resource (INSTR). It is used to define the

basic operations and attributes for a device, such as reading, writing, or triggering.


 Any connected IEC bus cable must be terminated by an instrument or controller.

7.2.2 Remote control over LAN using VXI-11 protocol

In the following example, the program "Measurement & Automation Explorer" from National Instruments is used on a Windows operating system to set up a LAN remote control link and to start a remote control session. The remote control program "Measurement & Automation Explorer" opens the connection to the instrument (using VISA functionality) and then sends commands to and receives device responses from the instrument.


A remote control connection requires a VISA installation but no additional hardware on the controller PC. The LAN I/O channel is selected at initialization time using the VISA resource string (also referred to as "address string"). A VISA alias (short name) is used to replace the complete resource string. The host address is either the R&S SGT's computer name or its IP address.

Proceed as described in [Chapter 4.13.2.2, "Assigning the IP address"](#), on page 29 to determine the relevant address information.

 In this example, it is assumed that:

- A LAN remote control link between the controller and the R&S SGT is already set up.
For information on setting up the link, see [Chapter 4.13.2, "Connecting a remote PC via LAN"](#), on page 27.
- A VISA and the "Measurement & Automation Explorer" program are installed on the remote PC.
For detailed information, refer to section "Remote Control Basics" in the user manual or to the online help of the "Measurement & Automation Explorer" program.

To configure the controller

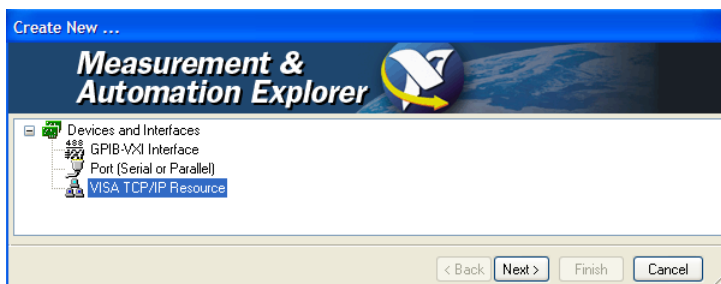
 The instrument is preconfigured for networks using DHCP (dynamic host configuration protocol). If you use this configuration, enter the computer name in the position of the IP address.

To enable the external controller to communicate with the software via TCP/IP protocol, set up a remote control link as follows:

1. Connect the controller and the instrument to the network (network cable). Switch them on.
2. Start the 'Measurement & Automation Control' program on the controller.
3. Select "Devices and Interfaces > Create New".

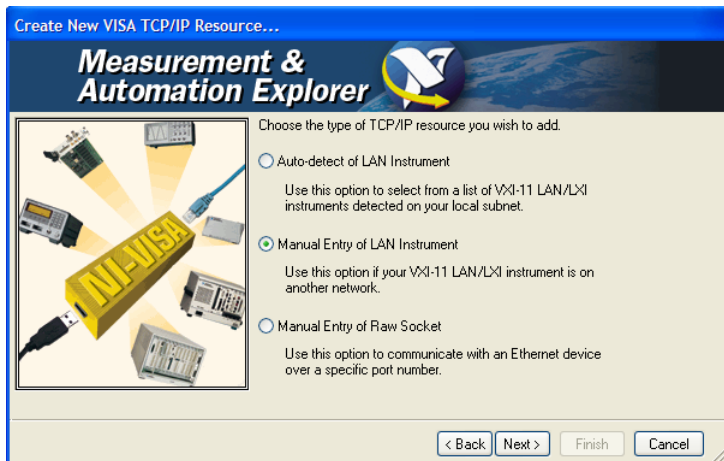


4. Select "VISA TCP/IP Resource" and confirm with "Next".



5. Choose the type of TCP/IP resource, that you wish to add and select "Next".

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6. Enter the IP address or the host name of the R&S SGT.
7. Select "Next".
8. Enter the alias name, if necessary.
Do not mistake the alias name with the computer name. Only use the alias name for instrument identification within the program. The menu displays the alias name as an option, if there is an Ethernet link.
9. Confirm the settings with "Finish".
The instrument is configured and the settings are displayed in the "TCP/IP Settings" tab.
10. To test the connection, select "Validate".
A message indicates whether you can set up the link to the instrument or not. If a connection cannot be set up, check whether the controller and the instrument are connected to the network (network cable) and are switched on. Check that the spelling of the IP address or the computer name is correct. For further error location, inform the network administrator. Operation in large networks can require additional addresses for link setup, e.g. gateway and subnet mask. Contact your network administrator.

The instrument is now registered in the program and can be addressed via the resource string or alias name.

To start a remote control session over LAN (using VXI-11)

1. Start the "Measurement & Automation Explorer" on the controller.
2. In the "Configuration" window, select "Device and Interfaces > VISA TCP/IP Resources", select the required instrument and select "Open VISA Test Panel".

Network operation and remote control

3. In the "viWrite" tab, write the command to be sent to the instrument and select "Execute".

Instrument responses are displayed on the "viRead" tab.

Tip: For further program operation, refer to the online help of the program.

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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