

R&S® SMW200A

Vector Signal Generator

Getting Started



1412926602

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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 [Chapter 1.1, "Safety Instructions"](#), on page 7.

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.

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

Lifting and carrying the product

The product is heavy. Do not move or carry the product by yourself. A single person can only carry a maximum of 18 kg safely depending on age, gender and physical condition. Look up the maximum weight in the data sheet. Use the product handles to move or carry the product. Do not lift by the accessories mounted on the product. Accessories are not designed to carry the weight of the product.

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 a carrying bag designed for your product, 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 and has to be connected to a fixed installation used to supply energy-consuming equipment such as household appliances and similar loads. Be aware 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.
- If a product has an exchangeable fuse, its type and characteristics are indicated next to the fuse holder. Before changing the fuse, switch off the instrument and disconnect it from the power source. How to change the fuse is described in the product documentation.
- 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.
	Heavy product Be careful when lifting, moving or carrying the product. Carrying the product requires at least two people or transport equipment.
	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 protects you against electric shock should an electric problem occur.

1.2 Labels on R&S SMW

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 SMW 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".
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1.3 Korea Certification Class B



이 기기는 가정용(B급) 전자파 적합기기로서 주로 가정에서 사용하는 것을 목적으로 하며, 모든 지역에서 사용할 수 있습니다.

2 Documentation Overview

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

www.rohde-schwarz.com/manual/smw200a

2.1 Getting Started Manual

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

2.2 User Manuals and Help

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

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

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

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

2.3 Tutorials

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

2.4 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>

2.5 Instrument Security Procedures

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

2.6 Printed Safety Instructions

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

2.7 Data Sheets and Brochures

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

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

Application Notes, Application Cards, White Papers, etc.

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

2.8 Release Notes and Open Source Acknowledgment (OSA)

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

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

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

2.9 Application Notes, Application Cards, White Papers, etc.

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

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

3 Key Features

The R&S SMW is a new high-performance signal generator developed to meet demanding customer requirements. Offering excellent signal characteristic and straightforward and intuitive operation, the signal generator makes signal generation fast and easy.

Outstanding key features of the R&S SMW are:

- Frequency range from 100 kHz to 44 GHz
- Optional second RF path with variable frequency range
- Up to 2 GHz I/Q modulation bandwidth (in RF) with internal baseband
- Wideband baseband and vector signal generator in one box
- Support of all important digital standards such as LTE incl. eMTC/NB-IoT, 5G NR, WLAN IEEE 802.11a/b/g/n/j/p/ac/ax, 3GPP FDD/HSPA/HSPA+
- Generating signals for radar module and receiver tests
- Versatile configuration: from single-path vector signal generator to multichannel MIMO receiver tester
- Optional integrated fading simulator with up to 200 MHz bandwidth
- Ideal for MIMO, MSR, 5G NR or LTE-Advanced applications thanks to up to eight signal sources and up to 64 fading channels
- Implementation of all key MIMO fading scenarios such as 2x2, 3x3, 4x4, 8x4, 4x8, and 2x4x4 using a single instrument
- Internal digital adding of baseband signals, with frequency and level offset
- Excellent signal quality for high accuracy in spectral and modulation measurements
- Intuitive operation via touchscreen with block diagram as key element
- Graphical signal monitoring at practically every point in the signal flow
- SCPI macro recorder and code generator for generating executable remote control code from manual operating steps (for MATLAB®, CVI, etc.)

For more information, see data sheet.

4 Preparing for Use

This chapter describes the basic steps to be taken when setting up the product for the first time.

4.1 Lifting and Carrying

1. **WARNING!** The R&S SMW can be heavy, e.g., if fully equipped. Use a lifting equipment, see also ["Lifting and carrying the product"](#) on page 8.
Use the two carrying handles at the front for lifting and carrying the R&S SMW.
2. Also use the handles for mounting the R&S SMW in a rack. See [Chapter 4.4.2, "Mounting the R&S SMW in a Rack"](#), on page 21.

4.2 Unpacking and Checking

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

See also:

- ["Setting up the product"](#) on page 8.
- ["Intended use"](#) on page 7.

4.4.1 Placing the R&S SMW on a Bench Top

To place the product on a bench top

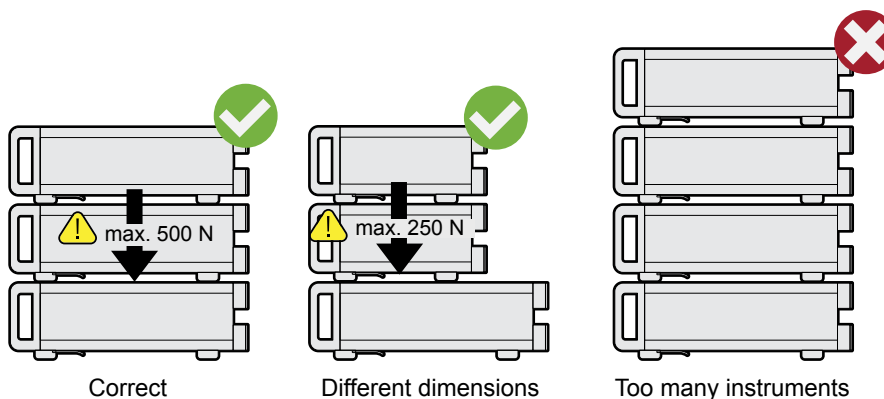
1. Place the product on a stable, flat and level surface. Ensure that the surface can support the weight of the product. For information on the weight, see the data sheet.

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:

- It is best if all products have the same dimensions (width and length).
- The overall load on the lowest product must not exceed 500 N.
- With smaller products on top of the lowest product, the overall load on the lowest product must not exceed 250 N.



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 SMW 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 SMW in a rack

1. Use an adapter kit that fits the dimensions of the R&S SMW to prepare the instrument for rack mounting. For information on the dimensions, see data sheet.
 - a) Order the rack adapter kit designed for the R&S SMW. For the order number, see data sheet.
 - b) Mount the adapter kit. Follow the assembly instructions provided with the adapter kit.
2. **WARNING!** The R&S SMW can be heavy, e.g., if fully equipped. Use a lifting equipment, see also "[Lifting and carrying the product](#)" on page 8.
Lift the R&S SMW to shelf height.
3. Grab the handles and push the R&S SMW 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 SMW at the rack.

To unmount the R&S SMW from a rack

1. Loosen the screws at the rack brackets.
2. **WARNING!** The R&S SMW can be heavy, e.g., if fully equipped. Use a lifting equipment, see also "[Lifting and carrying the product](#)" on page 8.
Bring the lifting equipment to shelf height.
3. Remove the R&S SMW from the rack.
4. If placing the R&S SMW on a bench top again, unmount the adapter kit from the R&S SMW. Follow the instructions provided with the adapter kit.

4.5 Important Aspects 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.
- USB
Double-shielded USB cables.
How to: [Chapter 4.8, "Connecting USB Devices"](#), on page 25.
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 24
- 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.
How to: See section "To connect instruments to the I/Q analog interface" in the user manual.
- Use the cable R&S SMU-Z6 for connection to the DIG I/Q interfaces of the instrument. The cable is available under material number 1415.0201.02.
How to: See section "To connect instruments to the I/Q digital interface" in the user manual.
- Use the cable R&S DIGIQ-HS for connection to the HS DIG I/Q interfaces of the instrument. The cable is available under material number 3641.2948.03.
How to: [Chapter 4.12, "Connecting to HS DIG I/Q"](#), on page 28

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 SMW 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.

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 SMW.
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

You can operate the R&S SMW via LAN (local area network) or you can operate it locally. This section describes how to connect the instrument to a LAN to operate or control the instrument remotely via a PC in a 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 SMW 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 SMW displays the address information on the screen.

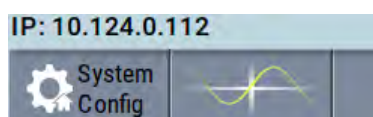


Figure 4-1: IP address indication on the screen (example)

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

4.8 Connecting USB Devices

USB connectors are located on the [front panel](#) and [rear panel](#). You can connect or disconnect all USB devices from the R&S SMW during operation.

To connect USB storage devices

USB storage devices, such as memory sticks, allow easy data transfer from/to the R&S SMW. 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 SMW.

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 SMW 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 SMW 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 RF A/RF B

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

If you have the instrument equipped with an option for rear panel connectors, the RF output connector is located on the rear panel.

To prepare for connecting to "RF A/RF B"

1. If the R&S SMW is switched on, deactivate the RF output, before connecting an RF cable to the RF A/RF B connector.
In the block diagram, select the block "RF" > "RF Level" > "RF ON > Off".
2. Use a high-quality RF cable that matches the RF connector type.
See ["Cable selection and electromagnetic interference \(EMI\)"](#) on page 22.
3. You can connect to two kinds of connectors:
 - ["To connect to non-screwable connectors \(BNC\)"](#) on page 26
 - ["To connect to screwable connectors \(PC 1.0/1.85/2.92/3.5 mm\)"](#) on page 26

To connect to non-screwable connectors (BNC)

- To connect the RF cable with the "RF A/RF B" connector, proceed as follows:
 - a) Carefully align the connector of the cable and the "RF A/RF B" 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 A/RF B" connector.

To connect to screwable connectors (PC 1.0/1.85/2.92/3.5 mm)

1. Use a high-quality cable that matches the connector type.
See ["Cable selection and electromagnetic interference \(EMI\)"](#) on page 22.
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 connector, proceed as follows:
 - a) Carefully align the connector of the cable and the connector along a common axis.

Connecting to LO In/Out

- 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](#).

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

For more information, see chapter "Handling" of the application note [1MA99](#).

If your instrument is equipped with a test port adapter, see the application note [1MA100](#).

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	5	0.56	5/16	8
3.5 mm	8	0.9	5/16	8
2.92 mm	8	0.9	5/16	8
2.4 mm	8	0.9	5/16	8
1.85 mm	8	0.9	5/16	8
1.0 mm	3	0.34	0.236	6

Preventing RF output switch-off

- **NOTICE!** If you set a too high output level, the reverse power can exceed a limit forcing the R&S SMW to switch off the RF output.

Set an RF output level that is not higher than the maximum permissible RF power as given in the data sheet.

4.10 Connecting to LO In/Out

"LO In/Out" connectors are Subminiature Version A (SMA) connectors.

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

Follow the instructions in ["To connect to screwable connectors \(PC 1.0/1.85/2.92/3.5 mm\)"](#) on page 26.

See also chapter "Local Oscillator Coupling" in the user manual.

4.11 Connecting to REF IN/REF OUT

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

To connect to "REF IN"/"REF OUT" (reference < 1 GHz)

For connection, the R&S SMW provides BNC connectors.

- ▶ Follow the instructions in ["To connect to non-screwable connectors \(BNC\)"](#) on page 26.

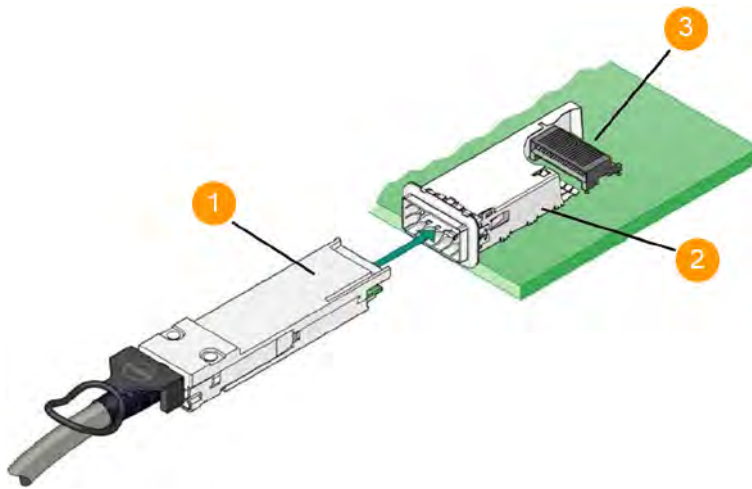
To connect to REF IN/REF OUT (reference = 1 GHz)

For connection, the R&S SMW provides SMA connectors.

- ▶ Follow the instructions in ["To connect to screwable connectors \(PC 1.0/1.85/2.92/3.5 mm\)"](#) on page 26.

4.12 Connecting to HS DIG I/Q

The HS DIG I/Q connector comprises a QSFP+ (Quad Small Form-factor Pluggable) socket, that has two components: a QSFP+ cage and a QSFP+ connector. The QSFP+ cable is equipped with the QSFP+ plug.



- 1 = QSFP+ plug
2 = QSFP+ cage
3 = QSFP+ connector

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

To connect to HS DIG I/Q interface

1. For connection, use the QSFP+ cable R&S DIGIQ-HS.
See "[Cable selection and electromagnetic interference \(EMI\)](#)" on page 22.
2. Hold the QSFP+ plug of the cable by its panes.
3. Turn the QSFP+ cable, so that the release tab shows upwards.
4. Insert and push the QSFP+ plug into the QSFP+ cage.

To disconnect from HS DIG I/Q interface




1. **NOTICE!** If you pull the cable, you can damage the cable and the HS DIG I/Q connector.
Pull the release tab.
2. Pull the QSFP+ plug out of the QSFP+ cage.

See also chapters "Digital Baseband Input Settings" and "I/Q Digital Output Settings" in the user manual.

4.13 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	 yellow	[I]
Ready	 green	[I]

To switch on the R&S SMW

The R&S SMW is off but connected to power. See [Chapter 4.6, "Connecting to Power"](#), on page 24.

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. Wait until the oven-controlled oscillator (OCXO) warms up. For the warm-up time, see data sheet.
3. Press the [On/Standby] key.
Key and LED are located on the [front panel](#).
The LED changes to green. The R&S SMW boots.

When starting for the first time, the R&S SMW 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 and the OCXO are active. To deactivate them, disconnect the instrument from the power supply.

To disconnect from power

The R&S SMW 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 SMW from the power source.

5 Instrument Tour

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

- [Front Panel Tour](#)
- [Rear Panel Tour](#)

This section explains the control elements and the connectors of the R&S SMW 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 SMW are described in [Chapter 1.2, "Labels on R&S SMW"](#), on page 10.

5.1 Front Panel Tour

This section provides an overview of the control elements and connectors on the front panel of the R&S SMW. On the [rear panel](#), you find all further connectors of the unit. The user interface can be displayed on a remote PC station used to manually remote control the instrument.

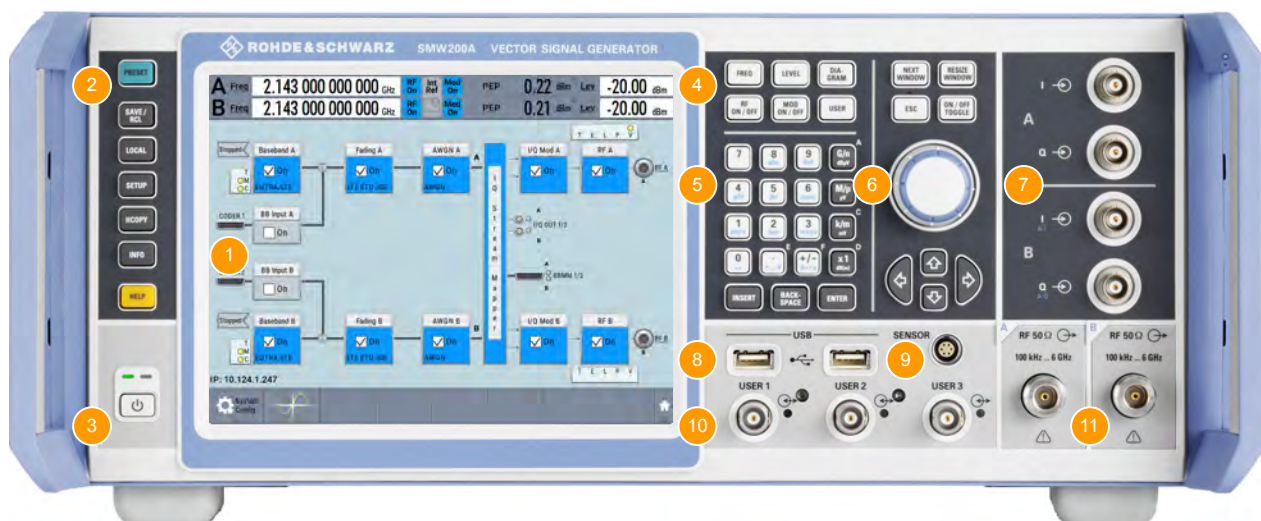


Figure 5-1: Front panel view

- 1 = Touchscreen, see [Chapter 5.1.1, "Touchscreen"](#), on page 34
- 2 = Utility keys, see [Chapter 5.1.2.1, "Utility Keys"](#), on page 35
- 3 = [On/Standby], see [Chapter 5.1.2.2, "On/Standby"](#), on page 36

- 4 = Function keys, see [Chapter 5.1.2.3, "Function Keys"](#), on page 36
- 5 = Keypad, see [Chapter 5.1.2.4, "Keypad"](#), on page 37
- 6 = Navigation controls, see [Chapter 5.1.2.5, "Navigation Controls"](#), on page 38
- 7 = I/Q input connectors (BNC), see ["I/Q, I/Q Bar"](#) on page 39
- 8 = USB connectors, see ["USB"](#) on page 39
- 9 = SENSOR connector, see ["SENSOR"](#) on page 40
- 10 = USER x input/output connectors (BNC), see ["USER x"](#) on page 40
- 11 = RF A/RF B output connectors, see ["RF A/RF B"](#) on page 40

5.1.1 Touchscreen

The block diagram and the most important settings are displayed on the screen on the front panel. The screen display also provides status and setting information and allows you to quickly reconfigure the signal flow. The screen is touch-sensitive, offering an alternative means of user interaction for quick and easy handling of the instrument.

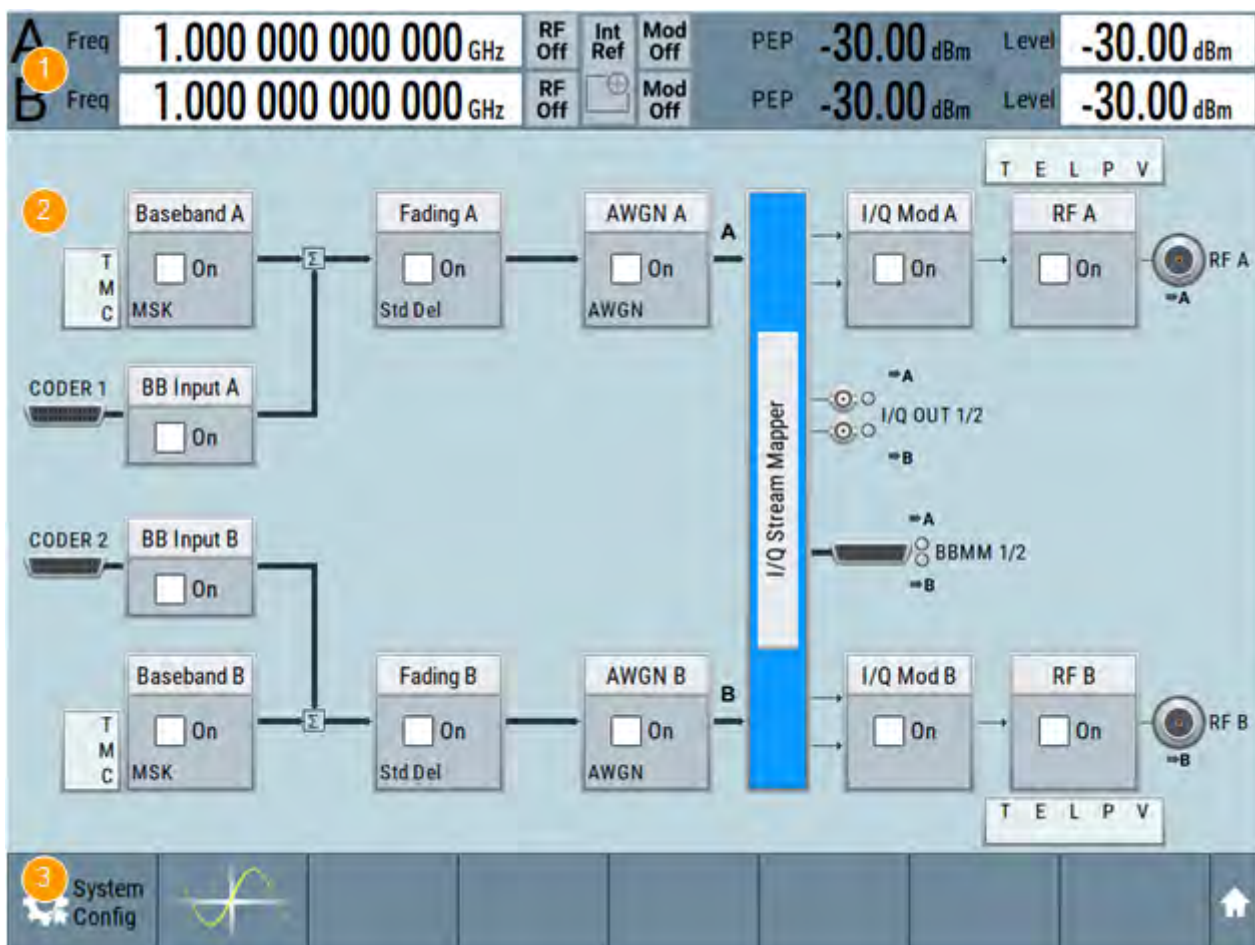


Figure 5-2: Touchscreen elements

- 1 = Status bar (frequency and level display)
- 2 = Block diagram
- 3 = Taskbar/softkey bar

Any user interface elements that react to a click by a mouse pointer also react to a tap on the screen, and vice versa. Using the touchscreen, you can perform the following tasks (among others) by the tap of your finger:

- Changing a setting
- Selecting new settings
- Scrolling through the list of parameters
- Saving or recalling settings
- Routing the signal flow
- Opening and closing dialogs

See also:

- [Chapter 8, "Instrument Control"](#), on page 99, for operating the touchscreen.
- "Maintenance" in the user manual, for instructions on cleaning the screen.

5.1.2 Keys

5.1.2.1 Utility Keys

The utility keys cause the R&S SMW to return to a defined instrument state and provide information on the instrument and assistance.

For more information, refer to chapter "General Instrument Functions" in the user manual.

Table 5-1: Utility keys

Utility Key	Assigned functions
[PRESET]	Sets the instrument to a defined state
[SAVE/RCL]	Saves and loads instrument setting Accesses the file manager
[LOCAL]	Switches from remote control to local (manual) control
[SETUP]	Accesses the general instrument settings
[HCOPY]	Opens the "Hardcopy" dialog for storing the current display in a file

Utility Key	Assigned functions
[INFO]	Displays status messages, error messages, and warnings
[HELP]	Displays context-sensitive help text

5.1.2.2 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 4.13, "Switching On or Off"](#), on page 30.

5.1.2.3 Function Keys

Function keys provide access to most common generator settings and functions.

A detailed description of the corresponding functions is provided in the user manual.

Table 5-2: Function keys

Function key	Assigned functions
[FREQ]	Activates frequency entry. ¹⁾
[LEVEL]	Activates level entry. ¹⁾
[Diagram]	Brings the block diagram to the foreground. Active dialogs are minimized.
[RF ON/OFF]	Switches the RF output on and off. ²⁾
[MOD ON/OFF]	Switches the modulations on and off. ²⁾
[USER]	Key with a customizable function. You can define the action to be executed.
Function execution (in navigation controls area)	
[ON/OFF TOGGLE]	<ul style="list-style-type: none"> Switches highlighted elements or a function block on and off. 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.

¹⁾ The entry field that was active last is activated. Press the key again to activate the entry field of the other path.

²⁾ Status is displayed in the "Status bar". The key switches off all RF signals/modulations; press the key again to restore the last active status.

5.1.2.4 Keypad

The keypad is used 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. In the case of an alphanumeric parameter, inserts a "-" at the cursor position.
Unit keys (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. In the case of 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.
[INSERT] key	Toggles between insert and overwrite mode
[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: <ul style="list-style-type: none"> • 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.
[Backspace] key	If an alphanumeric entry has already been started, this key deletes the character to the left of the cursor.
[Enter] key	Has the same effect as pressing the rotary knob <ul style="list-style-type: none"> • 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.

5.1.2.5 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.

Rotary Knob

The rotary knob has several functions:

- Increments (clockwise direction) or decrements (counterclockwise direction) the instrument parameter at a defined step width in the case of a numeric entry.
- 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.

Navigation Keys

The navigation keys can be used alternatively to the rotary knob to navigate through dialog boxes, diagrams, or tables.

Table 5-4: Navigation keys

Type of key	Description
[Up/Down] Key	The [Up] and the [Down] key does the following: <ul style="list-style-type: none">• In a numeric edit dialog box, increase or decrease the instrument parameter.• In a list, scroll forward and backward through the list entries.• In a table, move the selection bar vertically.• In windows or dialog boxes with vertical scrollbar, move the scrollbar.
[Left/Right] Key	The [Left] and the [Right] key does the following: <ul style="list-style-type: none">• In an alphanumeric edit dialog box, move the cursor.• In a list, scroll forward and backward through the list entries.• In a table, move the selection bar horizontally.• In windows or dialog boxes with horizontal scrollbar, move the scrollbar.

Display Keys

The display keys arrange different windows on the display.

Table 5-5: Display keys

Display key	Assigned functions
[NEXT WINDOW]	Toggles between the active dialogs
[RESIZE WINDOW]	Adjusts the size of the active dialog to use the whole height of the display.
[ESC]	<p>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.</p> <p>For "Edit" dialog boxes the following mechanism is used:</p> <ul style="list-style-type: none"> • 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.

5.1.3 Connectors

The RF and I/Q connectors and various others interface connectors are on the front panel.

I/Q, I/Q Bar

BNC connectors for input of external I/Q signals for analog modulation. The signals are fed directly into the I/Q modulator.

One pair of I and Q inputs are available per installed RF path.

Use the connectors for connections as follows:

- I/Q connectors: Direct (single-ended) or positive differential input of analog I/Q signals
- I/Q Bar connectors: Negative differential input of analog I/Q signals

How to: Chapter "How to Apply an External Digital Baseband Signal" in the user manual

USB

There are two female USB (universal serial bus) connectors of type A (host USB) on the front panel. You can connect, for example, a keyboard, a mouse or a USB memory stick.

Further USB connectors of type A (host USB) and USB type B (USB Device) are available on the rear panel.

How to: [Chapter 4.8, "Connecting USB Devices"](#), on page 25.

SENSOR

Connector for R&S NRP sensors.

A power sensor is connected to the R&S SMW 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 SMW 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

USER x




BNC multipurpose connectors for defining input signals and output signals.

The [Table 5-6](#) lists the signals assigned to the USER x connectors in the default instrument state.

Table 5-6: Default configuration of the USER x connectors

USER connector	Direction	Default assigned signal
1	Output	Baseband A Marker 1
2	Output	Baseband A Marker 2
3	Input	Global Trigger 1

A dedicated LED indicates the connector status:

-  green: an input connector
-  yellow: an output connector
-  no light / gray: the connector is not active

See also chapter "Local and Global Connector Settings" in the user manual.

RF A/RF B

Outputs for the RF signal of path A and path B.

The connector type depends on the maximum frequency f_{\max} , see table below.

Table 5-7: RF connector types and maximum frequency f_{max}

Connector type	Range	Relevant option
N female	$f_{max} \leq 7.5 \text{ GHz}$	RF A: R&S SMW-B1003/-B1006/-B1007 RF B: R&S SMW-B2003/-B2006/-B2007
Test port adapter, PC 2.92 mm female	$7.5 \text{ GHz} < f_{max} \leq 40 \text{ GHz}$	RF A: R&S SMW-B1012/-B1020/-B1031/-B1040/-B1040N RF B: R&S SMW-B2020
PC 1.85 mm male and adapter 1.85 mm female	$40 \text{ GHz} < f_{max} \leq 44 \text{ GHz}$	RF A: R&S SMW-B1044/-B1044N

Note: The PC 1.85 mm male connector for up to 44 GHz comes with a protective 1.85 mm female adapter to prevent the sensitive connector from damage. It is available as a spare part, and can be replaced if damaged. Contact your Rohde & Schwarz support center or www.customersupport.rohdeschwarz.com for information.

How to: [Chapter 4.9, "Connecting to RF A/RF B"](#), on page 26

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.

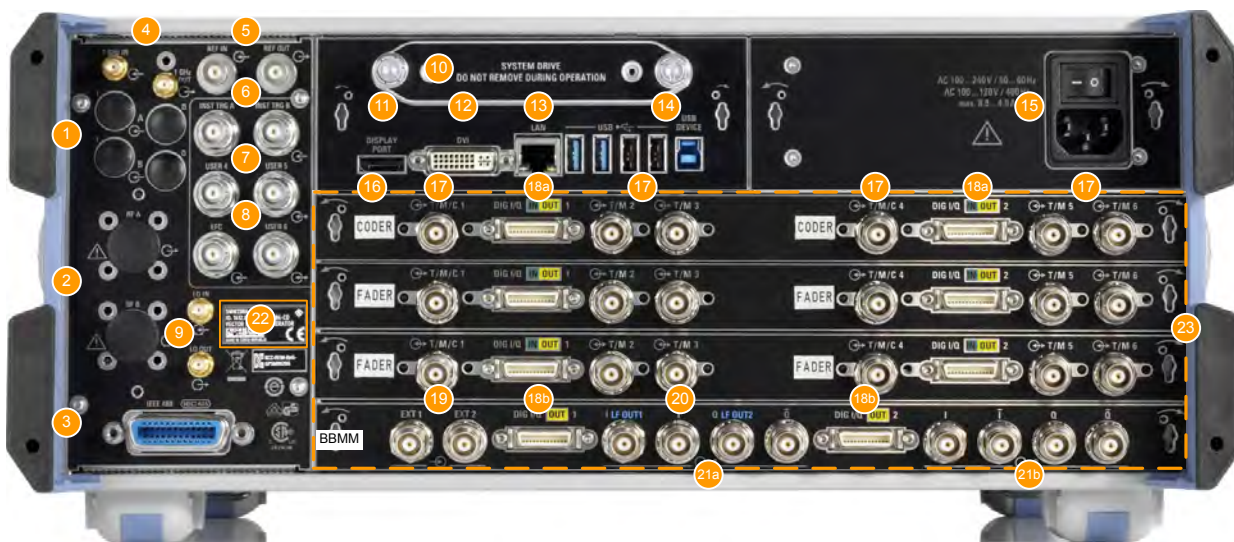


Figure 5-3: Rear panel view of instrument equipped with R&S SMW-B10 and R&S SMW-B13T (standard baseband)

- 1, 2 = Connectors for use in a rack
- 3 = IEC 625/IEEE 488 connector, see "[IEC 625/IEEE 488](#)" on page 43
- 4 = REF IN 1GHz and REF OUT 1GHz connectors (SMA), see "[REF IN/REF OUT](#)" on page 44
- 5 = REF IN/REF OUT connectors (BNC)
- 6 = INST TRIG x connectors (BNC), see "[INST TRIG x](#)" on page 44
- 7 = USER x connectors (BNC), see "[USER x](#)" on page 44
- 8 = EFC connectors (BNC), see "[EFC](#)" on page 44
- 9 = LO IN/LO OUT connectors (SMA), see "[LO IN/LO OUT](#)" on page 44
- 10 = HDD/SSD system drive, see "[System drive \(HDD/SSD\)](#)" on page 45
- 11, 12 = Display Port, DVI connectors, see "[Display Port, DVI](#)" on page 45
- 13 = LAN connectors, see "[LAN](#)" on page 45
- 14 = USB/USB Device connectors, see "[USER x](#)" on page 44
- 15 = AC power supply connection and main power switch, see "[AC power supply connector and switch](#)" on page 45
- 16 = Board designation (CODER, FADER, BBMM)
- 17 = T/M/C and T/M connectors (BNC), see "[T/M/C](#)" on page 45
- 18a, b = DIG I/Q connectors, see "[DIG I/Q](#)" on page 46
- 19 = EXT x connectors (BNC), see "[EXT x 1/2](#)" on page 47
- 20 = LF OUT x connectors (BNC), see "[LF OUT x](#)" on page 47
- 21a, b = I/Q, I/Q Bar connectors (BNC), see "[I/Q, I/Q Bar](#)" on page 47
- 22 = Serial number (six digits in the string 1412.0000.02-<serial number>-<checksum>)
- 23 = R&S SMW-B10, R&S SMW-B13T and R&S SMW-B14 boards location

The rear panel view differs in particular if the standard or wideband baseband options are installed. The [Figure 5-4](#) shows a detail view of the rear panel. Shown are only the different boards.

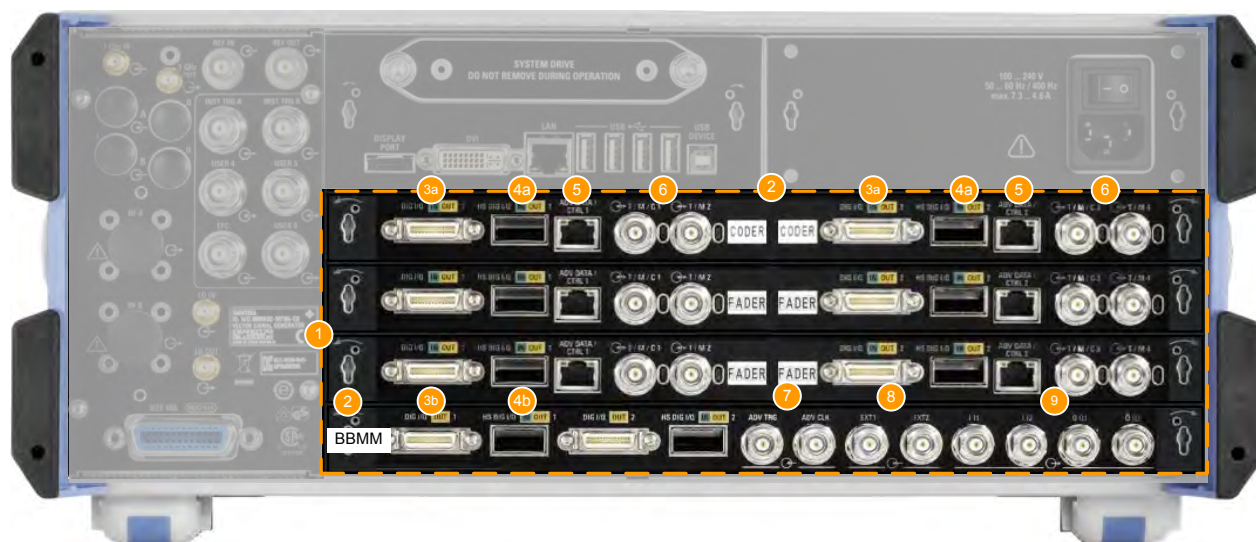


Figure 5-4: Detail view: Rear panel of instrument equipped with R&S SMW-B9 and R&S SMW-B13XT (wideband baseband)

- 1 = R&S SMW-B9, R&S SMW-B13XT and R&S SMW-B15 boards location
- 2 = Board designation (CODER, BBMM, FADER)
- 3a, 3b = DIG I/Q connectors (connectors on the FADER board are provided for future use), see ["DIG I/Q"](#) on page 46
- 4a, 4b = HS DIG I/Q connectors (connectors on the FADER board are provided for future use), see ["HS DIG I/Q"](#) on page 48
- 5 = ADV DATA/CTRL connectors, see ["ADV DATA/CTRL"](#) on page 48
- 6 = T/M/C and T/M connectors (BNC), see ["T/M/C"](#) on page 45
- 7 = ADV TRIG and ADV CLK connectors (BNC), see ["ADV TRIG, ADV CLK"](#) on page 48
- 8 = EXT x connectors (BNC), see ["EXT x 1/2"](#) on page 47
- 9 = I/Q, I/Q Bar connectors (BNC), see ["I/Q, I/Q Bar"](#) on page 47

5.2.1 Connectors

I/Q

Rear panel I/Q input connectors, recommended for use of the instrument in a 19" rack. See ["I/Q, I/Q Bar"](#) on page 39.

How to:

- [Chapter 4.4.2, "Mounting the R&S SMW in a Rack"](#), on page 21
- Chapter "How to Apply an External Digital Baseband Signal" in the user manual

RF A/RF B

Rear panel RF output connectors for the first RF path (option R&S SMW-B81/-B83) and the second RF path (option R&S SMW-B82/-B84). These options are recommended for use of the instrument in a 19" rack.

How to:

- [Chapter 4.4.2, "Mounting the R&S SMW in a Rack"](#), on page 21
- [Chapter 4.9, "Connecting to RF A/RF B"](#), on page 26

IEC 625/IEEE 488

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 SMW. To set up the connection, use high-quality shielded cables. See ["Cable selection and electromagnetic interference \(EMI\)"](#) on page 22.

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

REF IN/REF OUT

Input/output for external reference signal.

BNC connectors for reference signals from 1 MHz to 100 MHz.

SMA connectors for 1 GHz reference signals.

The external reference is used for both paths.

How to: [Chapter 4.11, "Connecting to REF IN/REF OUT"](#), on page 28

INST TRIG x

BNC connector for input of external trigger signals. The signals trigger sweeps and list mode.

See chapter "Signal Generation and Triggering in the Sweep and List Modes" in the user manual.

USER x




BNC multipurpose connectors for defining input signals and output signals.

[Table 5-8](#) lists the signals assigned to the USER x connectors in the default instrument state.

Table 5-8: Default configuration of the USER x connectors

USER connector	Direction	Default assigned signal
4	Input	Global Trigger 2
5	Output	Signal Valid A
6	Not used	None

A dedicated LED indicates the connector status:

-  green: an input connector
-  yellow: an output connector
-  no light / gray: the connector is not active

See also chapter "Local and Global Connector Settings" in the user manual.

EFC

BNC connector for input of an EFC (external frequency control) signal for electronic tuning of the internal reference frequency.

LO IN/LO OUT

Option: R&S SMW-B90

SMA connector for local oscillator input and output for phase-coherent RF signal:

- LO IN: Input of phase coherence signal

- LO OUT: Output of phase coherence signal

How to: [Chapter 4.10, "Connecting to LO In/Out"](#), on page 27

System drive (HDD/SSD)

Hard disk drive (HDD) or solid-state drive (SSD); the SSD requires option R&S SMW-B93.

For security reasons, the hard disk is bound to the specific R&S SMW. You can remove it from the instrument, but you cannot use it in other instruments.

See also section "Removing the system drive from the R&S SMW" in the user manual.

Display Port, DVI

Provided for future use.

LAN

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

How to: [Chapter 4.7, "Connecting to LAN"](#), on page 24

USB/USB Device

- Four female USB type A connectors, 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
- Female USB Device connector (USB type B), for example for remote control.

How to: [Chapter 4.8, "Connecting USB Devices"](#), on page 25

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 24.

T/M/C

BNC multipurpose input/output trigger/marker/clock connectors.

The number of connectors depends on the installed baseband options:

- Standard baseband generator (R&S SMW-B10):
One T/M/C and two T/M connectors per board.
- Wideband baseband generator (R&S SMW-B9):
One T/M/C and one T/M connectors per board

The input/output signal has to be defined. The [Table 5-9](#) lists the configuration of the local connectors in the default instrument state.




Table 5-9: Default configuration of the T/M/C connectors (standard baseband)

T/M/C connector (Standard baseband)	Direction	Default assigned signal	Remark
1, 4	Output	Clock	Local clock signal for the particular baseband
2, 5	Input	Trigger	Local trigger signal for the particular baseband
3, 6	Output	Marker 3	Marker output signal from the particular baseband

Table 5-10: Default configuration of the T/M/C connectors (wideband baseband)

T/M/C connector	Direction	Default assigned signal
1	Output	Symbol clock
2	Input	External serial data

A dedicated LED indicates the connector status:

-  green: an input connector
-  yellow: an output connector
-  no light / gray: the connector is not active

See also the chapters in the user manual:

- "Data, Clock and Control Signals and Sources in the Baseband"
- "Local and Global Connectors"

DIG I/Q




Connectors for the input/output of a digital I/Q signal from and to a Rohde & Schwarz instrument, like a signal generator, signal analyzer, the R&S®IQW, or the R&S®CMW500.

The interfaces require the options listed in [Table 5-11](#) (for details see the data sheet).

Table 5-11: Overview of the DIG I/Q interfaces and the required options

Location	Designation	Required option
CODER boards	CODER 1/2 In	R&S SMW-B10, standard baseband generator R&S SMW-B9, wideband baseband generator, if "System Config > Mode = Advanced"
FADER boards	FADER 1/2/3/4 In/Out	R&S SMW-B14, fading simulator
BBMM board	BBMM 1/2 Out	R&S SMW-B13/-B13T and R&S SMW-K18, digital baseband output R&S SMW-B13XT and R&S SMW-K19, if "System Config > Mode = Advanced"

A dedicated LED indicates the connector status:

-  green: an input connector
-  yellow: an output connector
-  no light / gray: the connector is not active

EXT x 1/2

Input for external analog modulation signals.

Any of the two inputs can be used for path A and path B.

LF OUT x

Option: R&S SMW-B13/-B13T

Output for internal LF generator signal.

Note: The output of the internal LF signal and the analog I/Q signal use the same physical connectors.

These signals cannot be output at the same time.

See also data sheet and user manual, section "Analog Modulation".

I/Q, I/Q Bar

BNC connector for output of direct (single-ended) or differential analog I/Q signals.

Use the connectors for connections as follows:

- I/Q connectors: Direct (single-ended) or positive differential output of analog I/Q signals
- I/Q Bar connectors: Negative differential output of analog I/Q signals

The number of connectors depends on the installed baseband options:

- Standard baseband (R&S SMW-B10 and R&S SMW-B13T)
Two single-ended analog and two differential outputs.

Output of differential signal requires option R&S SMW-K16.

- Wideband baseband (R&S SMW-B9 and R&S SMW-B13XT)
Two single-ended analog or one differential output. Differential and single-ended signals cannot be output at the same time.
Output of differential signal requires option R&S SMW-K17.

How to: Chapter "How to Connect External Instruments and Configure the Signal Flow" in the user manual

ADV DATA/CTRL

Option: R&S SMW-B9/-B13XT and R&S SMW-K503/-K504

Interface for exchanging of external data and control signals.

See user manual R&S SMW-K501/-K502/-K503/-K504 Extended and Real-Time Sequencing, Real-Time Control Interface.

ADV TRIG, ADV CLK

Option: R&S SMW-B9/-B13XT

Input and output for synchronization signal in multi-instrument setups.

See also "Multi-Instrument Setups" in the user manual.

HS DIG I/Q

Option: R&S SMW-B9/-B13XT

Connectors for the input/output of high-speed digital I/Q signals, for example, from and to Rohde & Schwarz instruments.

The interfaces require the options listed in [Table 5-12](#).

For more information, see data sheet.

Table 5-12: Overview of HS DIG I/Q interfaces and required options

Location of the interface	Designation	Required option
CODER board	CODER 1/2 In	R&S SMW-B9, wideband baseband generator
BBMM board	BBMM 1/2 Out	R&S SMW-B13XT, wideband baseband main module R&S SMW-K19 for the output of digital signals

The interface is a QSFP+ (Quad Small Form-factor Pluggable) module. It supports max. bandwidth of up to 50 Gsample/s with optical active cables.

How to: [Chapter 4.12, "Connecting to HS DIG I/Q"](#), on page 28

6 Trying Out the Instrument

This chapter introduces the most important functions and settings of the R&S SMW step by step. The complete description of the functionality and its usage is given in the R&S SMW user manual. Basic instrument operation is described in [Chapter 8, "Instrument Control"](#), on page 99.

You can perform the tasks described in this section step-by-step or run the build-in tutorials, see:

- ["To start a tutorial in an interactive step-by-step mode"](#) on page 112

Prerequisites

- The instrument is set up, connected to power and started up as described in [Chapter 4, "Preparing for Use"](#), on page 19.
- Throughout this description, the term **base unit** describes a R&S SMW equipped with the options R&S SMW-B10, R&S SMW-B13, and R&S SMW-B1003.

You can check all supplied options and licenses of the instrument, see chapter "Requesting Instrument Configuration and Specifications" in the user manual.

For the first signal generation tasks, you use the internal baseband and reference signal, so you do not need any additional signal source. More complex signal generation tasks, however, require an instrument equipped with additional options and/or external signals. Each task description lists its prerequisites.



The screenshots in this description show a fully equipped instrument. Consider that, the block diagram displayed on your particular instrument can differ from the one used in the example.

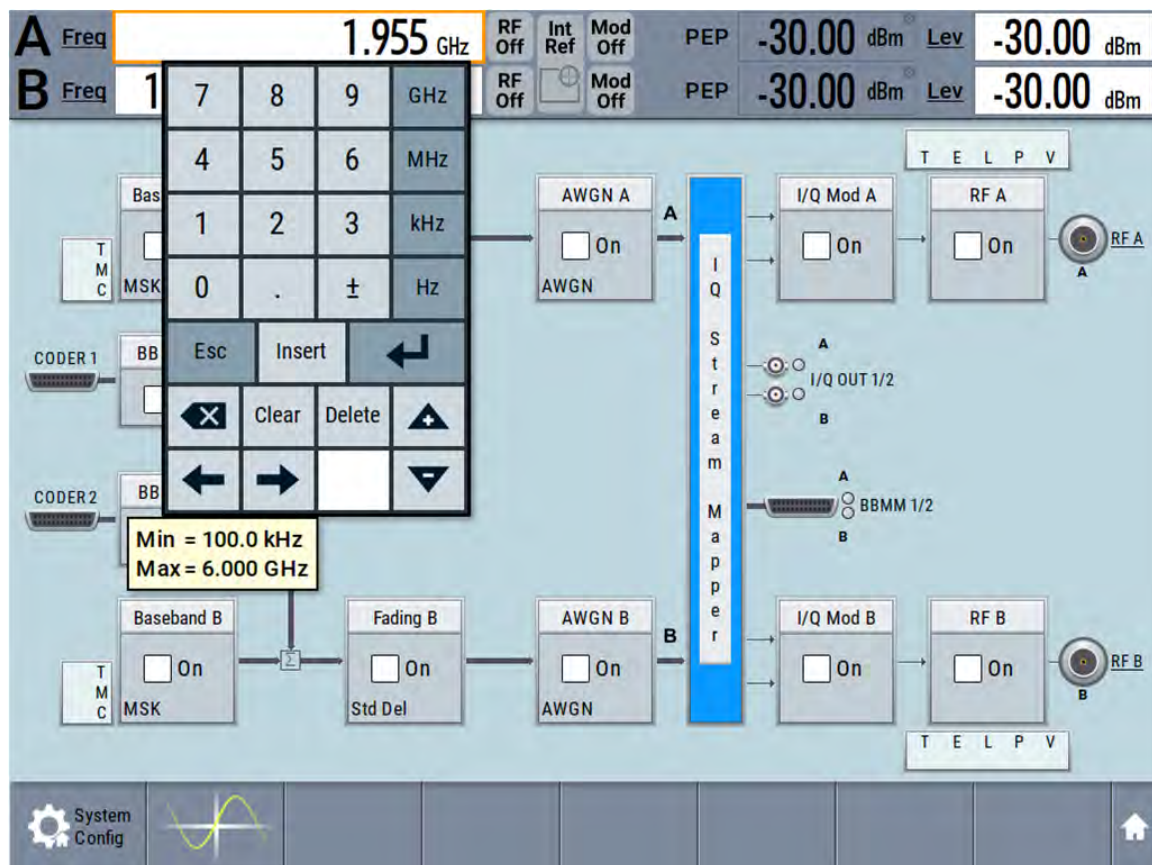
The instrument is manually operated via the touchscreen. Try out the following:

- [Generating an Unmodulated Carrier](#)..... 50
- [Generating a Digitally Modulated Signal](#)..... 53
- [Triggering the Instrument with an External Signal](#)..... 55
- [Enabling and Configuring a Marker Signal](#)..... 62
- [Routing a Baseband Signal to the Outputs](#)..... 63
- [Verifying the Generated Signal](#)..... 68
- [Saving and Recalling Settings](#)..... 72
- [Generating an EUTRA/LTE Signal](#)..... 75
- [Enabling MIMO Configuration](#)..... 79

6.1 Generating an Unmodulated Carrier

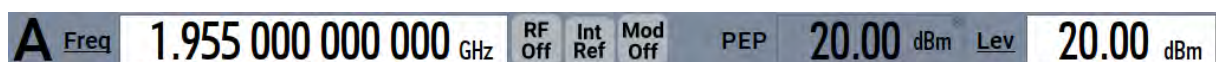
We start out by generating a simple unmodulated signal. The R&S SMW in this example can be a base unit in its minimal configuration.

1. On the R&S SMW front panel, press the [PRESET] key to start out in a defined instrument configuration.
2. Set the frequency:
 - a) On the "Status Bar", tap the "A Freq" field.
 - b) On the on-screen keypad, enter 1.955 and press the "GHz" key.



The on-screen key pad closes and the frequency value is displayed.

3. On the "Status Bar", tap the "Lev" field and enter the level in the same way.



4. Select "Block Diagram > RF A Block > On" to enable the output of the generated unmodulated signal.

Generating an Unmodulated Carrier

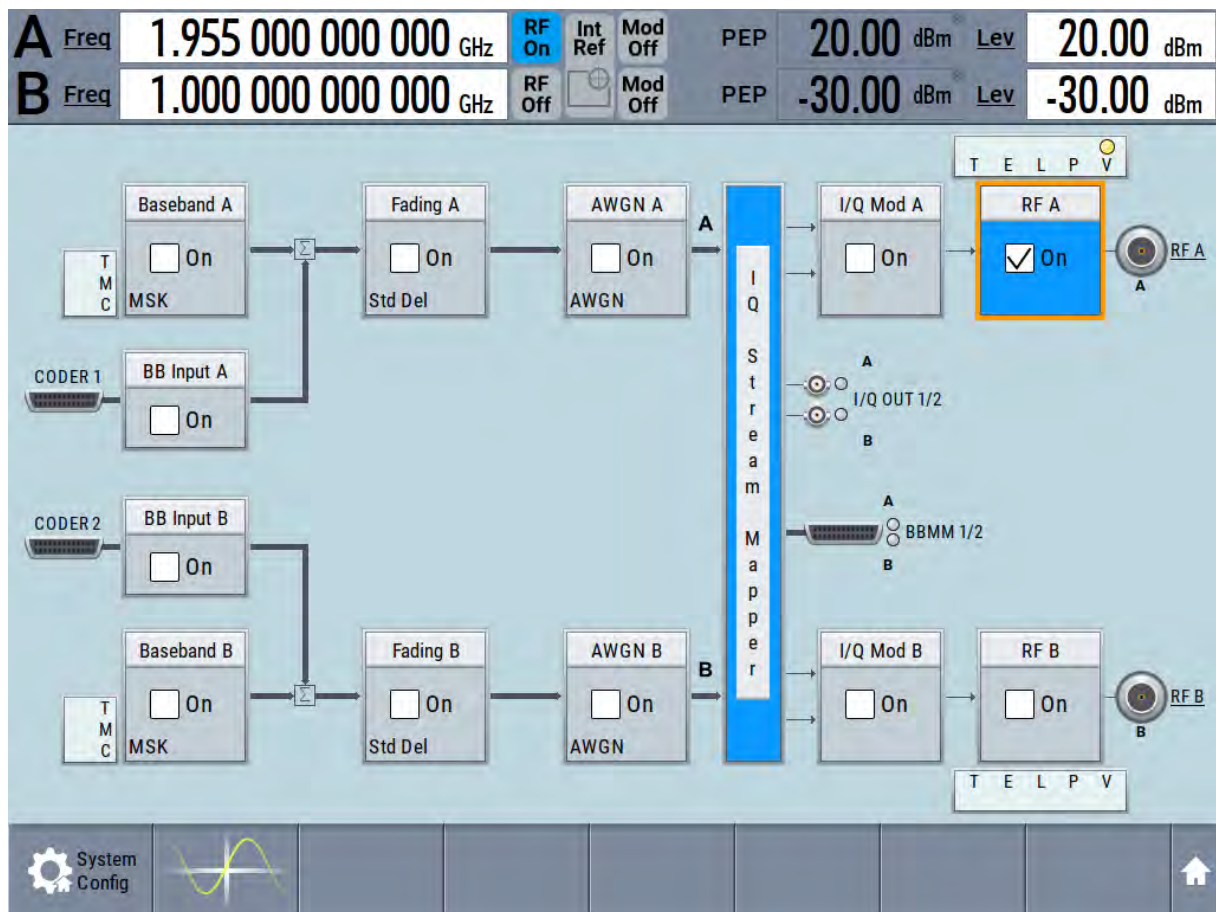


Figure 6-1: Block diagram: Generating an unmodulated signal

Tip: Alternative way to access the instrument functions. To fulfill the same task, you can use other hot spots in the block diagram, the provided functions under the "RF" block or the function front panel keys.

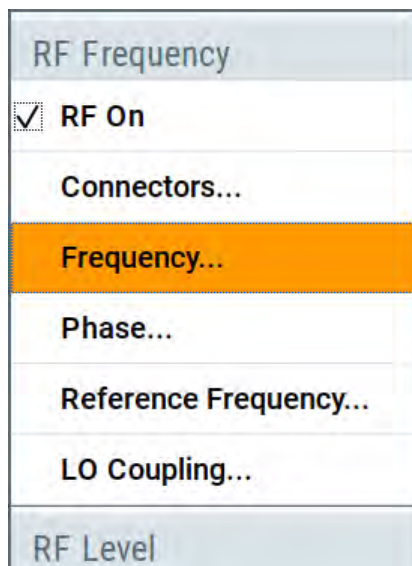
Try out the following:

- On the "Status Bar" and in the block diagram, tap the underlined labels Freq, Lev and RF A.

Or:

- Select "Block Diagram > RF A" block, navigate through the context menu, and use the settings provided in the "Frequency" and "Level" dialog.

Generating an Unmodulated Carrier



To enable signal generation, enable the "RF On".

Or:

- Use the [FREQ], [LEVEL], and [RF ON/OFF] key on the front panel.

See also [Chapter 8, "Instrument Control"](#), on page 99.

The 1.95 GHz signal is output at the RF A connector at the front panel of the R&S SMW.



Connect RF A of the R&S SMW to a signal analyzer, for example R&S®FSW, to display the generated signal.

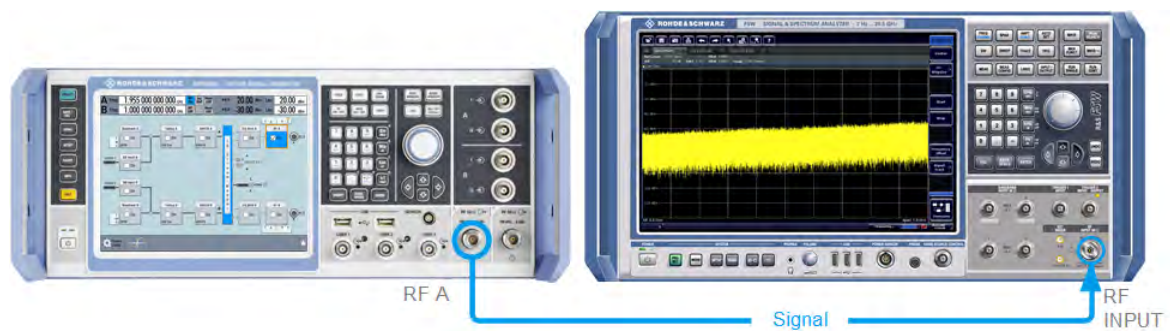


Figure 6-2: Simplified test setup

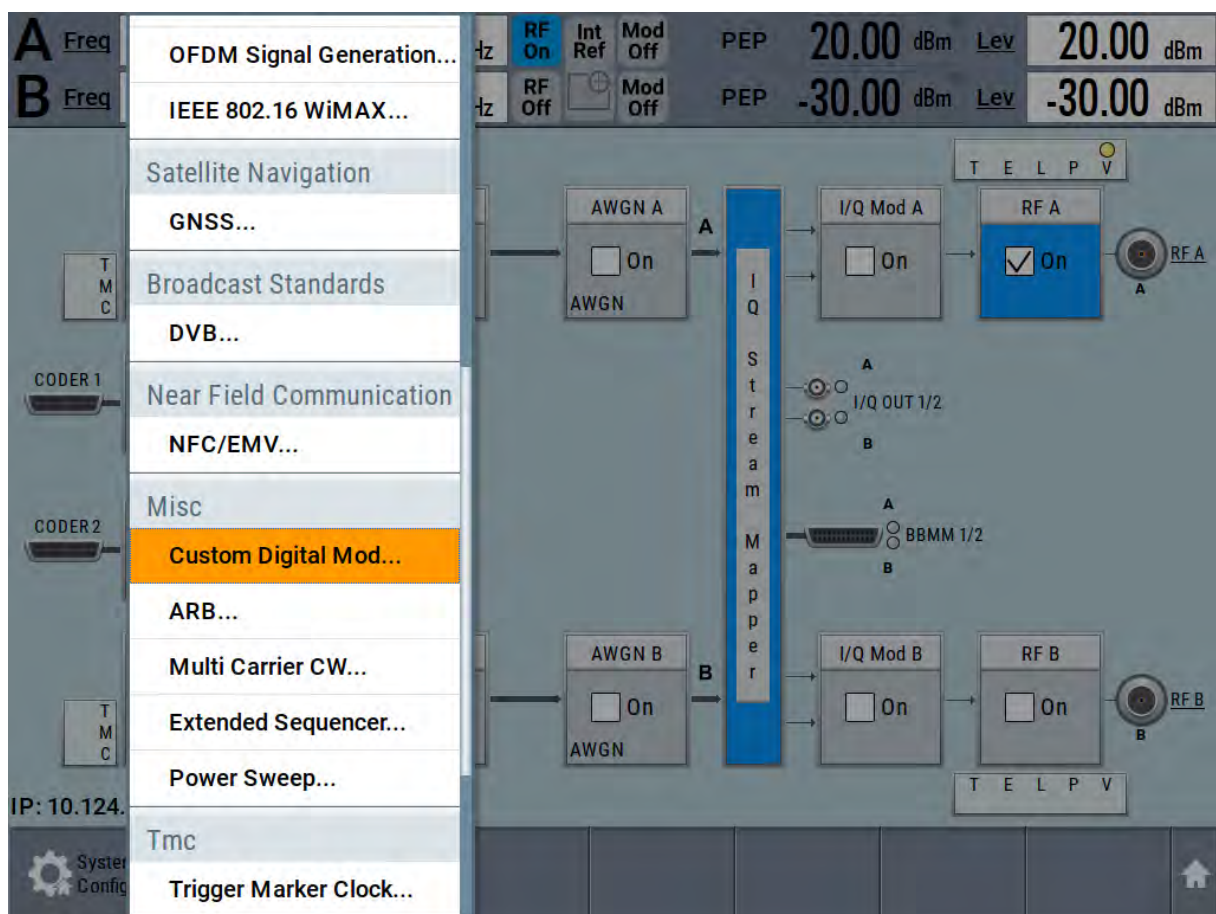
For the required settings of the signal analyzer, refer to its user manual or its online help.

6.2 Generating a Digitally Modulated Signal

This example shows you how to generate a simple WCDMA-3GPP (QPSK 45° offset) signal with the help of the "Custom Digital Modulation" functionality. The minimum requirement for R&S SMW in this example is a base unit.

The initial situation is not the instrument's preset state but rather the configuration described in [Chapter 6.1, "Generating an Unmodulated Carrier"](#), on page 50.

1. In the block diagram, select "Baseband A" and navigate to the section "Misc > Custom Digital Mod..."



The "Custom Digital Modulation" dialog opens.

2. In the "Custom Digital Modulation" dialog, select "General > Set acc to standard > WCDMA-3GPP".
3. Select "General > State > On" to enable signal generation.

Generating a Digitally Modulated Signal



4. Select the "Modulation" tab and observe the used "Modulation Type".

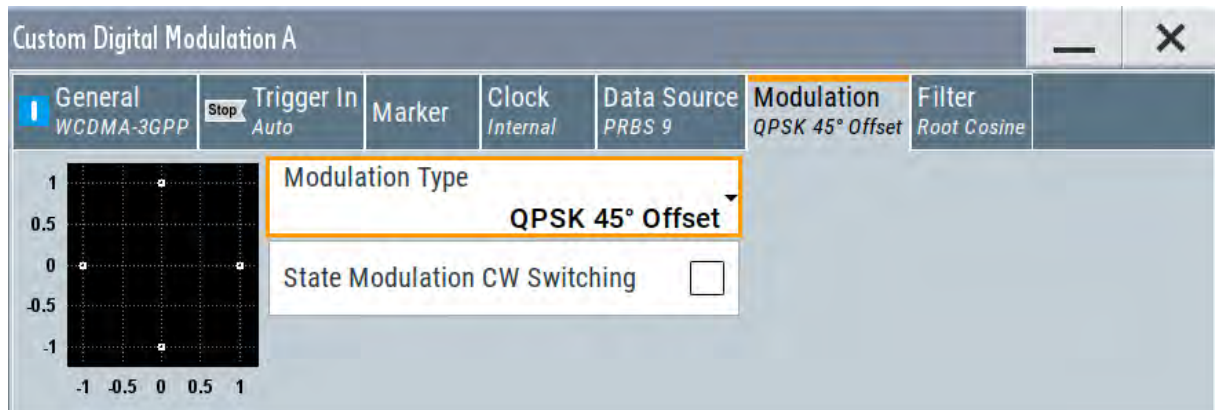


Figure 6-3: Display of the used modulation type

The instrument activates automatically "I/Q Mod A", uses the internal trigger and clock signals, and generates a WCDMA-3GPP signal, modulated with a QPSK 45° offset modulation.

Triggering the Instrument with an External Signal

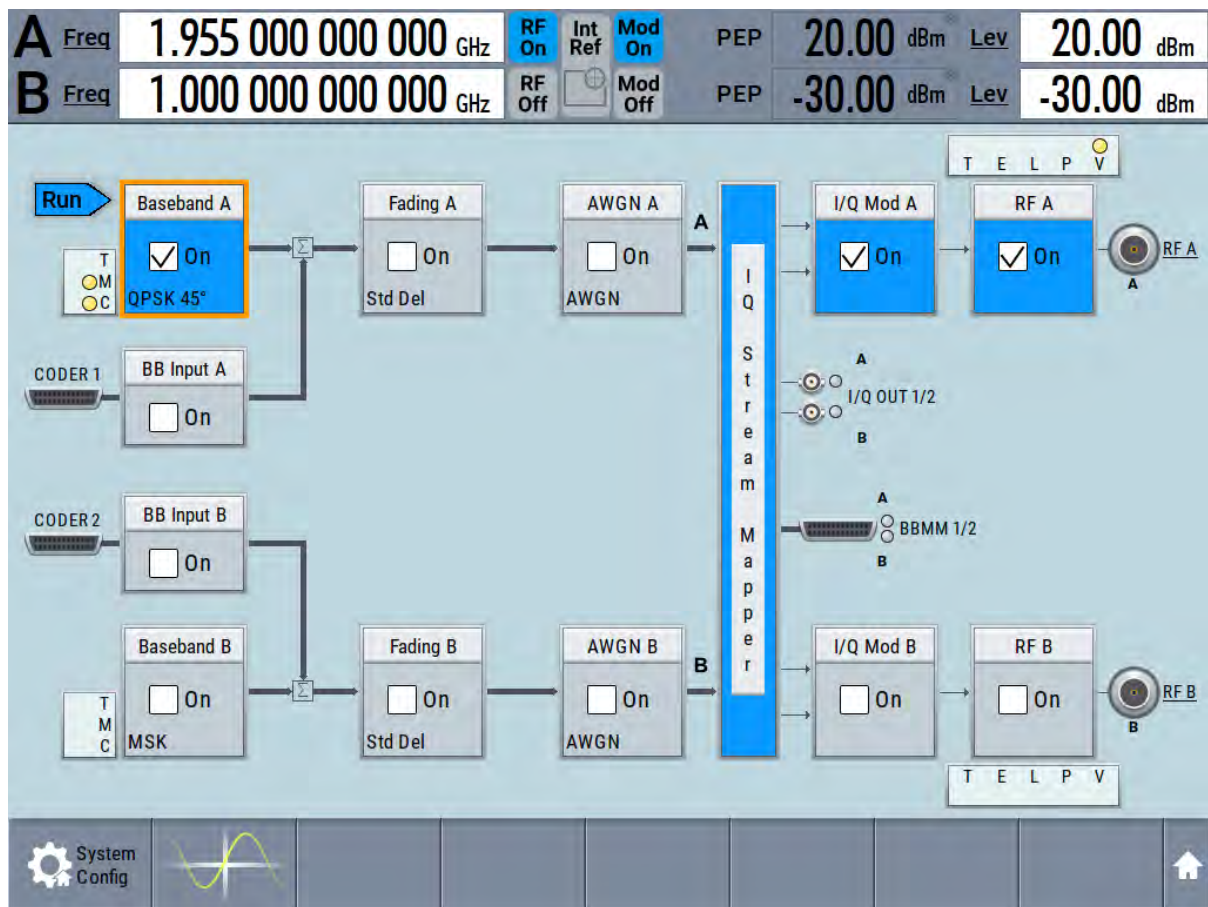


Figure 6-4: Block diagram: Generating a digitally modulated signal

6.3 Triggering the Instrument with an External Signal

The example configurations are rather theoretical cases, because you rarely use the R&S SMW as a stand-alone instrument. Usually, the instrument would be connected to a device under test (DUT) and/or other measurement equipment. As a rule, whenever a test setup requires two or more devices, provide them with a common reference frequency. Some test setups require control of the signal generation start and an exact generation start time. A defined trigger event starts signal generation, e.g. when triggering the instrument internally or externally from the DUT.

This example illustrates the general principle of external triggering and extends the configuration performed in [Chapter 6.2, "Generating a Digitally Modulated](#)

Triggering the Instrument with an External Signal

[Signal](#)", on page 53 by the configuration of the required trigger signal and connector settings.



In this example, we use global USER connectors. Alternatively, you can achieve the same configuration goal with local [T/M/C](#) connectors.

This test setup requires one signal analyzer, like the R&S®FSW, as additional equipment.

To start the signal generation in Baseband A synchronous to an external global trigger signal

The configuration requires three main steps with the following goals:

1. Observe the current connector configuration and define an input connector for the external global trigger signal.
See ["To verify the current connector configuration"](#) on page 56
2. Configure Baseband A to use this external global trigger signal as trigger source.
See ["To reconfigure the trigger settings"](#) on page 59
3. Connect the instrument and the external trigger source.
See ["To connect the instrument and the external trigger source"](#) on page 60

To verify the current connector configuration

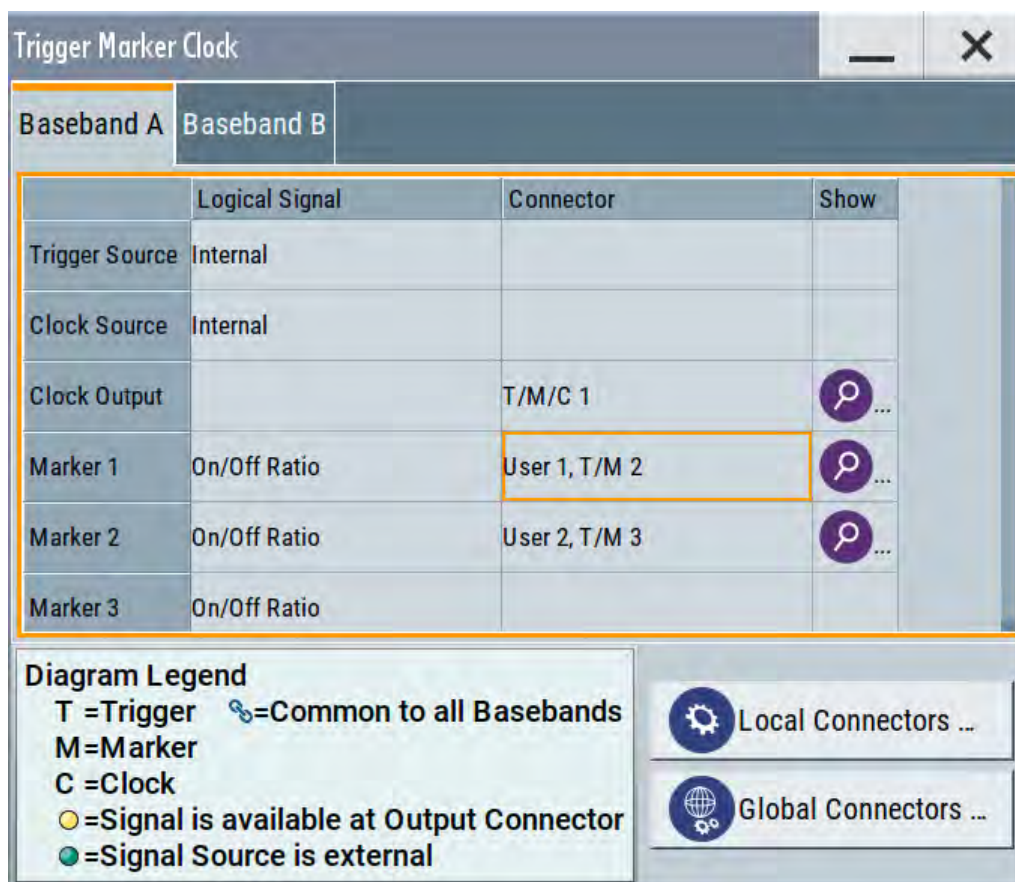
The R&S SMW is equipped with multi-purpose bi-directional local T/M/C connectors and global USER connectors. Because the signal direction, input or output, and the signal mapping are configurable, we recommend that you check the current configuration before cabling or further instrument's configurations.

1. To display *an overview* of the current mapping of the logical signals to the connectors, perform one of the following:
 - In the block diagram, select the Trigger/Marker/Clock status LEDs on the left side of the "Baseband" block.



- Select "Baseband > Trigger Marker Clock".

Triggering the Instrument with an External Signal



The instrument uses its internal trigger and clock signals, and the default mapping of the marker signals to the connectors.

2. To access the related connector settings, perform one of the following:
 - Select "Global Connector Settings"
 - Tap the connector name, for example select the connector "User 1, T/M 2"

Triggering the Instrument with an External Signal

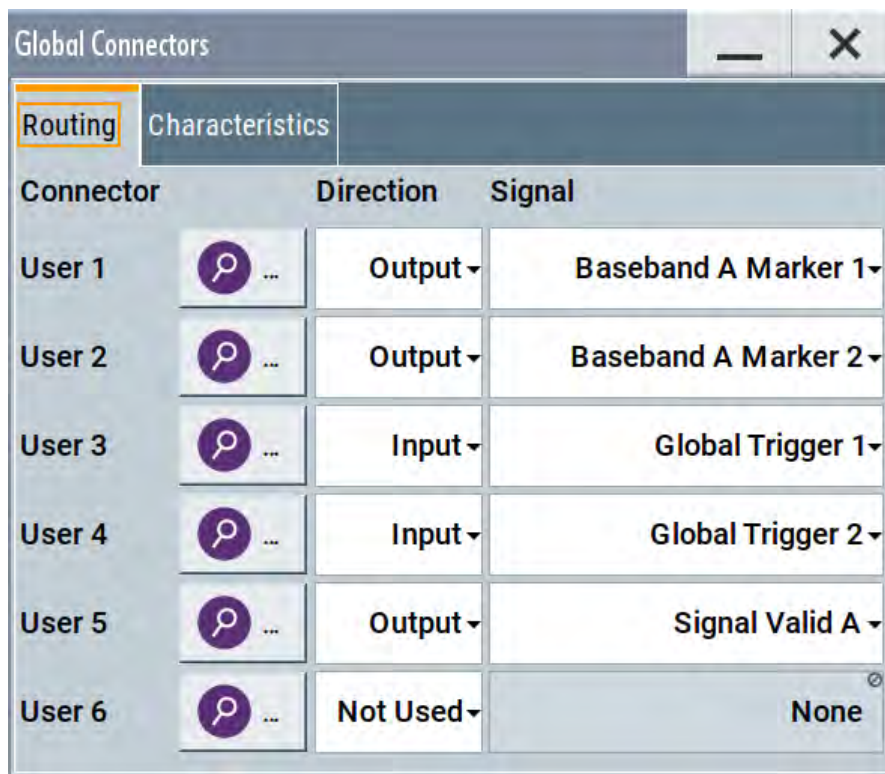


Figure 6-5: Signal mapping to the global connectors

The "Global Connectors" dialog displays the current connectors configuration. The settings are configurable, but in this example we use the default mapping.

- Alternatively, select "Block Diagram > Baseband > Misc > Custom Digital Mod", select the "> Trigger In" tab and select "Local Connector Settings" or "Global Connector Settings".

In the current mapping, the three global connectors **USER x** on the front panel are configured as follows:

- "Marker 1/2" are output at the USER 1/2 connectors
- The USER 3 connector is an input for the "Global Trigger 1" signal.

Check the front panel of the R&S SMW. The USER 1/2 LEDs are yellow; the USER 3 LED is green.



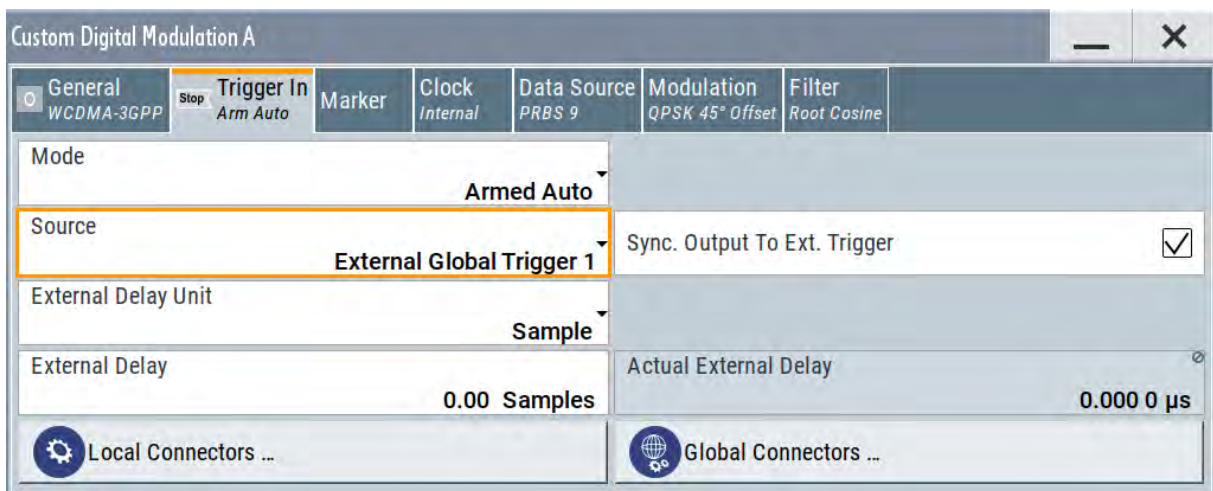
Find the physical location of each connector

Use the built-in "Trigger Marker Clock > Show" function to display the location of the selected connector. A blinking LED on the front/rear panel also indicates the selected connector.

To reconfigure the trigger settings

We assume that the instrument is configured as described in [Chapter 6.2, "Generating a Digitally Modulated Signal"](#), on page 53 and the default connector mapping is maintained (see [Figure 6-5](#)).

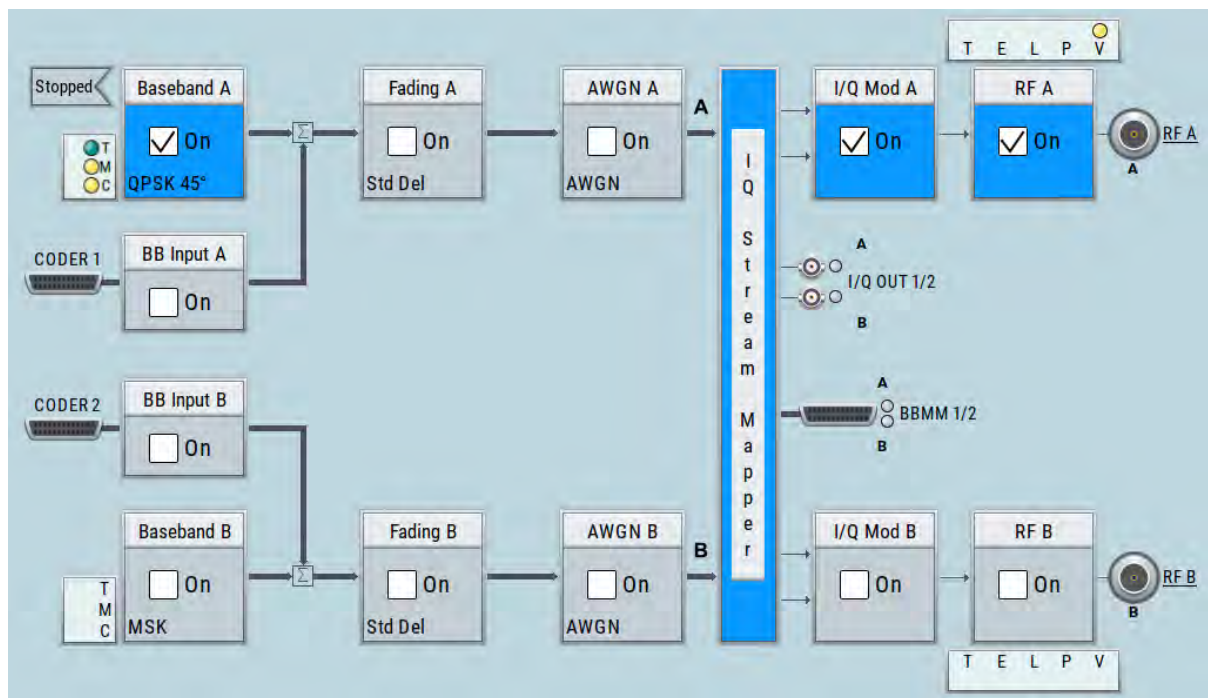
1. In the block diagram, select "Baseband > Misc > Custom Digital Mod > Trigger In".
2. Select the following settings:
 - a) "Mode > Armed Auto"
 - b) "Source > External Global Trigger 1".



The instrument expects an external global trigger event. In this current configuration (see [Figure 6-5](#)), the "Global Trigger 1" signal has to be supplied at the input connector USER 3.

The Trigger/Marker/Clock status LEDs in the block diagram confirm that an external trigger signal is selected; the signal generation is however stopped.

Triggering the Instrument with an External Signal



To connect the instrument and the external trigger source

1. Use a suitable cable to connect the external trigger source to the USER 3 connector of the R&S SMW, see [Figure 6-6](#).

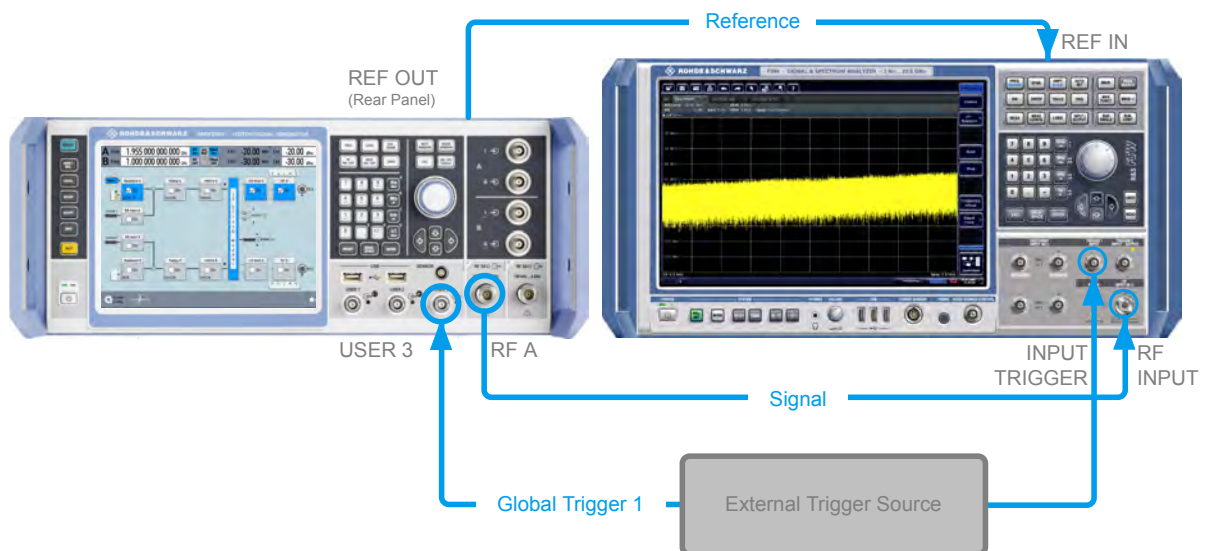
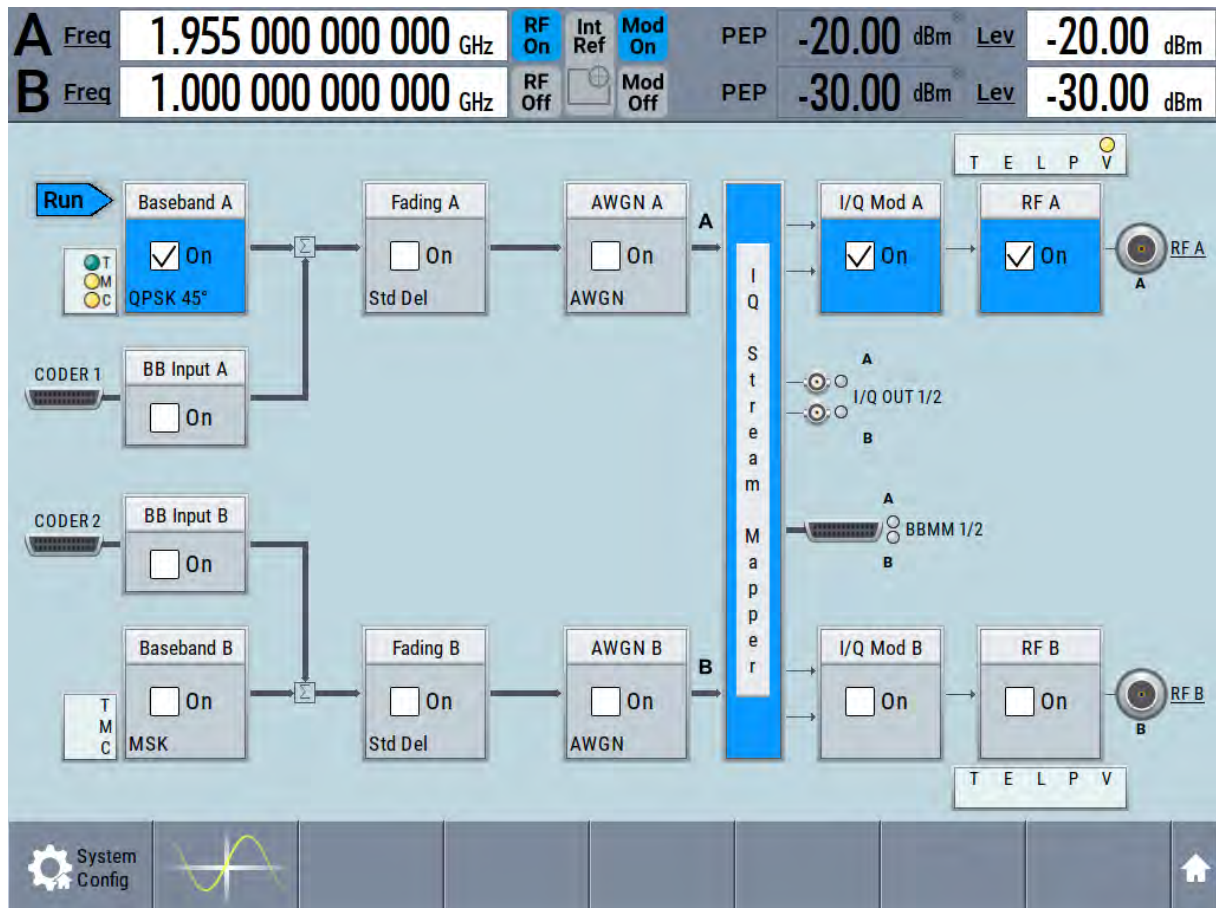


Figure 6-6: Simplified representation of a test setup**

** = The figure depicts the cabling as a general principle; a particular test setup does not require all connections at the same time.

Triggering the Instrument with an External Signal

The Figure 6-6 depicts the location of the connectors and explains the connection as principle. In practice, you would rather "substitute" the analyzer by a DUT, like a base station (BS). Other than in the example, the DUT can be the source for the reference signal. Instead of an external trigger source, the DUT can send, e.g., a frame trigger signal to the R&S SMW. The R&S SMW acts still as the signal source.



2. Use suitable cables to connect the **RF A/B** and **REF OUT** connectors of the R&S SMW to the signal analyzer or the DUT.

Upon the receiving of an external trigger event, the R&S SMW starts the signal generation and then generates a continuous signal. An "Arm" stops the signal generation. A subsequent trigger event causes a restart of the signal generation.



To learn more about this topic, refer to:

- Chapter "Baseband Trigger Signals" in the user manual
- Chapter "Local and Global Connectors" in the user manual

6.4 Enabling and Configuring a Marker Signal

Test setups often require that an external device is synchronized to the generated data stream. For this purpose, the R&S SMW can output marker signals (or markers) also to the generated signal. The R&S SMW provides several regular marker signals and marker signals specific to the firmware option. With suitable marker settings for instance, you can mark slot or frame boundaries or mark the start of a particular modulation symbol.

This example extends further the configurations performed in [Chapter 6.2, "Generating a Digitally Modulated Signal"](#), on page 53. We assume a default connector mapping (see [Figure 6-5](#)).



In this example, we use the global USER connectors. Alternatively, you can achieve the same configuration goal with the local [T/M/C](#) connectors.

This test setup requires one oscilloscope, like the R&S®RTO, as additional equipment.

1. In the block diagram, select "Block Diagram > Baseband > Misc > Custom Digital Mod > Marker" tab.
2. Select "Marker Mode > Marker 1 > Pulse" and "Divider = 32".
Generated is a periodic marker with marker frequency of 120 KHz. The signal is output at the USER 1 connector of the R&S SMW (see [Figure 6-5](#)).
3. Use a suitable cable to connect the USER 1 connector of the R&S SMW to the monitoring instrument, for example oscilloscope like R&S®RTO, see [Figure 6-7](#).

Routing a Baseband Signal to the Outputs



Figure 6-7: Simplified representation of a test setup for signal monitoring**

** = The figure depicts the cabling as a general principle

4. Use a suitable cable to connect the **I OUT** connector of the R&S SMW to the monitoring instrument.



To learn more about this topic, refer to chapter "Regular Marker Output Signals" in the user manual.

6.5 Routing a Baseband Signal to the Outputs

This section emphasizes on the signal routing capabilities in the default state of the instrument (standard system configuration mode). The R&S SMW provides the "I/Q Stream Mapper" function to route and distribute each of the generated I/Q signals (streams) to any of the available output connectors.

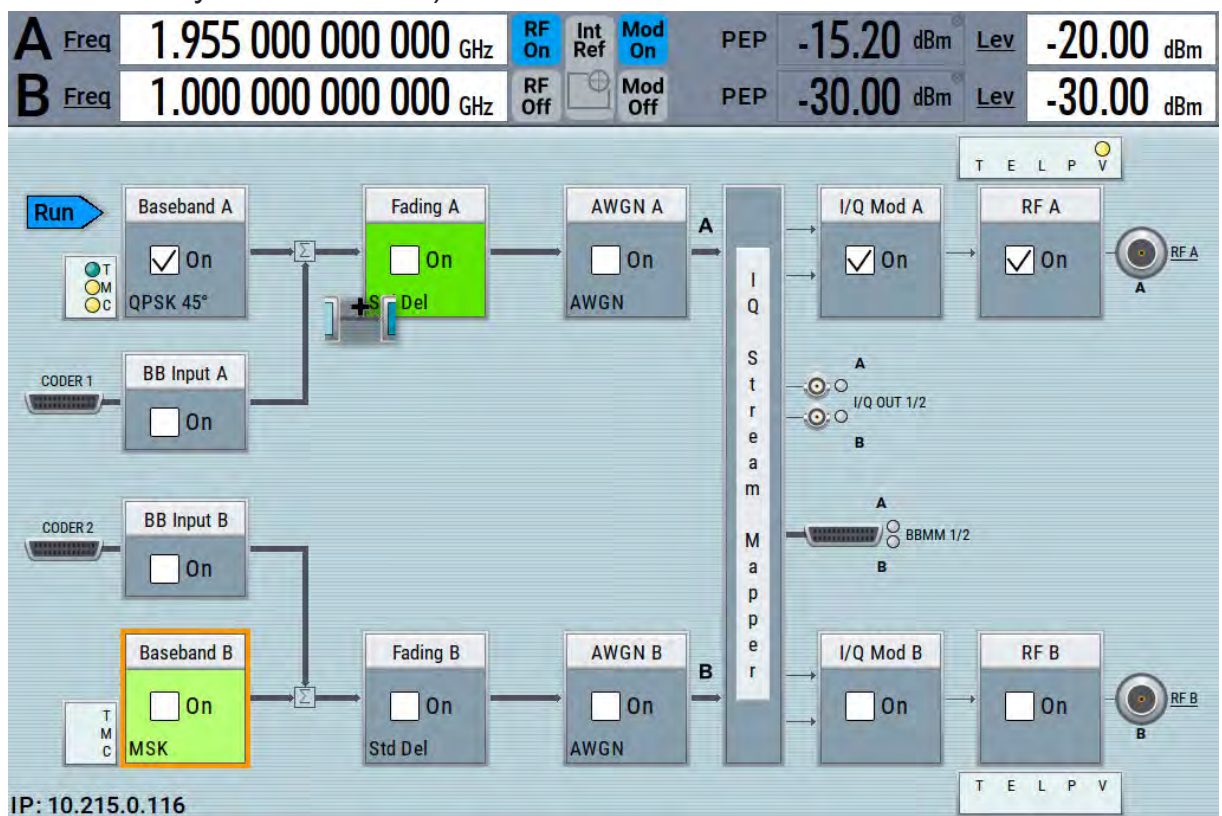
In the provided example, you use the R&S SMW to generate two baseband signals, apply a baseband frequency shift, weight them and add them. You then route the generated stream and define the output connector. The initial situation is the configuration described in [Chapter 6.3, "Triggering the Instrument with an External Signal"](#), on page 55.

The minimum requirement for the instrument in this example is an R&S SMW equipped with the options 2xR&S SMW-B10, R&S SMW-B13T, and R&S SMW-B1003/-B2003.

Routing a Baseband Signal to the Outputs

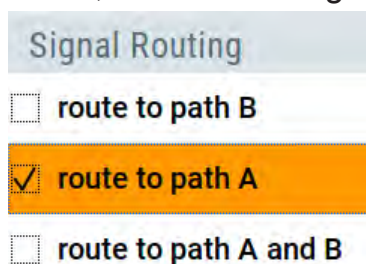
To configure a composed baseband signal

1. In the first baseband, generate a WCDMA-3GPP signal as described in [Chapter 6.2, "Generating a Digitally Modulated Signal"](#), on page 53.
2. To route the signal from "Baseband B" block to the first signal path, use one of the alternatives:
 - In the block diagram, select "Baseband B" block and drag&drop it to the first path ("Fading A" block or "AWGN A" block depending on the options installed on your instrument).



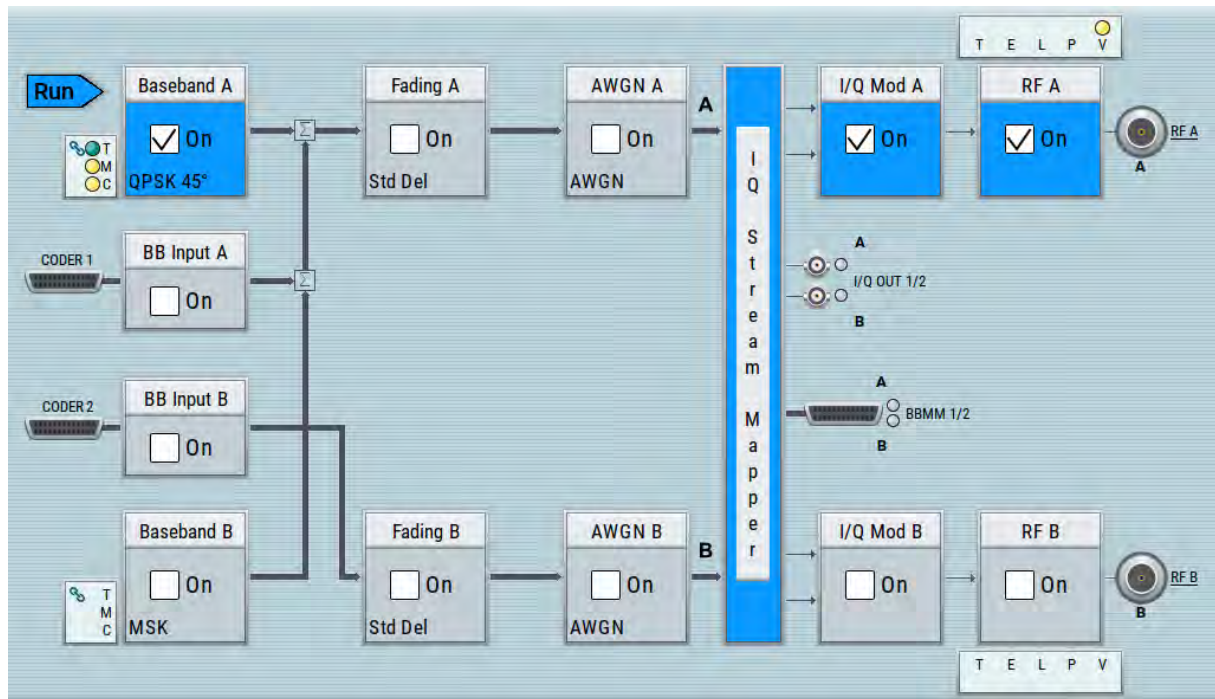
Select the "Fading B" block and drag&drop it to the "Baseband B" block.

- In the block diagram, select "Baseband B" block, navigate in the context menu, and select "Signal Routing > route to path A".

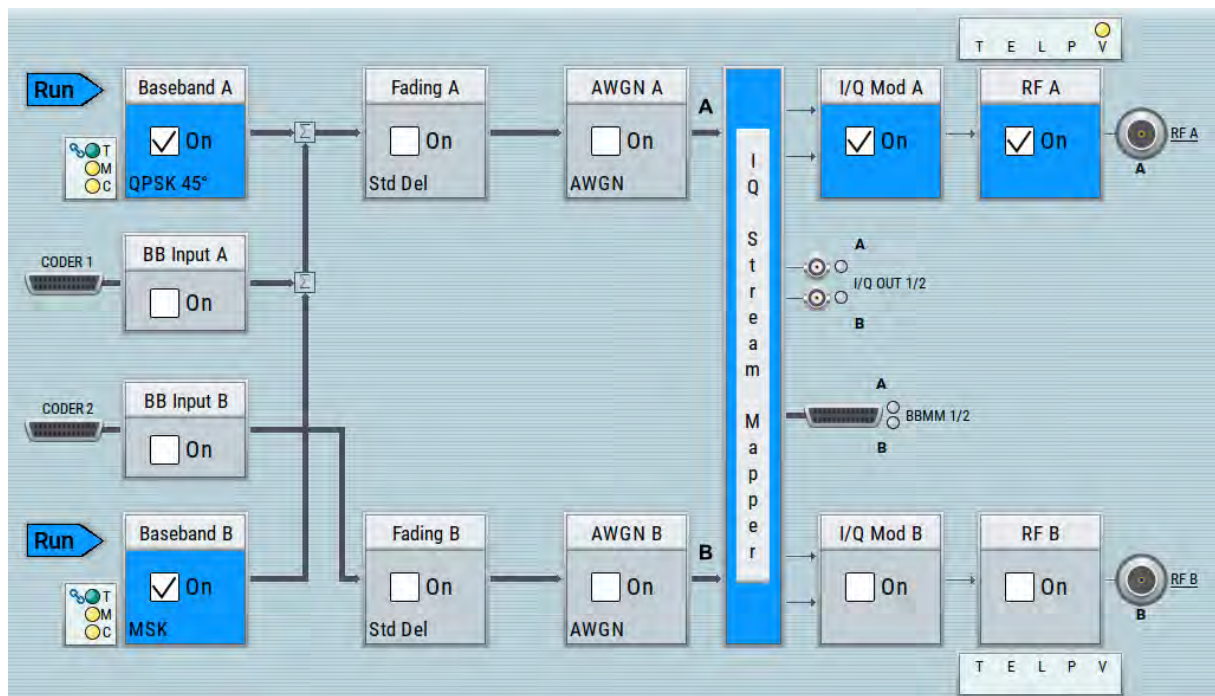


The block diagram displays the routing.

Routing a Baseband Signal to the Outputs



3. In the block diagram, select "Baseband B > Misc > Custom Digital Mod...", select "Set acc. to standard > 3GPP FDD" and enable "Custom Digital Modulation > State > On".



4. To apply frequency and power offsets to the signals, select "Baseband B > Baseband Offsets".
 - a) Enter "Baseband A > Frequency Offset > 5 MHz".

Routing a Baseband Signal to the Outputs

- b) Enter "Baseband B > Frequency Offset > -5 MHz".
- c) Enter "Baseband B > Path Gain > -30 dB".
- d) Close the "Baseband Offsets" dialog.

Baseband Offsets			
	Frequency Offset /Hz	Phase Offset /°	Gain /dB
Baseband A	-5 000 000.00	0.00	0.000
BB Input A	0.00	0.00	0.000
BB Input B	0.00	0.00	0.000
Baseband B	5 000 000.00	0.00	-30.000

The symbols Δf and Δ in the block diagram confirm that the signals are added weighted with a frequency offset on both paths and a path gain on path B.

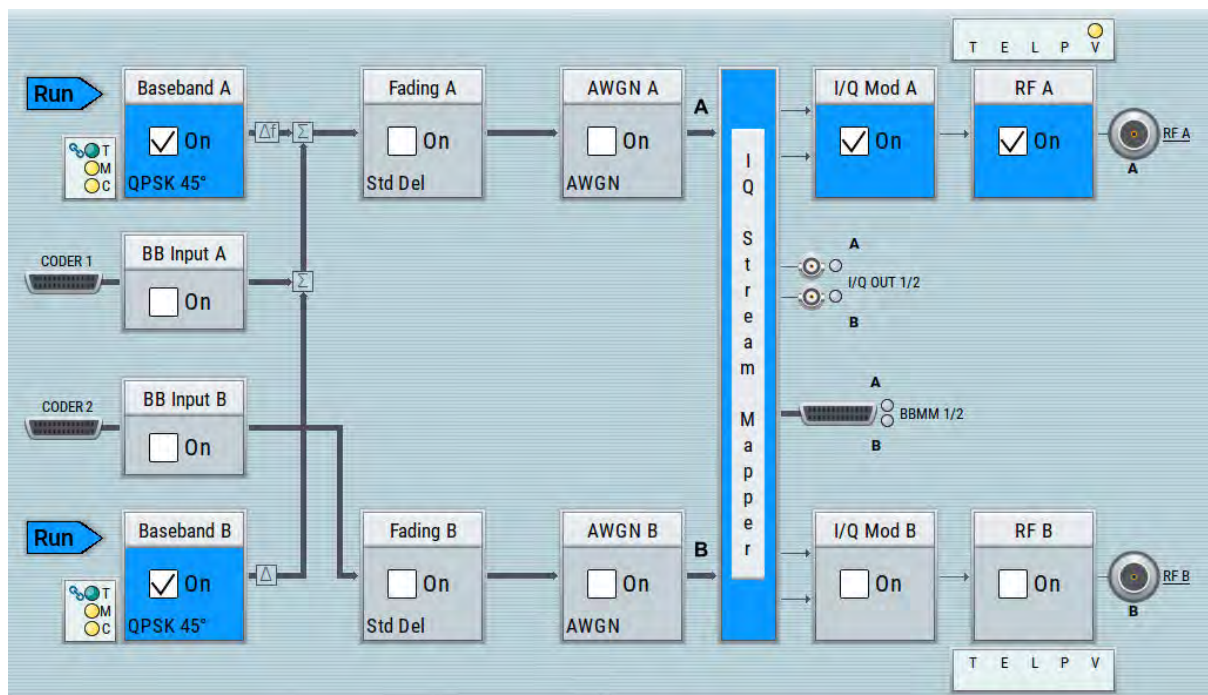



Figure 6-8: Block diagram: Generating a composed signal (stream A)





To enable simultaneous signal generation in both basebands, the R&S SMW couples the trigger settings in the available basebands. The trigger settings enabled in "Baseband A" apply automatically to the "Baseband B". The symbol  confirms that common trigger settings are applied.

To map the I/Q stream and define the output connector

The term stream describes the signal at the input of the "I/Q Stream Mapper" up to the output connectors of the instrument.

1. In the block diagram, select the "I/Q Stream Mapper" block.

The "System Configuration > I/Q Stream Mapper" dialog displays the current (default) distribution and mapping of the I/Q streams to the output connectors as a mapping matrix.

System Configuration								
Fading/Baseband Config	I/Q Stream Mapper		External RF and I/Q		Overview			
	Frequency Offs /Hz	Phase Offs /°	RF A	RF B	I/Q OUT 1	I/Q OUT 2	BBMM 1	BBMM 2
Stream A	0.00	0.00						
Stream B	0.00	0.00						
Combination			Single	Single	Single	Single	Single	Single

Stream A is routed to all the available output connectors: the analog RF A and I/Q ("I/Q OUT 1") connectors, and the digital I/Q output connectors DIG I/Q ("BBMM1").

2. To reconfigure the mapping, tap a matrix entry, for example disable the output of stream A on the BBMM 1 interface.

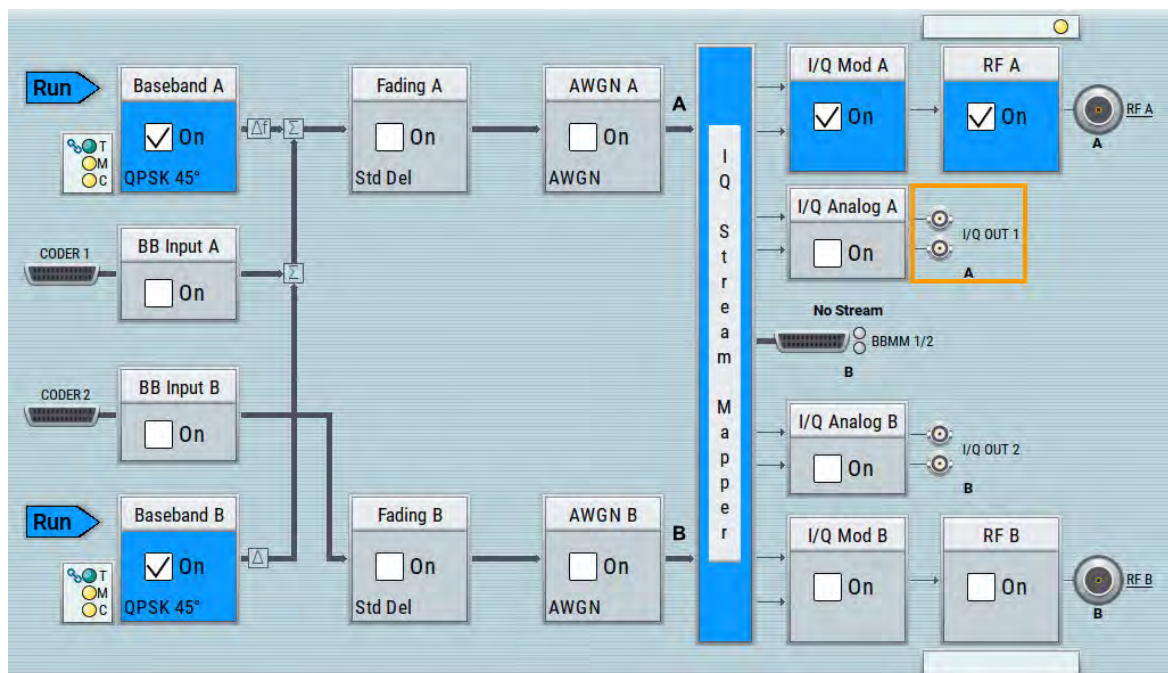
With the "I/Q Stream Mapper", you route the streams; the outputs are, however, not necessarily activated.

Tip: How to access the settings of the input and output interfaces.

In the block diagram, the blocks related to the input and output interfaces can be folded for a better overview.

If the block diagram does not show the "I/Q Analog" block, tap the corresponding connector icon, i.e. "I/Q Out 1/2", to unfold the settings.

Verifying the Generated Signal



The generated composed signal (stream A) is output at the analog "RF A" connector and routed to the "I/Q Out 1" connector. The block diagram confirms this routing and displays the letter "A" next to the symbols of the output connectors.

Consider however that the I/Q connectors are disabled.



To learn more and to explore the whole range of the routing capability, refer to chapter "Signal Routing and System Configuration" in the user manual.

6.6 Verifying the Generated Signal

It is often useful to check the spectra of the configured signals, before you enable the RF output of the instrument.

The R&S SMW provides a build-in function to represent the generated signal on a graphical signal display. We demonstrate this feature by showing the characteristics at one particular point of the signal processing chain. You can, however, display the signal characteristics at other different stages.

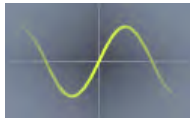
This example shows you how to use this graphical display to verify the generated signal. Use the signal generated in [Chapter 6.5, "Routing a Baseband Signal to the Outputs"](#), on page 63.

To access the graphical signal display functionality

- Perform one of the following:
 - a) Select "Taskbar > System Configuration > Graphics"



- b) On the "Taskbar", tap the wave icon.

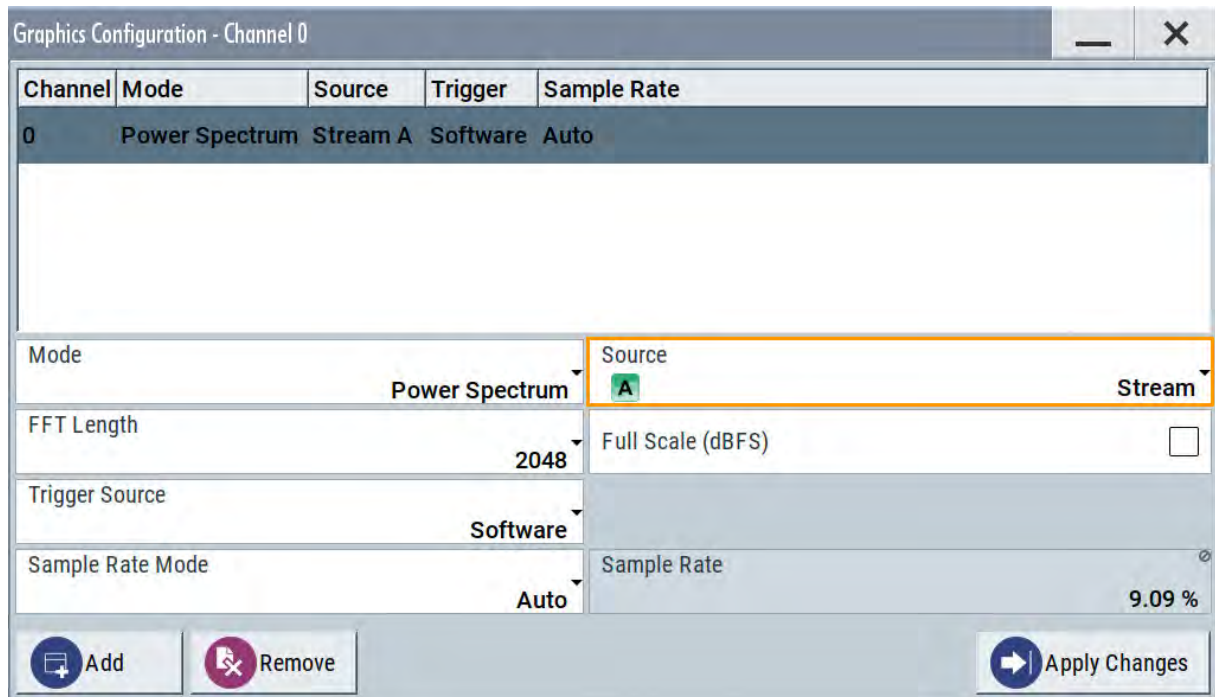


The "Graphics Configuration" dialog opens.

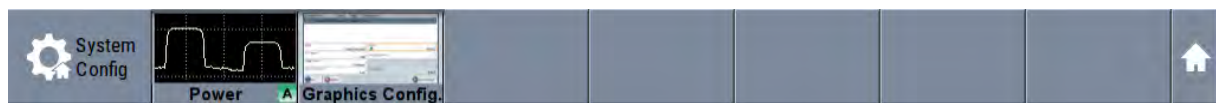
To visualize the sum signal

1. In the "Graphics Configuration" dialog, select "Mode > Power Spectrum".
2. Select "Source > A Stream".
3. Select "Add" to enable signal display.

Verifying the Generated Signal



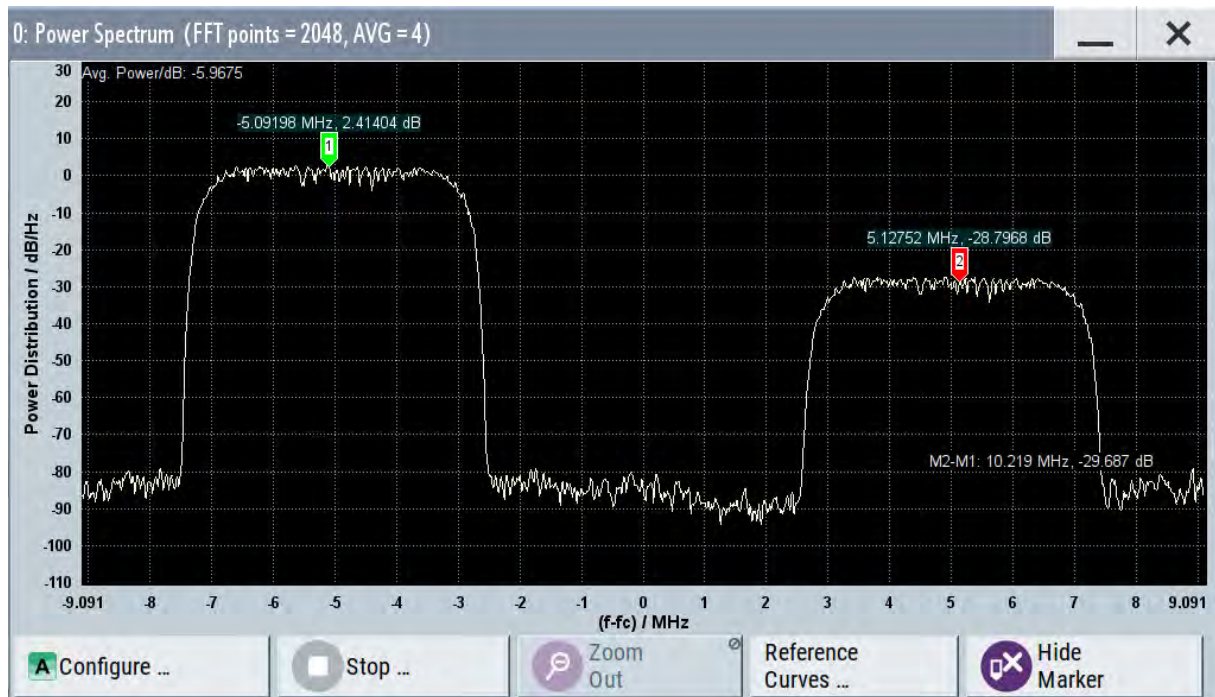
A new thumbnail (minimized view) indicating the active diagram appears in the "Taskbar".



4. Press the thumbnail graphic.

The graphic enlarges and the diagram is displayed in a normal size.

Verifying the Generated Signal



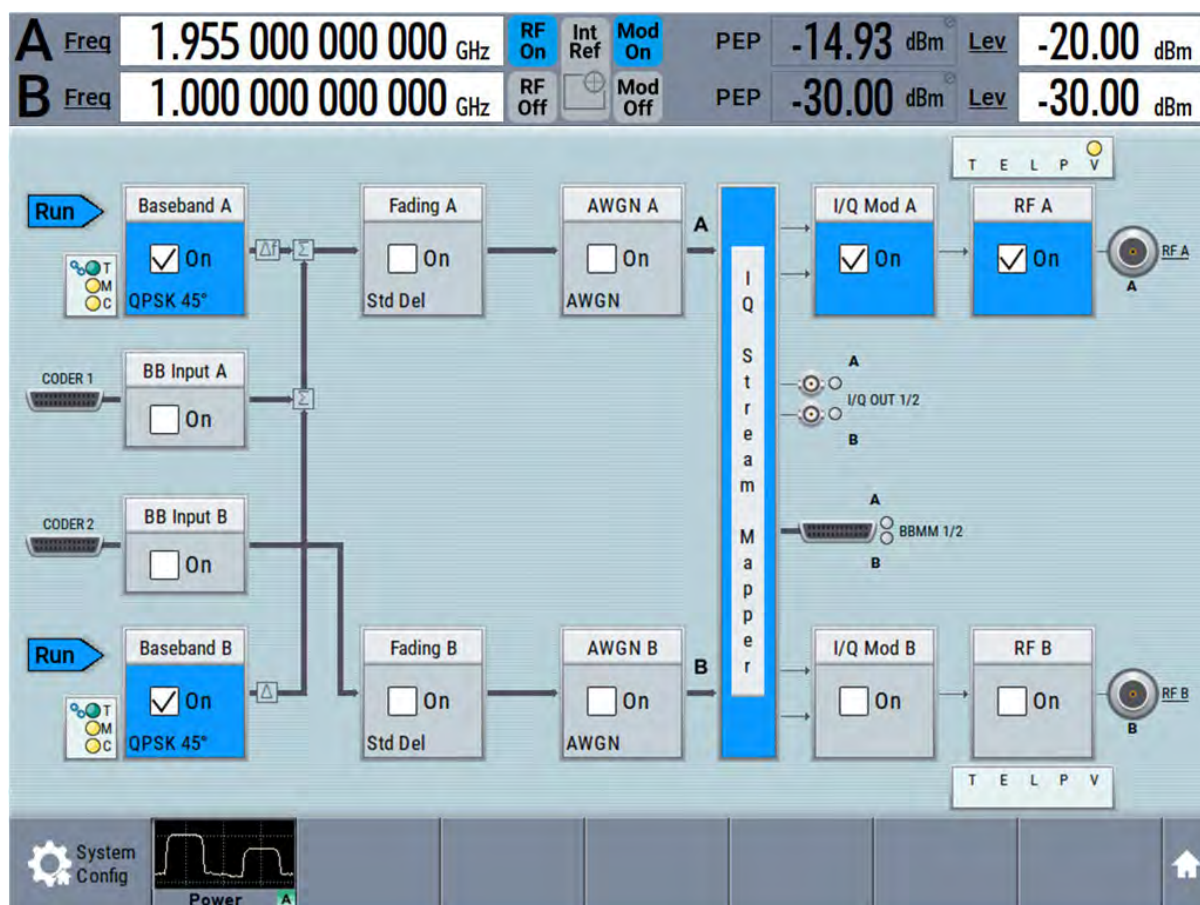
The "Power Spectrum" displays two signals, both 3GPP FDD signals are frequency shifted and the right one is also attenuated.

- To retrieve more information, zoom in the spectrum and select "Show Marker" to measure the distance between the two signals.
In principle, the zoom in function works like the two-finger pinching for magnifying images on your cell phone.

- In the "Power Spectrum" dialog, select "Configure" to return to the "Graphics Configuration" dialog.
Close the "Graphics Configuration" dialog.

This action has no effect on the configured graphics but on the dialog itself.

The block diagram displays the current signal routing. It indicates that frequency and power offsets are enabled and displays the acquisition points for the real-time diagrams minimized in the "Taskbar".



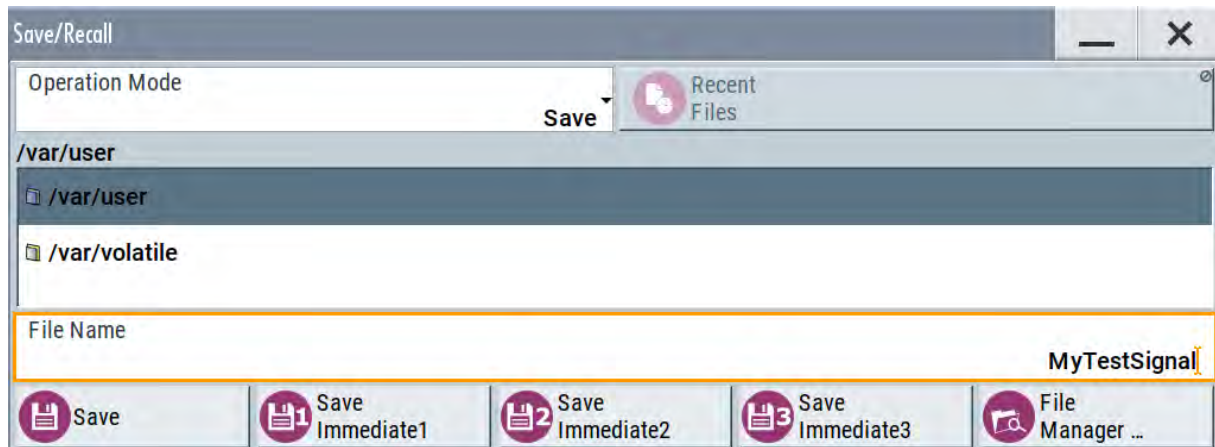
6.7 Saving and Recalling Settings

To restore the results of our measurements later, we saved the instrument settings to a file.

To save instrument settings to a file

We assume, a test configuration as described in [Chapter 6.5, "Routing a Baseband Signal to the Outputs"](#), on page 63.

1. Press the [SAVE/RCL] key on the front panel.
2. In the "Save/Recall" dialog box, select "Operation Mode > Save".
Tap the "Filename", use the on-screen keyboard, and enter *MyTestSignal*.



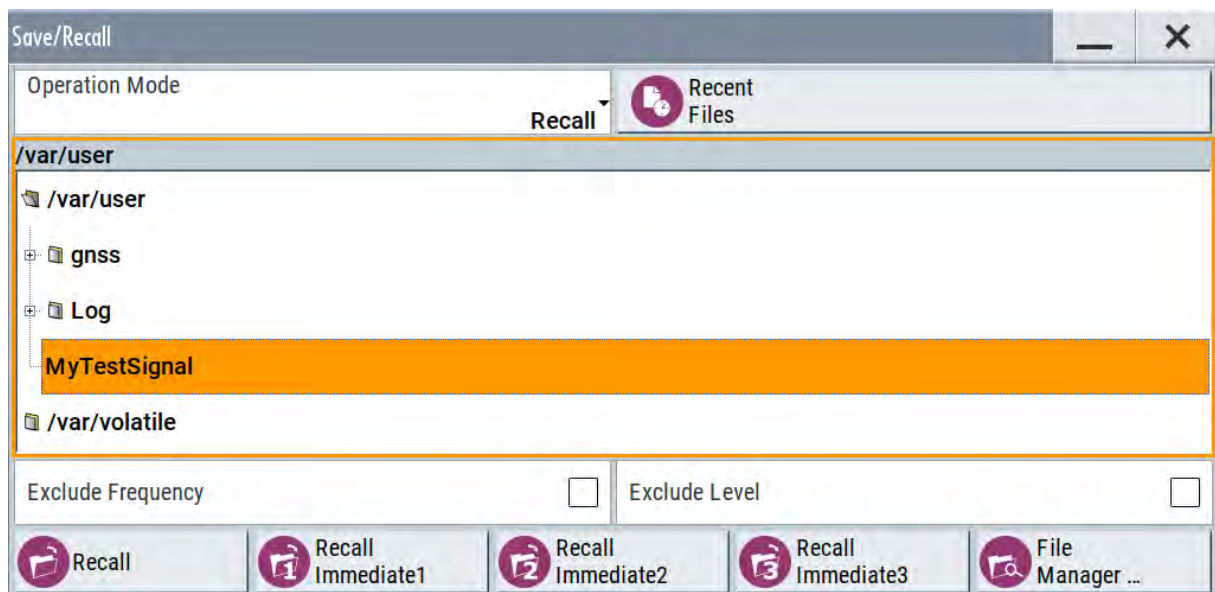
3. Tap the "Save" button.

The file `MyTestSignal.savrcltxt` is saved 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 saved user settings are restored afterwards.
2. Press the [SAVE/RCL] key.
3. In the "Save/Recall" dialog, select "Recall" operation.
4. Navigate to the directory, in which you saved the file `MyTestSignal` and select it.



5. Tap the "Recall" button.

All instrument settings are restored and the display resembles [Figure 6-8](#), which shows the instrument display right before the settings were saved.

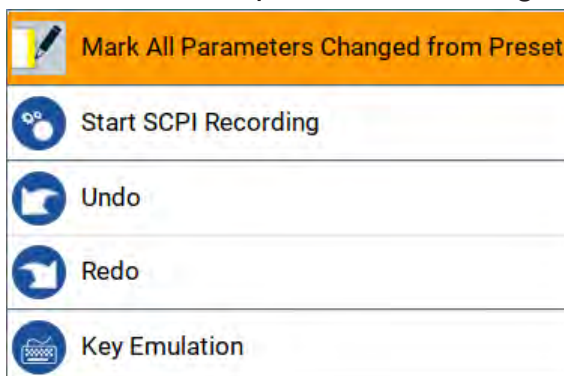


How to display all parameters with values different to their preset values

When you load a file to your instrument, you may 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.

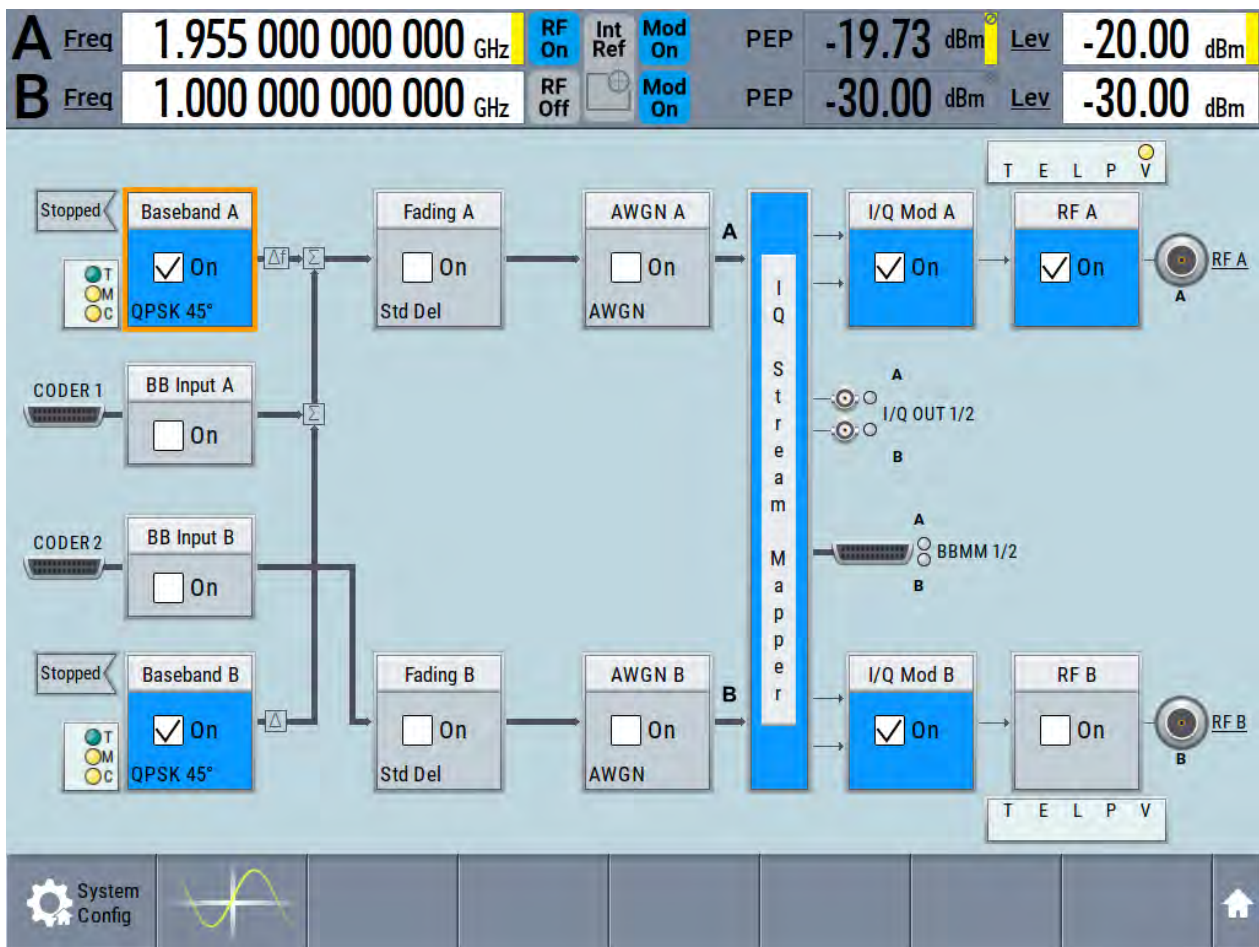
Try out the following:

- Tap and hold on an empty space in the block diagram to access the context-sensitive menu.
- Select "Mark all parameters changed from preset".



- All changed parameters are highlighted.

Generating an EUTRA/LTE Signal



6.8 Generating an EUTRA/LTE Signal

The main application field of the R&S SMW is the generation of digital signals in accordance with several telecommunication and wireless standards, like WCDMA, EUTRA/LTE or WLAN, to name a few. This example uses the digital standard EUTRA/LTE to introduce the way you can access and interact with the instrument and experience the advantages provided by the additional options.

The minimum requirement for R&S SMW in this example is a base unit equipped with the additional option R&S SMW-K55 EUTRA/LTE.

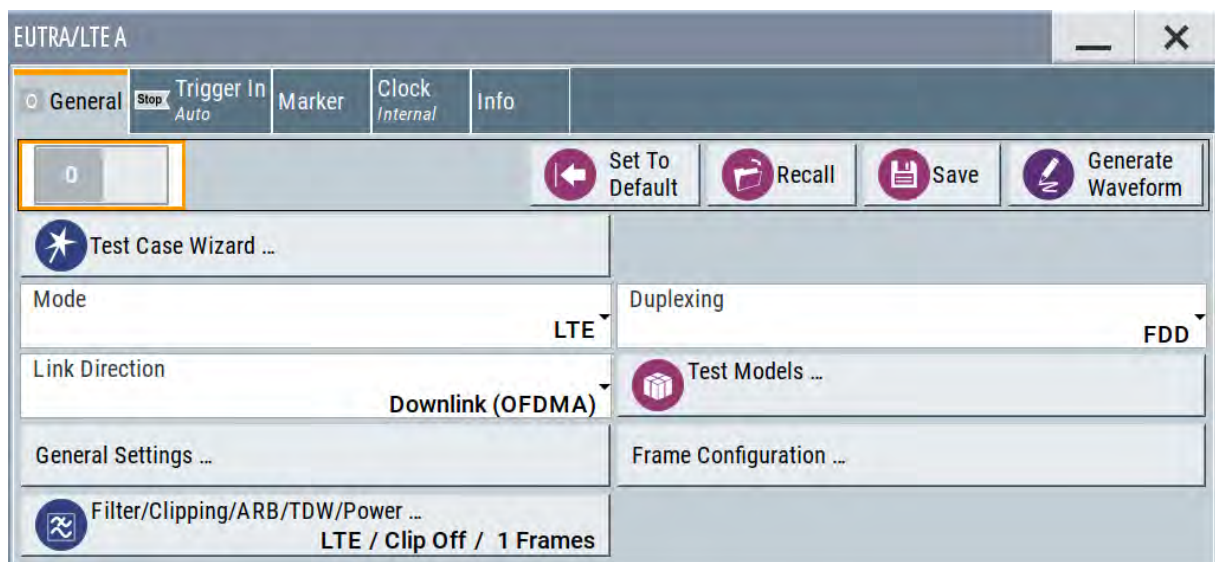
To generate a downlink test signal

The main focus of the following example is not on the R&S SMW capabilities and the features provided by the firmware option. The example aims rather to help you get familiar with the settings and configuration principle common for the digital standards.

We use one of the provided EUTRA test models (E-TM) to show how to generate a test signal upon a quick selection.

1. On the R&S SMW front panel, press the [PRESET] key to start out in a defined instrument configuration.
2. In the block diagram, select "Baseband > Beyond 3G Standards > EUTRA/LTE".

The EUTRA/LTE dialog appears and displays the general settings provided for the digital standard.



As in the user interfaces of all digital standards, the "EUTRA/LTE" dialog is divided into several tabs. The "General" tab comprises the primary settings of the standard, the functions for storing and recalling settings and provides access to further functions and dialogs, like the "Filter" settings. The "Trigger In", "Marker" and "Clock" tabs comprise the settings related to the corresponding function.

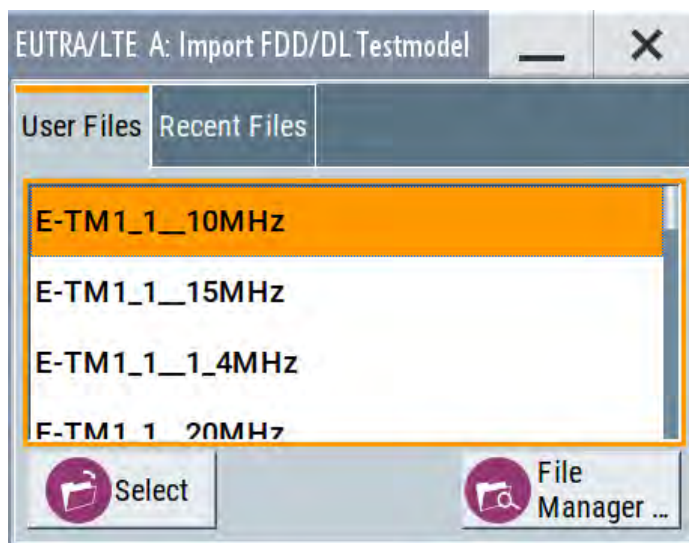
The more complex the digital standard itself is, the more comprehensive the further dialog and tab structure. The start dialog of each digital standard, however, follows a repeating dialog structure that comprises the tabs "General", "Trigger In", "Marker" and "Clock". (See also [Chapter 8.3.4, "Additional Display Characteristics"](#), on page 105).

Tip: To display the dialog in its maximal height, press the [RESIZE WINDOW] key on the front panel.

3. In the "EUTRA/LTE General" tab, select "Test Models".

The test models is a function for quick selection and settings adjustment according to one of the various EUTRA test models (E-TM).

A standard "File Select" function enables you to select from files with predefined settings.



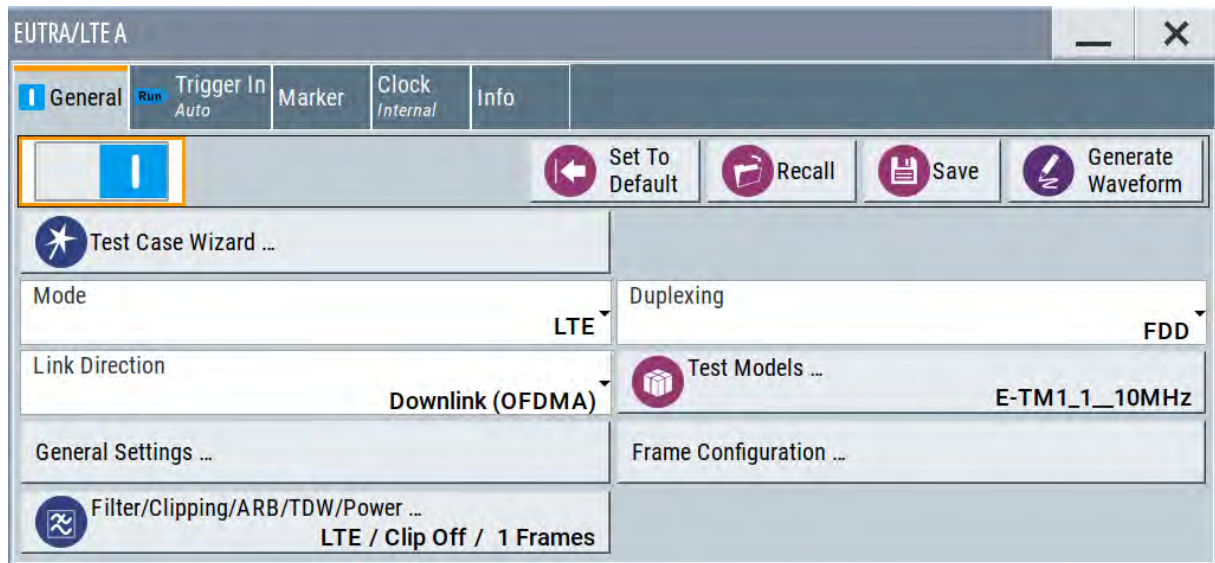
Tip: On the front panel, press the [HELP] key to retrieve detailed information on the current settings and on the contents of the predefined files.

4. Navigate to a file, for example to the E-TM1_1_10MHz (an E-TM1.1 test model with 10 MHz channel bandwidth) and confirm with "Select".

The dialog closes automatically and the user interface confirms the name of the selected file.

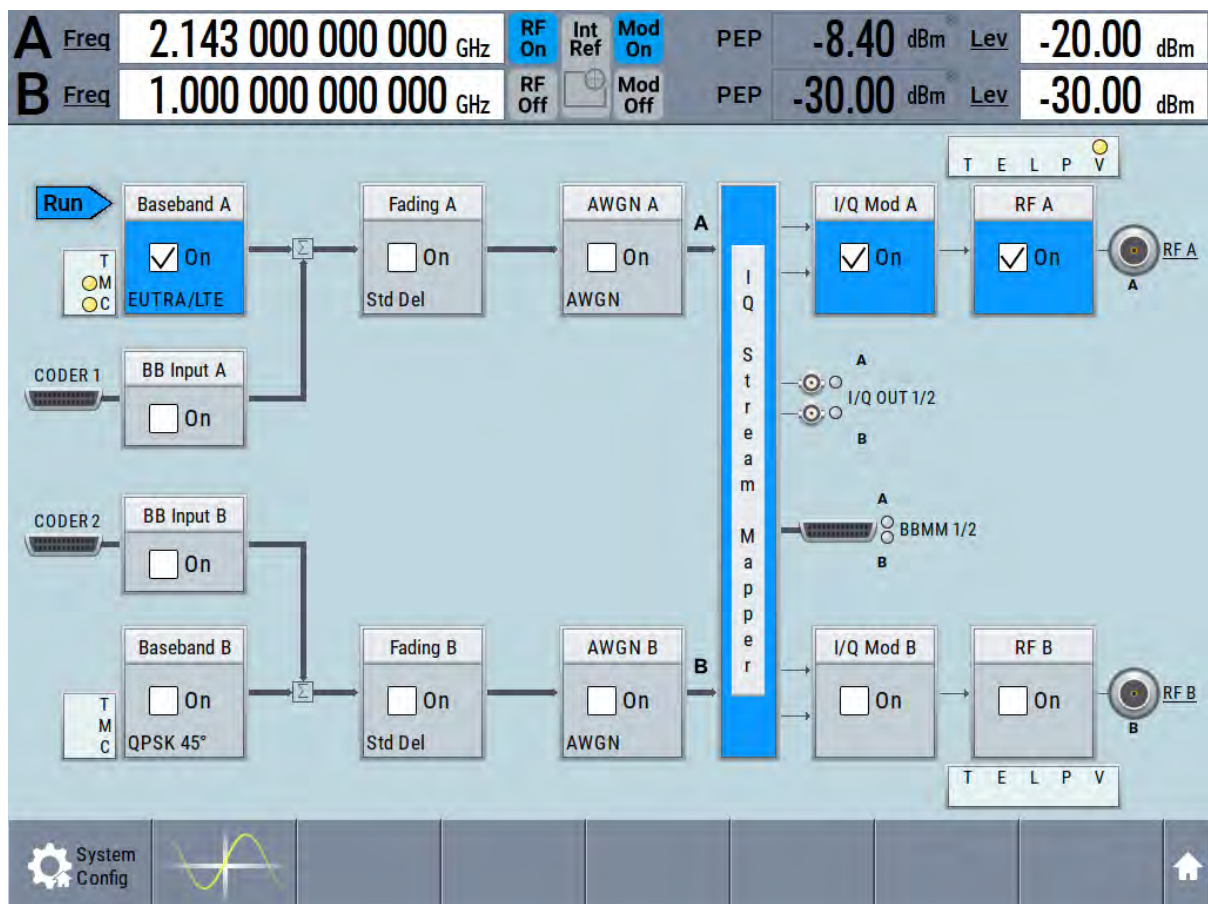
5. In the "EUTRA/LTE > General" tab, select "State > On".

Generating an EUTRA/LTE Signal



Close the dialog.

- On the "Status Bar", tap the "Freq" and "Lev" fields and enter new values, for example *2.143 GHz* and *-20 dBm*. Select "RF A > On".



The instrument generates an EUTRA/LTE test signal with the selected channel bandwidth, frequency, and level.



With these first steps, you have gained an impression of the provided functionality.

For a comprehensive description of the full range of capabilities, refer to the user manual "EUTRA/LTE Digital Standard for R&S SMW200A".

6.9 Enabling MIMO Configuration

The R&S SMW supports versatile MIMO configurations and provides comfortable functions to simplify the definition and signal routing for MIMO test setups and configuration involving several instruments. For complex routing scenarios, the "System Configuration" functionality is the start and central configuration point. Within one dialog, you can configure complex configurations with up to 8 Tx or Rx antennas or up to two stand-alone 2x2 MIMO systems, e.g. 8x2 MIMO or LTE-A carrier aggregation with 2x2 MIMO.

This example does not cover the whole range of the "System Configuration" capabilities but delivers an insight into the topic. The example shows how to use coupled baseband sources and select a suitable fading and baseband configuration to generate an EUTRA/LTE signal in 2x2 MIMO configuration.



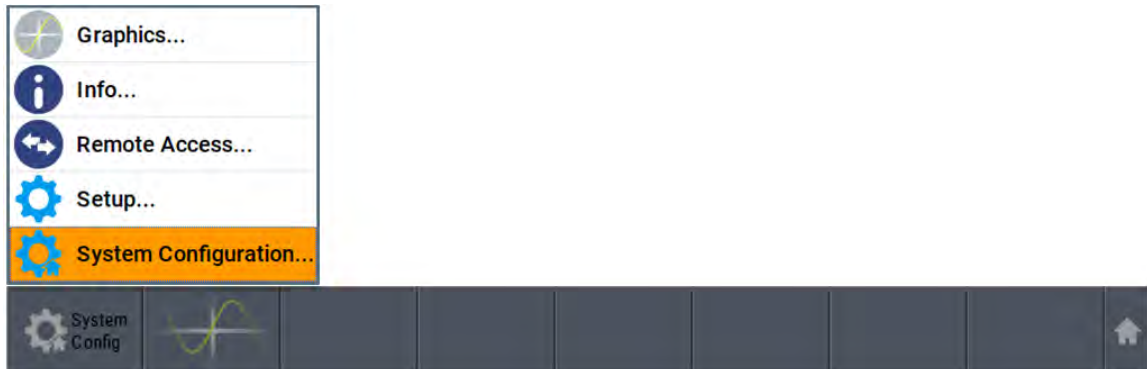
To learn more and to explore the whole range of capability provided by the "System Configuration" function, refer to chapter "Signal Routing and System Configuration" in the user manual.

The instrument in this example is a R&S SMW equipped with two signal paths:

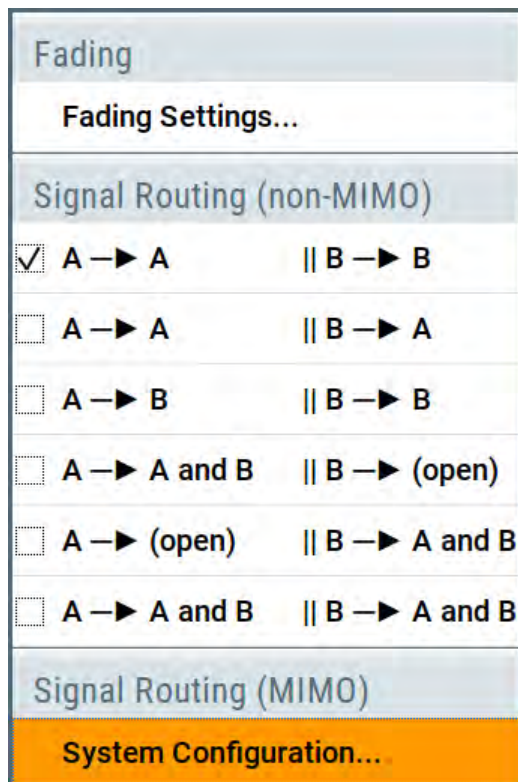
- 2 options standard baseband generator R&S SMW-B10 and one R&S SMW-B13T
- 2 options fading simulator R&S SMW-B14 and one option fading MIMO R&S SMW-K74
- Frequency options (e.g. R&S SMW-B1003/-B2003)
- 2 options R&S SMW-K55 EUTRA/LTE

To access the "System Configuration" function

1. Perform one of the following:
 - a) On the "Taskbar", select "System Config > System Configuration"



- b) In the block diagram, select "Fading > MIMO > System Configuration"



- c) In the block diagram, select "I/Q Stream Mapper" and select the "Fading/ Baseband Configuration" tab.

The "System Configuration > Fading/Baseband Configuration" dialog displays the current signal routing. The instrument works in the default "Standard" mode.

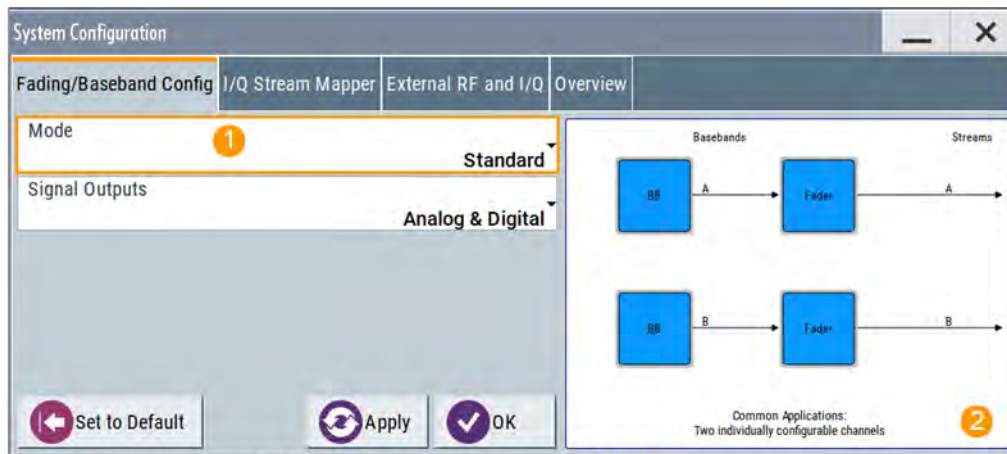


Figure 6-9: System Configuration in the default Standard Mode

1 = Standard or advanced mode; the last is required for configuration of complex LxMxN MIMO scenarios

2 = Simplified preview diagram with a description of the common application for the particular configuration

- Open "System Configuration > I/Q Stream Mapper" to obtain an overview of the current distribution and mapping of the I/Q streams to the output connectors, see also ["To map the I/Q stream and define the output connector"](#) on page 67.
- Open "System Configuration > External RF and I/Q Instruments" to gain information on the current setup.

The tab comprises the additional settings provided to simplify the configuration of connected instruments, like configuring the connectors, establishing a connection to the instruments, or controlling these instruments.

In this test setup, no further instruments are connected.

To enable a 2x2 MIMO configuration (1x2x2 "Fading and Baseband Configuration")

- In the "System Configuration > Fading/Baseband Configuration" dialog, select "Mode > Advanced" and enable the following settings:
 - "Entities (Users, Cells) > 1", "Basebands (Tx Antennas) > 2", "Streams (Rx Antennas) > 2"
 - Select "BB Source Config > Coupled Sources"
 - Observe the signal routing displayed on the preview diagram. Does it match with the expected signal routing?
 - Select "Apply" to confirm the configuration.

Enabling MIMO Configuration

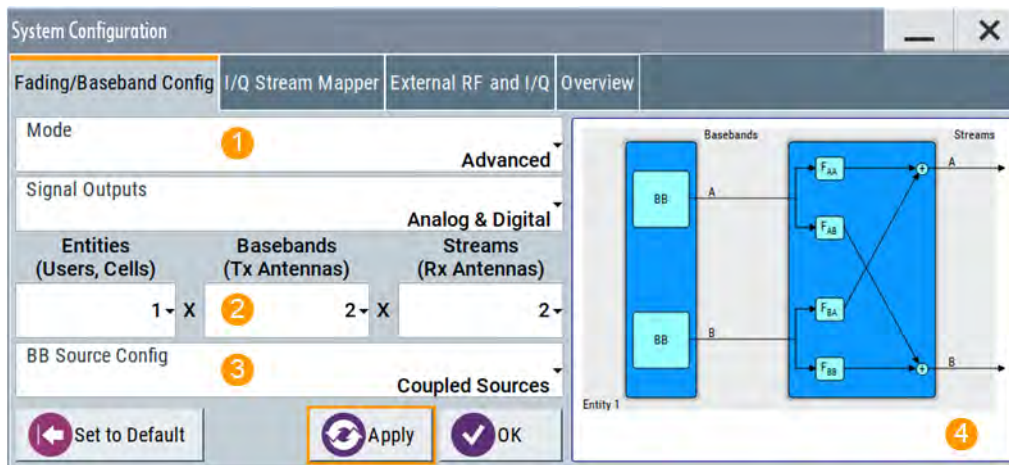


Figure 6-10: System Configuration in the Advanced Mode (1x2x2 configuration)

1 = Advanced mode, required for configuration of complex $L \times M \times N$ MIMO scenarios

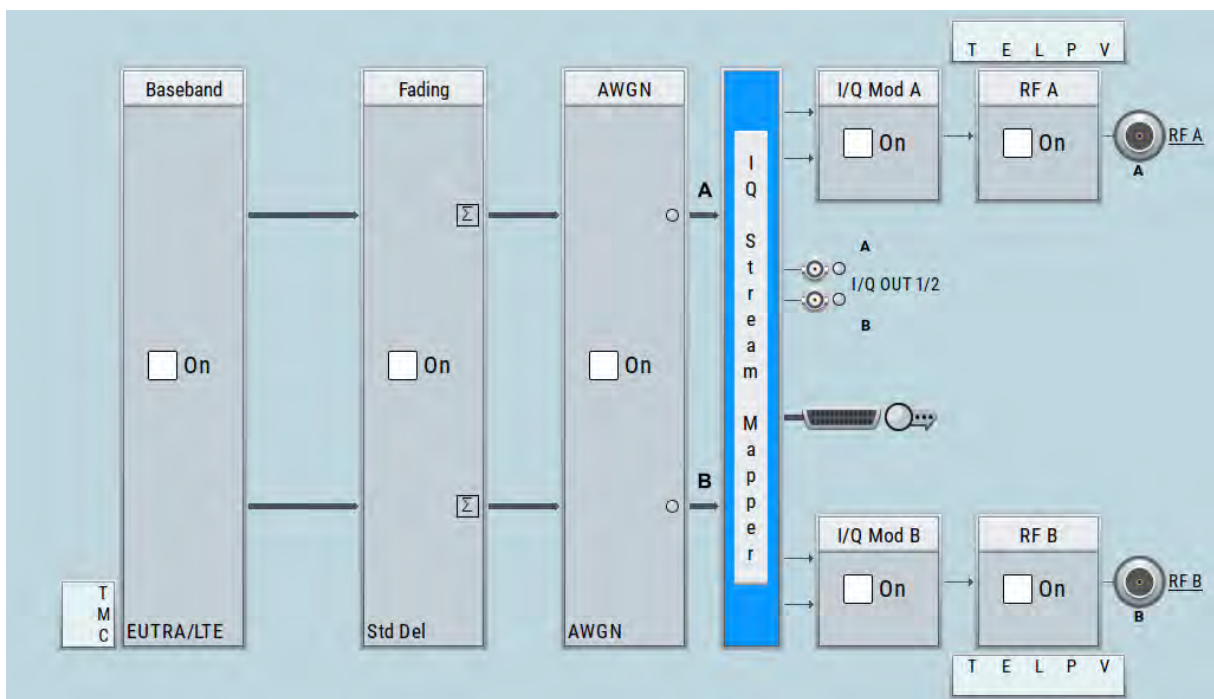
2 = Current signal routing; 2x2 MIMO configuration

3 = Separated and coupled baseband sources

4 = Simplified preview diagram of the particular configuration

2. Leave all further settings, i.e. the "I/Q Stream Mapper" settings, at their default values and close the "System Configuration" dialog.

The block diagram displays the selected configuration.

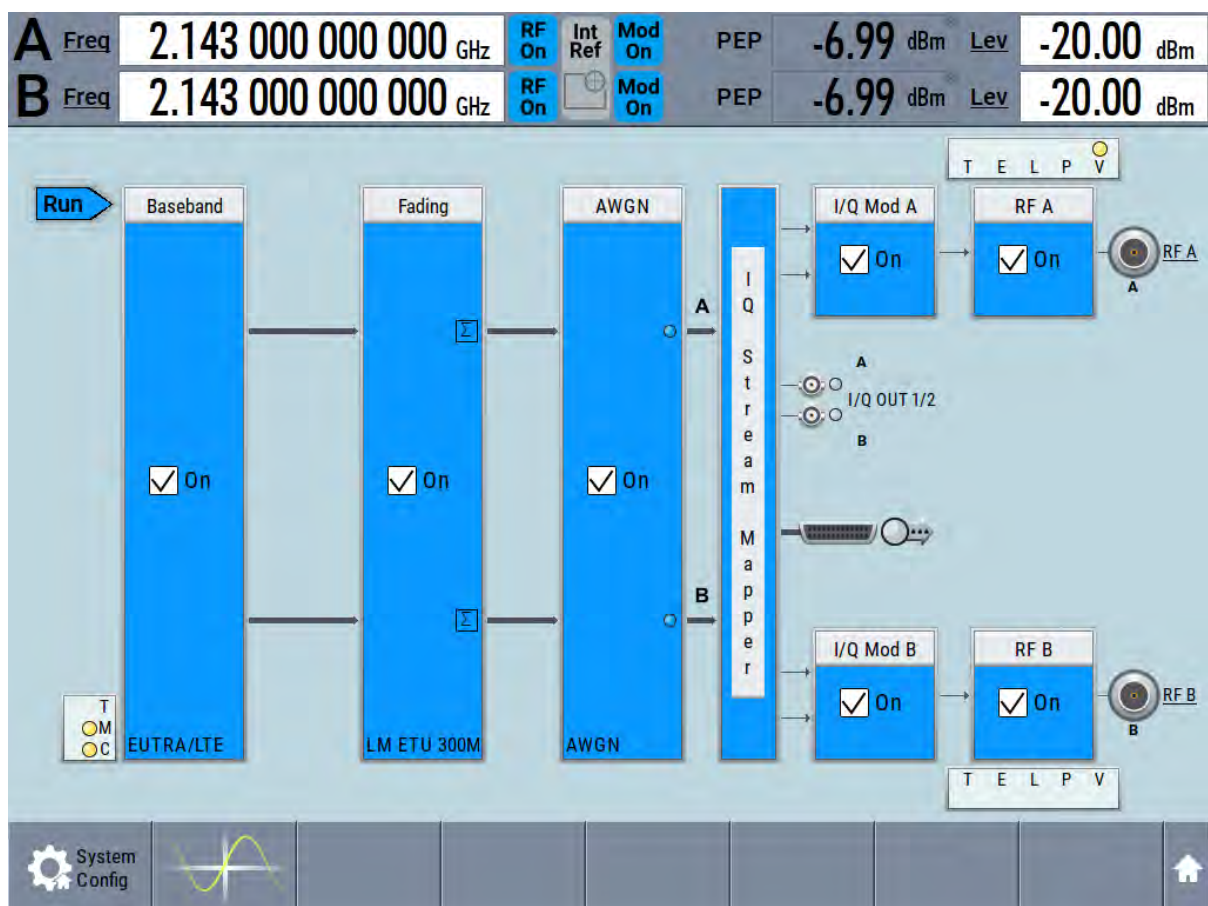


To generate an EUTRA/LTE signal in the 2x2 MIMO scenario

1. In the block diagram, select "Baseband > EUTRA/LTE", select "State > On", and close the dialog.

In coupled baseband source mode, the R&S SMW takes over the baseband signal configuration. The instrument adjusts the settings in the basebands automatically, for example the mapping of the transmitting antennas to the basebands.

2. In the block diagram, select "Fading > On".
The default "Standard Delay" fading profile is applied.
3. On the "Status Bar", set the same frequency and level settings for both paths:
a) "A Freq = B Freq = 2.143 GHz"
b) "Lev (A) = Lev (B) = -20 dBm"
4. In the block diagram, select "RF A > On" and "RF B > On".



The R&S SMW generates a realistic EUTRA/LTE downlink signal with 10 MHz channel bandwidth, though without any scheduled data.



To enable the generation of scheduled data, further configurations are required; these configurations are, however, outside the scope of this description.

For further information, refer to the user manual "EUTRA/LTE Digital Standard for R&S SMW".

7 System Overview

This section helps you to get familiar with the R&S SMW. It provides an introduction to the general concept of the instrument with a sample of the possible application fields. This section also introduces the main blocks in the signal generation flow.

For information on how to access functions and interact with the R&S SMW, refer to [Chapter 8, "Instrument Control"](#), on page 99.

7.1 Brief Introduction to the Instrument's Concept

The R&S SMW combines up to two independent signal generators in one instrument and offers unrivaled RF and baseband characteristics. Due to its *modular design*, the instrument can be optimally adapted to the requirements of different applications. Both RF paths can be equipped with one of the available frequency options with different upper frequency limit. The baseband section of the R&S SMW is fully digital. It contains the hardware for generating and processing I/Q signals in realtime or generating signals with an arbitrary waveform generator.

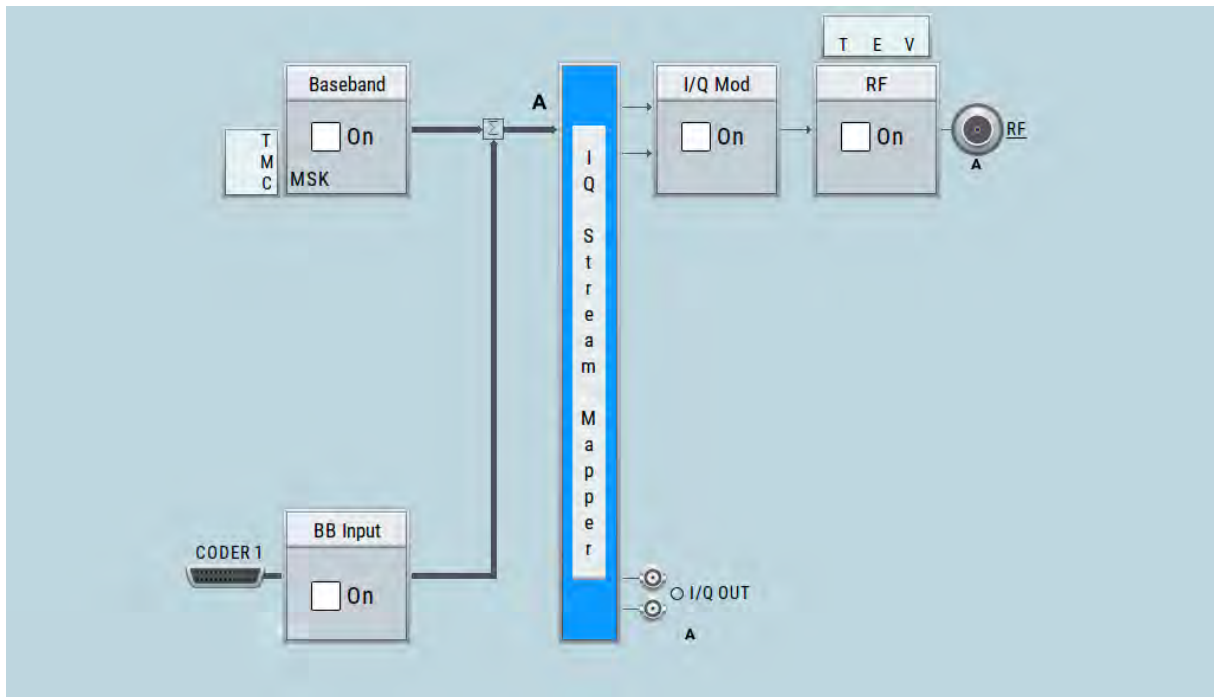
7.1.1 Signal Flow at a Glance

The R&S SMW is equipped with a large touchscreen, that displays a block diagram. The block diagram represents the signal flow and the general stages the signal generation goes through. Depending on the options the R&S SMW is equipped with, the appearance of the block diagram changes.

The following examples do not cover all possible cases but aim to introduce the way the block diagram depicts the installed options.

- An example of a base unit, equipped with one signal path (R&S SMW-B10, R&S SMW-B13, and R&S SMW-B1003)

Brief Introduction to the Instrument's Concept



- Two examples of a **fully equipped (standard baseband) instrument**.
The first one shows the default instrument state and the second one - an advanced configuration with more abstract representation.
 - In this "classic" representation, the block diagram displays all blocks for that the required hardware and software options are fitted. The block diagram shows the signal flow as it is.

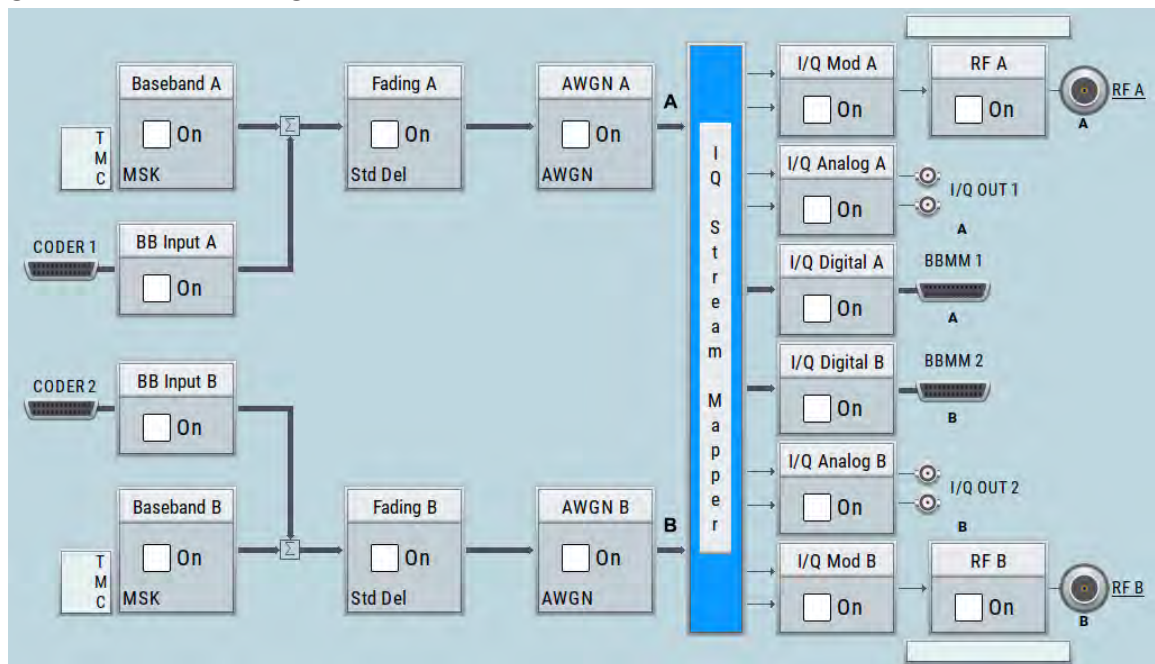


Figure 7-1: Block diagram of a fully equipped two path instrument (default)

Brief Introduction to the Instrument's Concept

- The block diagram depicting a 4x4 MIMO scenario with coupled baseband sources is a more abstract representation. Each stage of the signal generation is still represented by a functional block but the signal routing is displayed in a conceptional manner.

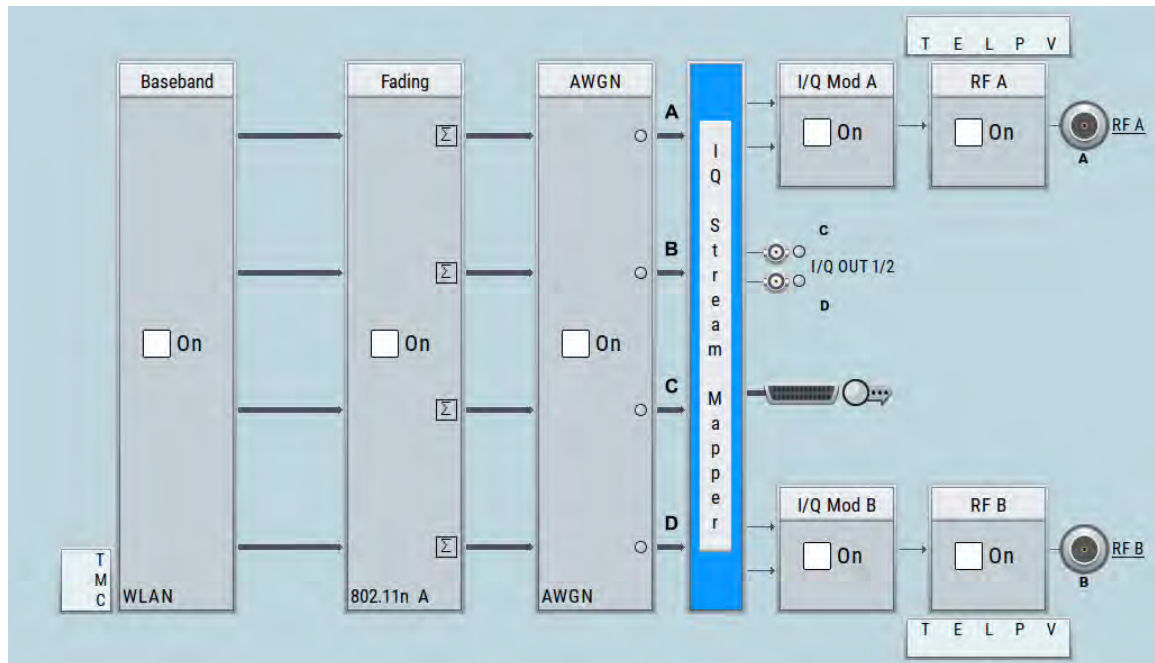


Figure 7-2: Block diagram of a fully equipped two path instrument (4x4 MIMO configuration)

For more examples, see also [Chapter 7.2, "Applications Examples of the R&S SMW"](#), on page 92.

The cross-reference between the installed options and the displayed settings

The [Table 7-1](#) is an excerpt of the available options and lists only the options required *to display* a functional block in the block diagram. The information assumes R&S SMW equipped with standard baseband generator R&S SMW-B10 and R&S SMW-B13T.

For exact information on the available options, and on the minimum requirements and the interdependencies between the provided options, refer to the R&S SMW data sheet.

Table 7-1: Required options per functional block (excerpt)

Functional block	Required option
"Baseband A"	R&S SMW-B10
"Baseband B"	Second option R&S SMW-B10
"BB Input A"	Included in R&S SMW-B10
"BB Input B"	Included in second option R&S SMW-B10
"Fading A"	R&S SMW-B14
"Fading B"	Second option R&S SMW-B14
"AWGN A"/"AWGN B"	At least one option R&S SMW-K62
"I/Q Stream Mapper"	-
"I/Q Mod A"	e.g., R&S SMW-B1003
"I/Q Mod B"	e.g., R&S SMW-B2003
"I/Q Analog A"	R&S SMW-B13
"I/Q Analog B"	R&S SMW-B13T
"I/Q Digital A"	R&S SMW-K18
"I/Q Digital B"	Second option R&S SMW-K18
"RF A"	e.g., R&S SMW-B1003
"RF B"	e.g., R&S SMW-B2003

7.1.2 Internal Baseband Source ("Baseband" Blocks)

The "Baseband" block represents the source of the baseband signals (basebands).

This functional block is the access point to:

- *The internal baseband generator*
The baseband generator contains modules for real time signal generation (custom digital modulation) and an arbitrary waveform generator (ARB). One or two baseband generators can be fitted in an R&S SMW and operated separately.
- *The available digital standards*
Generation of digital signals in accordance with the supported standards requires additional software options. For example, option R&S SMW-K55 generates signals according to the EUTRA/LTE standard.

- *The signal routing (in the standard "classic" mode of a standard baseband generator)*
Signals from the baseband generators can be routed between the available paths, and added (possibly with frequency, phase and power offsets).

7.1.3 Digital Baseband Input and Output ("BB Input", "I/Q Digital" Blocks)

The "BB Input" and the "I/Q Digital" blocks are the access point to the settings of the digital interfaces.

The R&S SMW is - depending on SW and HW options - able to receive digital baseband signals and to output digital baseband signals. A fully equipped standard baseband instrument provides eight configurable digital interfaces. Depending on the configuration, the available digital interfaces may be used as up to six inputs or up to six outputs.

The digital baseband inputs and outputs can be used together with other Rohde&Schwarz instruments, like signal generators, signal analyzers, the digital interface module R&S®IQW, or the R&S®CMW500 Radio Communication Tester. A Rohde&Schwarz signal generator for instance may serve as digital signal source in test configuration requiring more than two baseband sources. A test setup with the R&S®CMW500 Radio Communication Tester is suitable for testing under fading conditions.

The "BB Input" block is the access point to the settings of:

- *The external digital I/Q signals*
The external digital I/Q signals are further processed in the baseband section (e.g. fading, addition of noise)
- *The signal routing (in the standard "classic" mode)*
The external and internal baseband signals can be routed and added (possibly with frequency, phase and power offsets).

The "I/Q Digital" block is the access point to the settings of:

- The digital I/Q output signals
- The digital I/Q impairments

7.1.4 Fading Simulator ("Fading" Blocks)

The "Fading" block is displayed only in instruments equipped with the option R&S SMW-B14/-B15, fading simulator. This block controls the fading module and, in standard mode, the signal routing at the output of this module.

The fading simulator functionality enables you to simulate real time fading effects on the baseband signal. Provided the instrument is equipped with the required options, up to 20 dynamic fading paths in a SISO mode (single input single output) and up to 20 paths per MIMO channel in MIMO mode can be created simultaneously.

The fading extension options provide even more functionality, for example:

- Second option R&S SMW-B14 permits also real two-channel fading irrespective of the RF carrier spacing of the two channels
- The option R&S SMW-K71 comprises the 3GPP dynamic fading configurations moving propagation and birth-death propagation, and the fine delay fading configurations offering enhanced delay resolution
- The option R&S SMW-K72 extends the statistic functions and is required for additional fading profiles and some of the predefined test scenarios
- The option R&S SMW-K73 provides MIMO-OTA Enhancements and is required for full support of antenna radiation patterns, inverse channel matrix and the geometric-based channel model
- The option R&S SMW-K74 enables the simulation of MIMO scenarios with up to 8 transmitting or 8 receiving antennas.
- The option R&S SMW-K75 higher-order MIMO is required for the configuration of higher-order MIMO scenarios with up to 32 channels like 2x4x4
- The option R&S SMW-K821 MIMO subsets for higher-order MIMO modes

7.1.5 Additional White Gaussian Noise ("AWGN" Blocks)

The "AWGN" block is displayed only in instruments equipped with at least one option R&S SMW-K62. This block controls the additional white Gaussian noise generator (AWGN). An additive white noise is required for measurements of mobile radio base stations.

7.1.6 "I/Q Stream Mapper" Block

As one of the access points to the system configuration settings, the "I/Q Stream Mapper" provides direct access for configuring the distribution and mapping of the generated I/Q streams to the available output connectors, to the analog RF and I/Q output and to the digital I/Q output connectors.

7.1.7 I/Q Modulator ("I/Q Mod" Blocks)

The "I/Q Mod" blocks represent the I/Q modulators.

These functional blocks are the access point to:

- The I/Q modulation of the internal baseband signal
- The I/Q modulation of an external analog wideband signal (single ended or differential)
- The analog I/Q impairments

7.1.8 Analog I/Q Output ("I/Q Analog" Blocks)

The "I/Q Output" block represents the analog I/Q output connectors.

This block is the access point to the settings of:

- The analog I/Q output signals
The generated signal can be output as single ended or differential analog signal.
- The analog I/Q impairments

7.1.9 RF and Analog Modulations ("RF" Blocks)

The "RF" block represents the RF settings of the instrument.

This block is the access point to:

- RF frequency and level settings, the reference frequency, local oscillator, user correction, etc.
- The analog modulations
- The list and sweep modes

7.2 Applications Examples of the R&S SMW

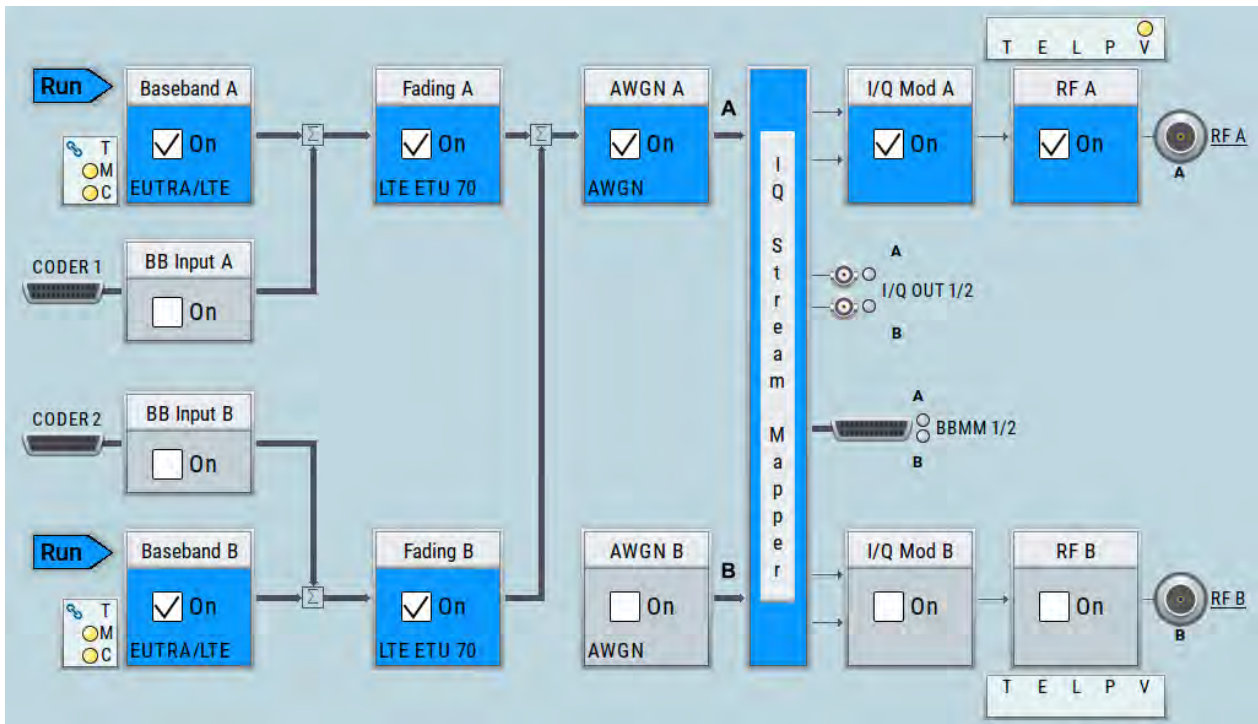
Due to its modular design, the R&S SMW can be optimally adapted to the requirements of different applications:

- **Generation of digitally modulated signal**
The main field of application of the R&S SMW is the generation of digitally modulated signals. The R&S SMW generates a digitally modulated signal in several ways: using the internal baseband generator, using the externally applied digital baseband signals or in an analog wideband I/Q operation.
- **Generation of test signals for diversity tests and MIMO scenarios**
The R&S SMW enables you to generate test signals in versatile MIMO configuration for which several signal generators were previously required.
- **Generation of a wanted signal and an interfering signal for receiver tests**
- **Addition of real-time signals of different standards, for example EUTRA/LTE and 3GPP FDD**
- **Generation of signals with up to 2 GHz signal bandwidth, for example for WLAN IEEE 802.11ad signals**
- **Generation of fading scenarios, e.g for test setups involving R&S SMW and R&S®CMW**

A few examples are given in the following.

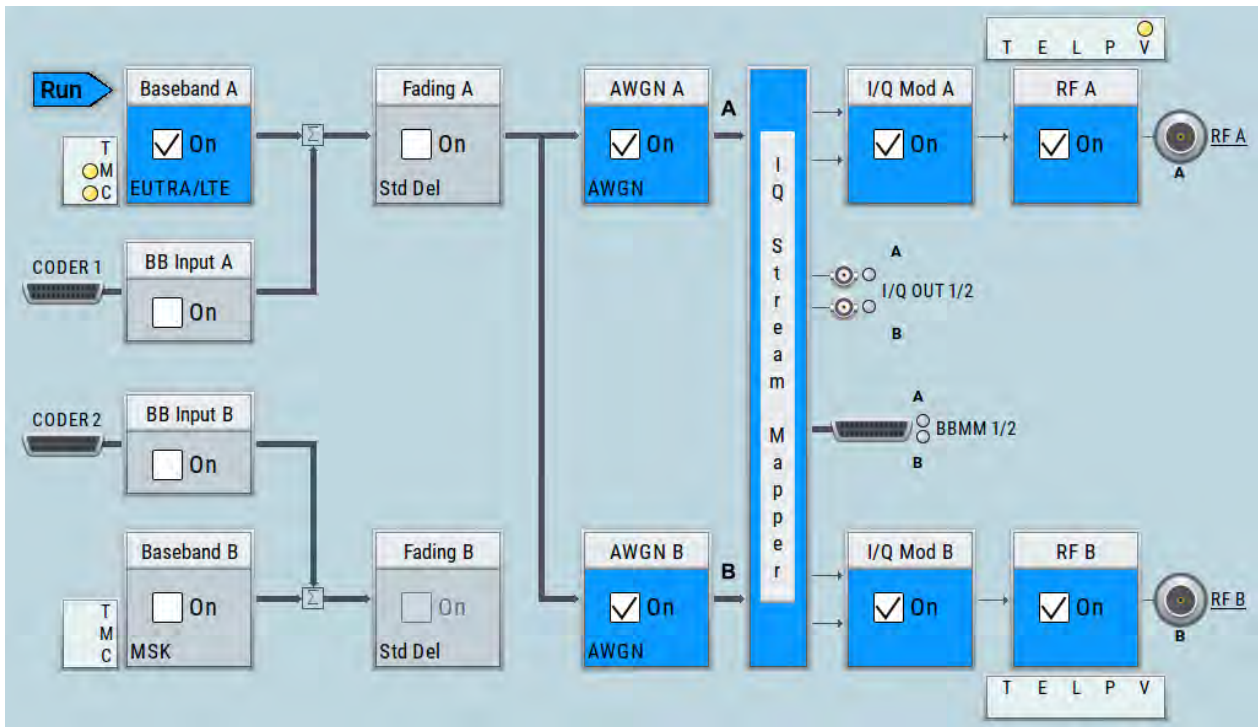
7.2.1 Transmit Diversity Test (MISO Scenario)

The block diagram in this example depicts the generation of a test signal using both internal baseband generators and 1 RF output (RF A).



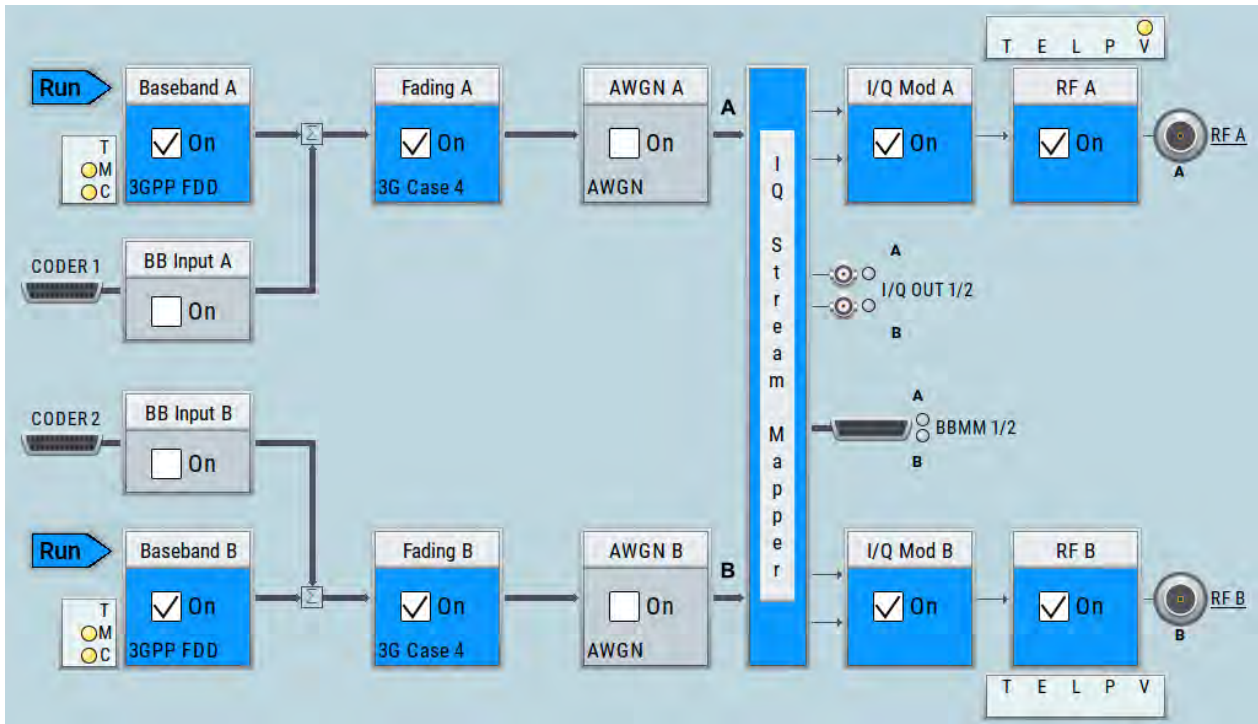
7.2.2 Receive Diversity Test (SIMO Scenario)

The block diagram in this example depicts the generation of a test signal using one internal baseband generator ("Baseband A") and distributing the signal to both RF outputs.



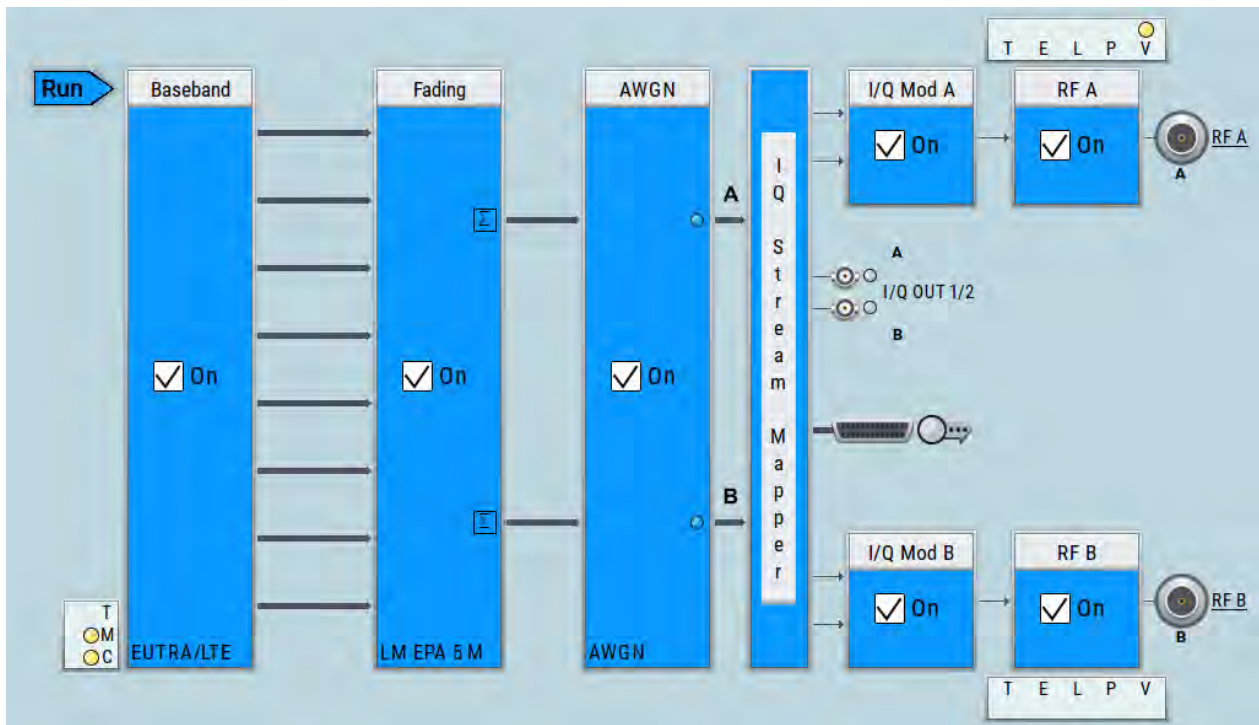
7.2.3 Generation of Signals for Testing of WCDMA Handover (Two Cells)

The block diagram in this example depicts the generation of a test signal using both internal baseband generators and both RF outputs, for example for hand-over tests. The R&S SMW acts as two independent generators in one instrument.



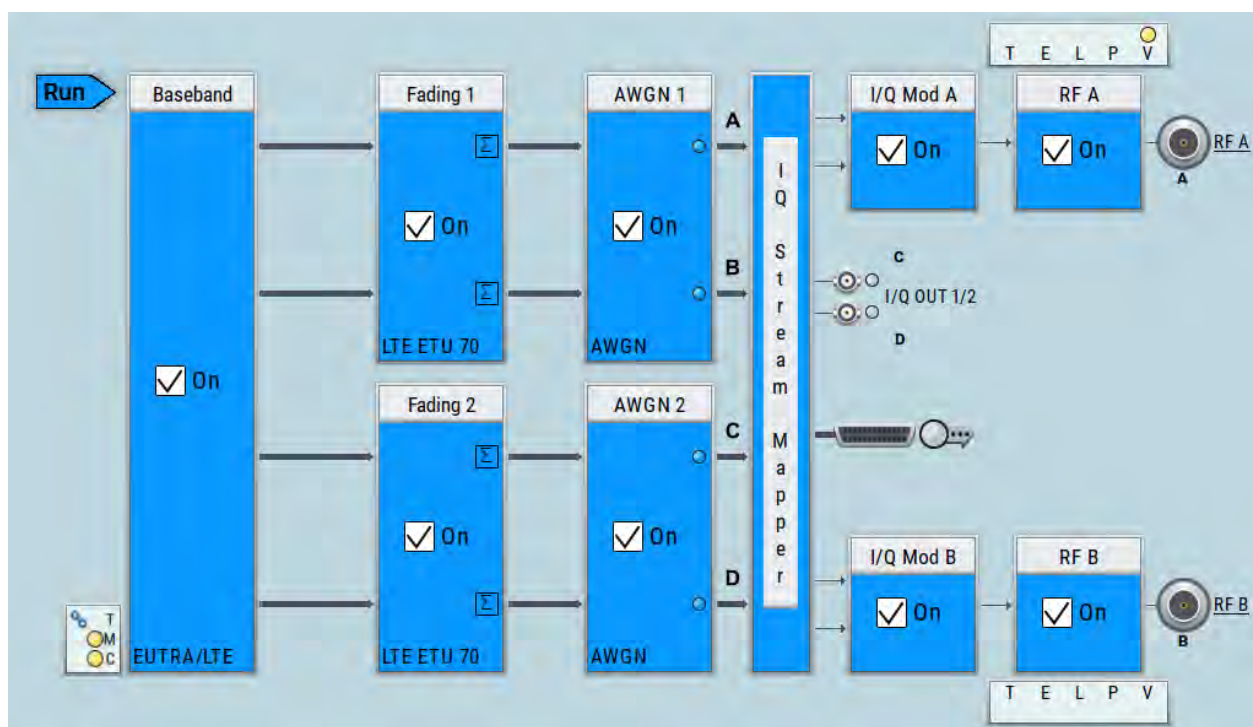
7.2.4 Generation of an EUTRA/LTE 8x2 MIMO Signal for UE Tests

The block diagram in this example depicts the generation of an EUTRA/LTE test signal in a 8x2 MIMO scenario, for example for UE tests. The instrument uses a coupled internal baseband source to generate all required baseband signals.



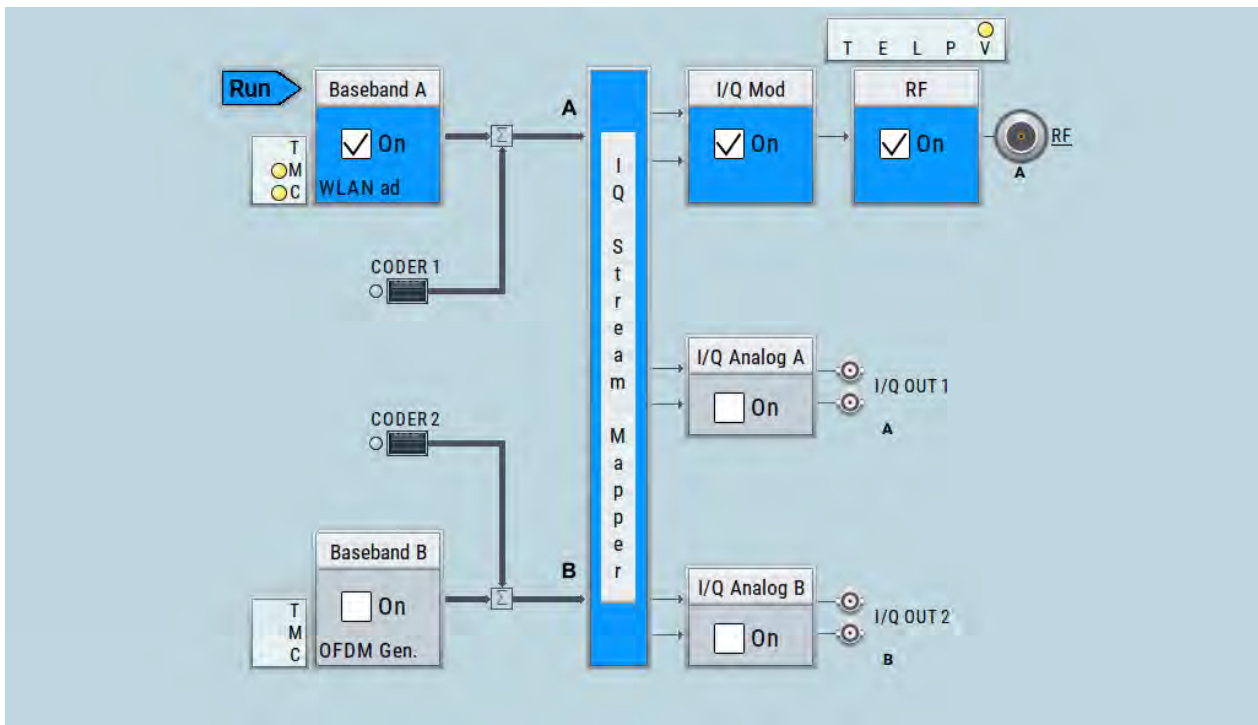
7.2.5 Generation of an LTE Test Signal with Carrier Aggregation and 2x2 MIMO each Component Carrier

The block diagram in this example depicts the generation of an EUTRA/LTE test signal with two component carriers (intra-band carrier aggregation) and 2x2 MIMO fading each, for example for UE tests. The instrument uses a coupled internal baseband source and both RF outputs.



7.2.6 Generation of a WLAN 802.11ad Signal with 1.76 GHz Bandwidth

The block diagram in this example depicts the generation of a WLAN 802.11ad test signal with 1.76 GHz bandwidth. The instrument uses one internal wideband baseband generator with 2 GHz bandwidth and one RF output.



8 Instrument Control

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

It covers the following topics:

• Possible Ways to Operate the Instrument.....	99
• Means of Manual Interaction.....	100
• Understanding the Display Information.....	101
• Accessing the Functionality.....	107
• Entering Data.....	108
• Getting Information and Help.....	110
• Remote Control.....	115
• Remote Operation over VNC.....	116

8.1 Possible Ways to Operate the Instrument

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

- 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 8.8, "Remote Operation over VNC"](#), on page 116.

8.2 Means of Manual Interaction

For the manual interaction with the R&S SMW, 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 drag = drag&drop:
 - Moves a window (dialog or graphic) by dragging it to a new position on the screen, or
 - Routes a signal by selecting a block and dragging to the destination block, or
 - Resizes a window (dialog or graphic) by dragging an edge or a corner of a window to the destination size
- Touch and swipe = drag: Scrolls through the contents of a display element larger than the screen, e.g. a list or a table.
- Spread or pinch two fingers = zoom out, zoom in:
 - Increases or decreases the size of an area in a graphical display as it works on your cell phone

- **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 8.4, "Accessing the Functionality"](#), on page 107.

Understanding the Display Information

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.

8.3 Understanding the Display Information

The block diagram of the R&S SMW displays all main settings and generator states, divided into three main operation areas.

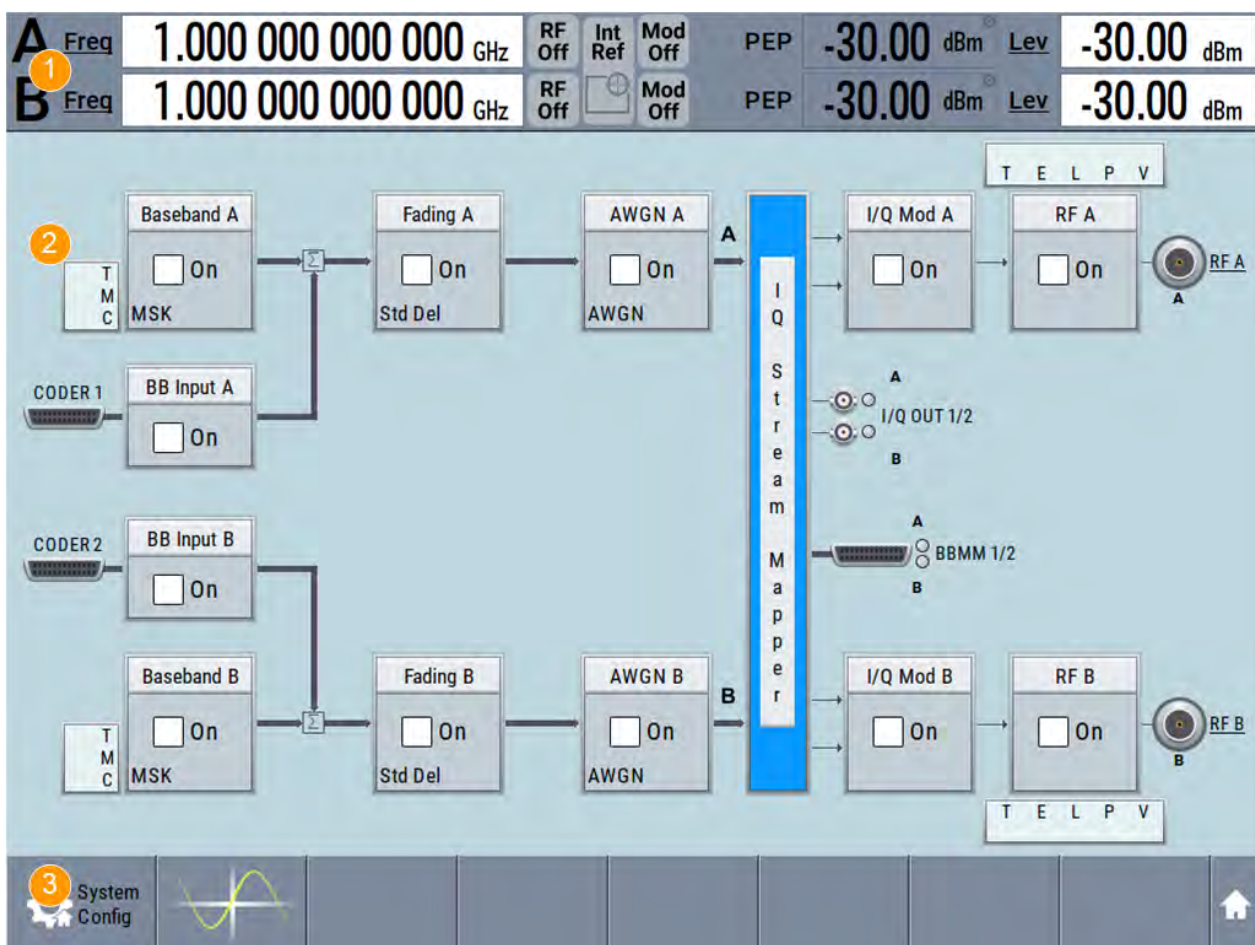


Figure 8-1: Block diagram

- 1 = Status bar
- 2 = Block diagram
- 3 = Taskbar/softkey bar

- [Status Bar](#)..... 102
- [Block Diagram](#)..... 102
- [Taskbar](#)..... 104
- [Additional Display Characteristics](#)..... 105

8.3.1 **Status Bar**

The status bar at the top of the screen indicates the RF frequency and the level of the output signal provided to the DUT. You can set both parameters directly here.



- 1 = Frequency display
- 2 = Status buttons
- 3 = Level display

The status buttons indicate key parameters that are set for the output signal. Most of the status buttons are virtual keys you can use to open a corresponding menu or dialog.

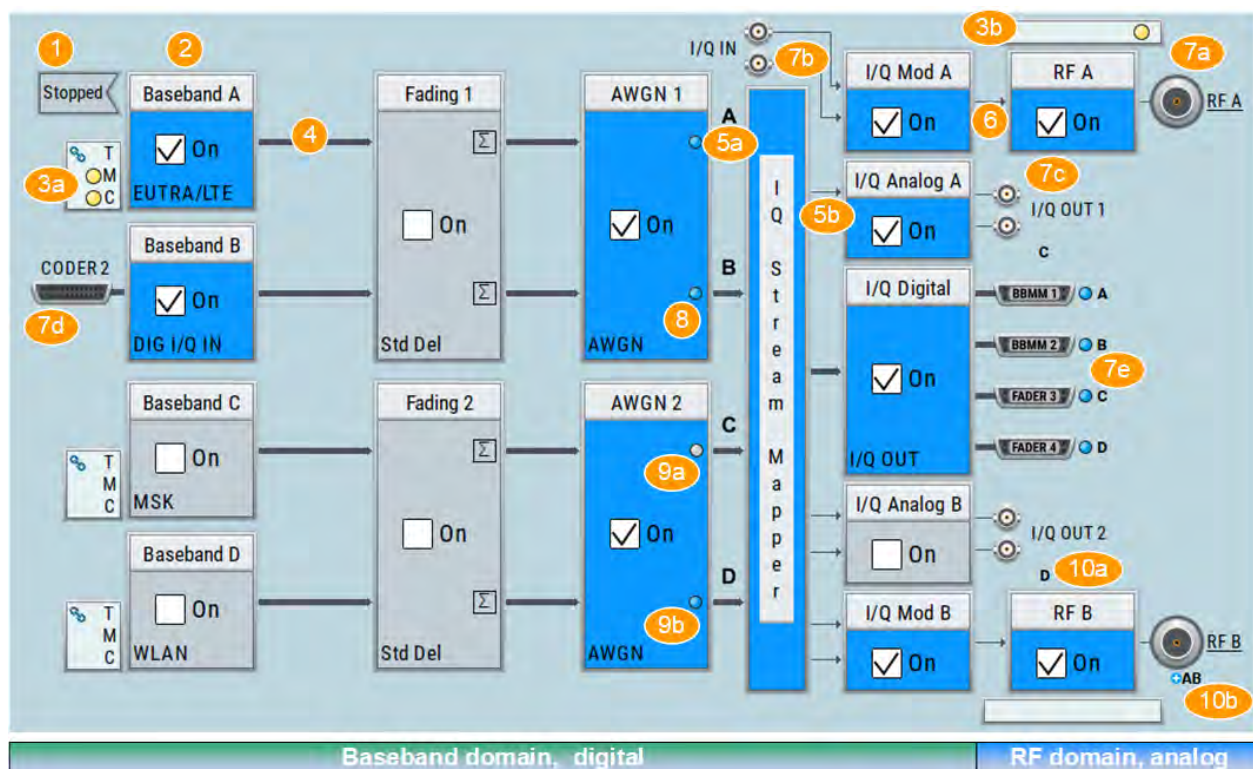
An overview of the status buttons and their functionality is given in the appendix of the user manual.

8.3.2 **Block Diagram**

The block diagram shows the current configuration and the signal flow in the generator with the aid of function blocks, connected by signal lines.

The following figure displays almost all the elements that can appear in the block diagram. However, it does not necessarily represent a useful configuration.

Understanding the Display Information



- 1 = Status indicator
- 2 = Functional block
- 3a / 3b = Control signal block
- 4 = Signal line (digital)
- 5a / 5b = Graphics indicator
- 6 = Signal line (analog)
- 7a / 7b / 7c / 7d / 7e = Connector icons (RF, analog, digital)
- 8 = Stream indicator
- 9a / 9b = Stream status indicator (On/Off)
- 10a / 10b = Stream indicator (Single, Add)

Starting from left up to the "I/Q Stream Mapper", you can see the functional blocks provided in the baseband domain. After the stream mapper, the analog section contains the digital to analog conversion and modulation to RF.

Legend	Item	Description
1	Status indicator	Indicates whether the signal is running or waiting for a trigger.
2	Functional block	Represents a basic task in signal generation. The push button provides access to any number of associated actions to accomplish the task. The On/Off (checkbox) and the block label quickly activates the basic task.

Legend	Item	Description
3	Control signal block	Indicates information on the control signals like signal content, input or output and provides quick access to the corresponding configuration dialog. A dedicated control block is displayed for each baseband block (3a) and RF block (3b).
4, 6	Signal lines (digital, analog)	Show the currently configured signal flow. <ul style="list-style-type: none"> Thick lines represent the digital I/Q streams, see (4) in the figure above Thin lines represent the analog signals (6)
5	Graphics indicator	Denotes that the signal is displayed graphically (5a/5b).
7	Connector icons	Represent the interfaces for signal input and output. <ul style="list-style-type: none"> RF signal connector output (7a) Icons vary depending on the frequency. Analog I/Q signal connector input (7b) Analog I/Q signal connector output (7c) Digital I/Q signal connector input (7d) Digital I/Q signal connector output (7e)
8	Stream indicators	Show the input streams at the I/Q stream mapper.
9	Stream status indicators	Show the status of a stream (On/Off)
10	Stream indicators	Indicates the output streams that are routed to the corresponding connectors, and the way the streams are internally processed: <ul style="list-style-type: none"> Single One stream mapped on the connector (9a). Add More than one stream is routed to a connector (9b).

8.3.3 Taskbar

The "Taskbar" contains labeled softkeys and minimized views (thumbnails) of active graphics and dialogs.

Initially, it shows the permanently assigned softkeys. The softkey with the sine wave denotes that no signal is activated for graphical representation.

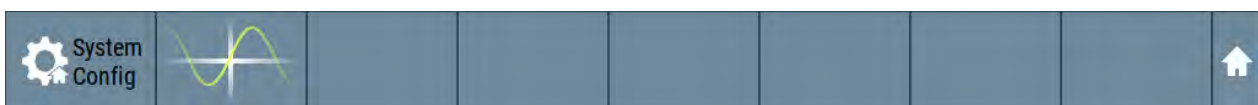


Figure 8-2: Taskbar in default state

Understanding the Display Information

Whenever you open a settings or graphics dialog, it is automatically assigned to the "Taskbar". The softkeys shown in the following figure represent the variants.



Figure 8-3: Taskbar fully assigned

- 1 = System configuration
- 2 = Remote control connections
- 3 = R&S NRP power sensors
- 4 = Graphics
- 5 = Dialogs
- 6 = Diagram / more

1	SystemConfig	Provides access to general system configurations like setup, display, or remote. The warning symbol signifies a permanent error message. It replaces the default symbol, as shown in Figure 8-2 .
2	Remote	Shows the established remote connections when the instrument is remotely controlled. Tip: An indicator in the status bar shows the current remote control status.
3	R&S NRP	Shows a connected external power sensor. If the sensor is active, the softkey background is blue.
4	Graphics	Shows that a signal is represented graphically.
5	Dialogs	Shows a dialog as a thumbnail, the dialog name, and the name of signal channel.
6	Diagram / more	The diagram icon as shown in Figure 8-2 minimizes all dialogs indicated on the screen. The block diagram is in the foreground. The "More" softkey indicates that more dialogs are open than can be displayed in the taskbar. Use this softkey to open a selection list with the remaining active dialogs, and the "Diagram" function.

8.3.4 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**

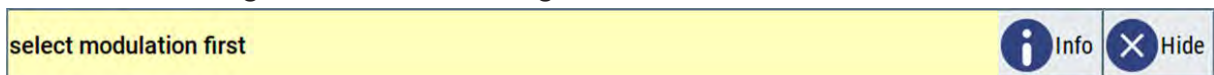
- *Active* elements like On/Off switches, state buttons have a **blue** background.
- *Selected* elements are framed or highlighted **orange**.
- *Inactive* elements are **gray**.

- **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 8.5, "Entering Data"](#), on page 108).

- **Info line**

The "Info line" shows brief status information and error messages. It appears when an event generates a message.



- **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.



1 = Status indicators

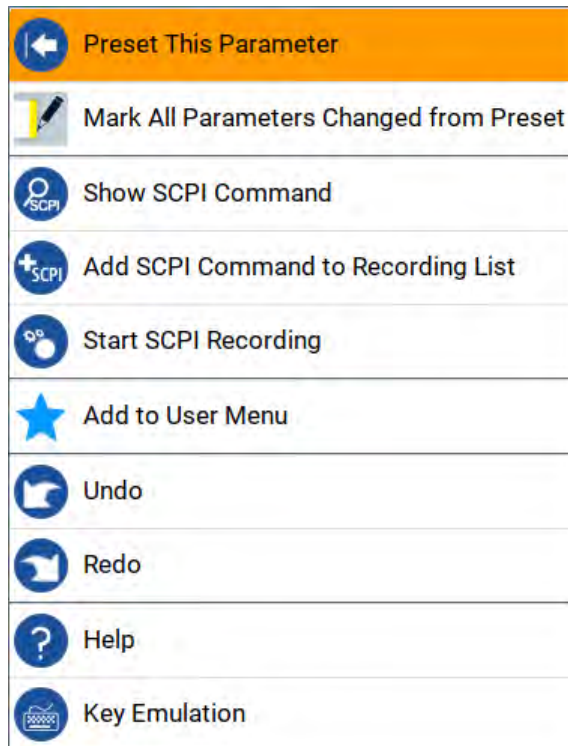
2 = Key parameter values

- **Scroll bar handle**

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

- **Context-sensitive menus**

Within the entire screen display, including single parameters, you can access context-sensitive menus that provide some additional functions.



8.4 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
- 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 block, and then the menu entry.

- Tap the minimized view (thumbnail) on the taskbar.

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

To minimize a dialog box

- ▶ Tap the "Minimize" icon in the upper right corner.

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 block diagram.

To select an option in a dialog box

- ▶ Tap the required option.

To select an option in a list

If many options are available - for example, for the trigger mode - the options are provided in a list. The current selection is shown on the list button.

1. Tap in the list.
2. To navigate through the list, try out the following:
 - Using a mouse, scroll in the list, tap the required option.
 - Use the rotary knob.
 - Use [ON/OFF TOGGLE] key to select the succeeding option
 - Use the front panel keys:
 - a) Press the [Left/Right] arrow keys to navigate to the list button.
 - b) Press the [Enter] key to open the list.
 - c) Press the [Up/Down] keys to navigate to the required option in the list.
 - d) Press the [Enter] key to select the marked option.

8.5 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.

Correcting 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.

Completing the entry

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

Aborting the entry

- Press the [ESC] key.
The dialog box closes without changing the settings.

8.5.1 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.
2. Tap the unit button to complete the entry.
The unit is added to the entry.
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.

8.5.2 Entering Alphanumeric Parameters

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

8.5.3 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.

8.6 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.
- The tutorials are interactive examples and demonstrations on how to perform specific tasks.

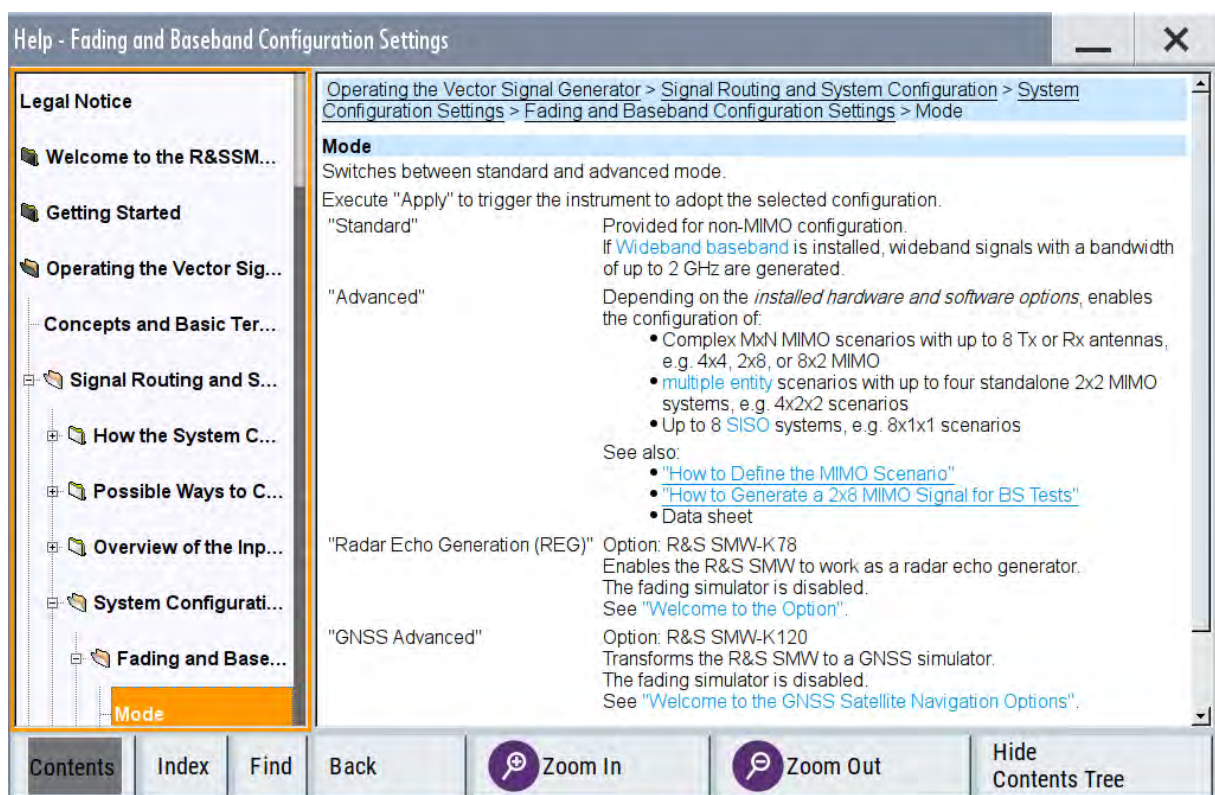
To access the tutorials

- Follow the instructions in [Chapter 8.6.1, "Using the Tutorials"](#), on page 112.

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.

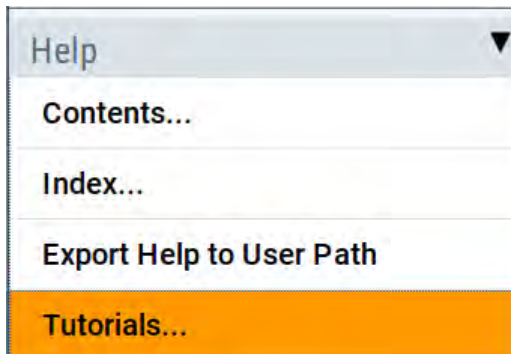
8.6.1 Using the Tutorials

A set of tutorials is embedded in the software. The tutorials are interactive examples and demonstrations on how to perform specific tasks.

To start a tutorial in an interactive step-by-step mode

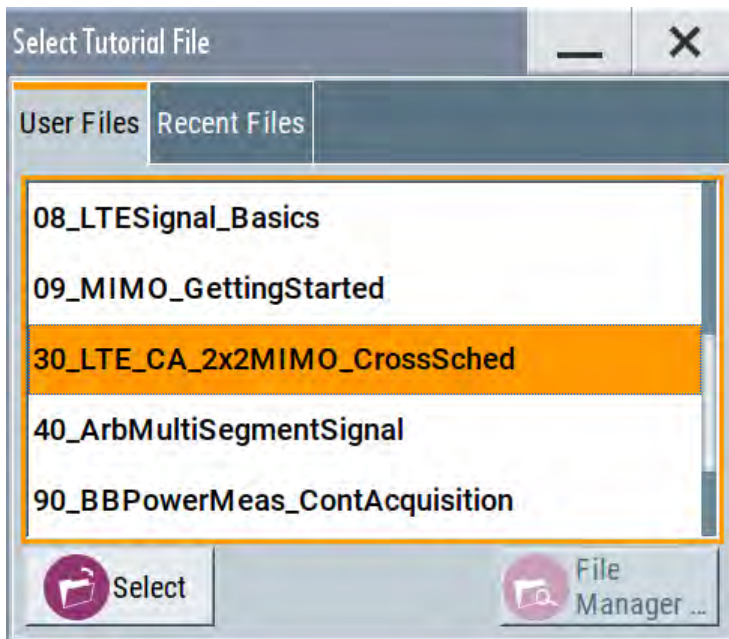
1. Press the [SETUP] key on the front panel.

2. Scroll-down in the list, tap on the "Help" section to expand it and tap on "Tutorials".

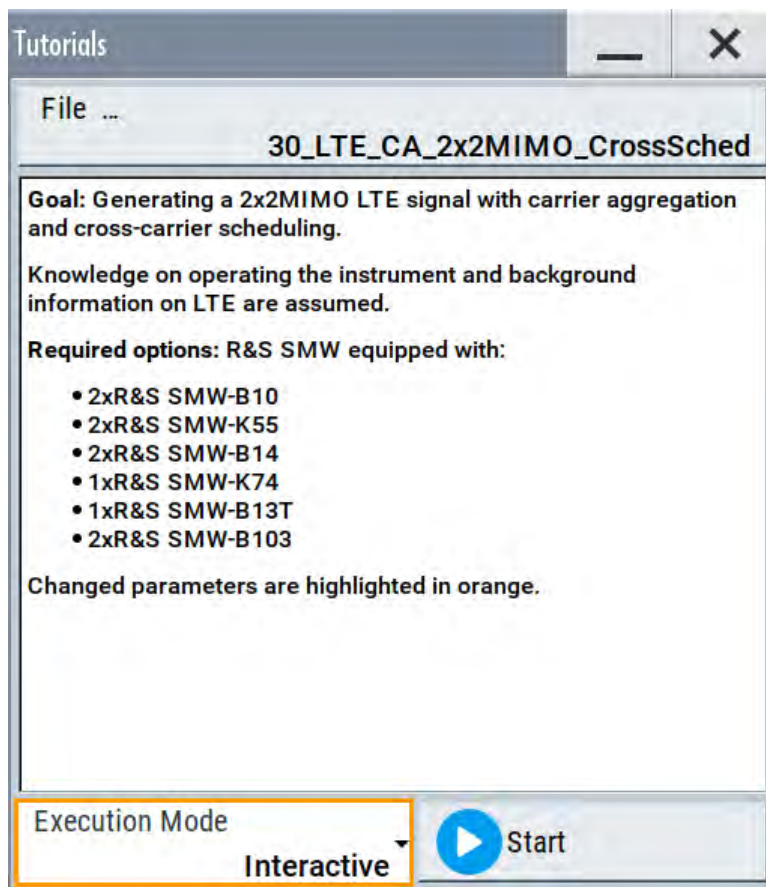


The "Tutorials" dialog opens.

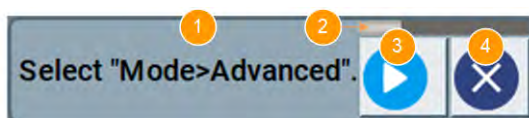
3. Select "File > Load Predefined Tutorial".



4. Tap on a tutorial from the list and confirm with "Select".
If the file contains a description, it is displayed.



5. Use the default mode, that is "Execution Mode > Interactive".
6. Tap on the "Start" button.
7. Observe the information displayed in the "Info" line (bottom of the display).



- 1 = Information on the performed action
- 2 = Progress bar
- 3 = "Next Step": confirms the execution of the step
- 4 = "Stop": terminates the tutorial

8. To execute a subsequent step, select the "Next Step" button.
A blinking cursor indicates the block or parameter affected by the step.



The instrument performs the configurations step-by-step and expects your confirmation. Dialogs are opened and closed; changed parameters are highlighted in orange.

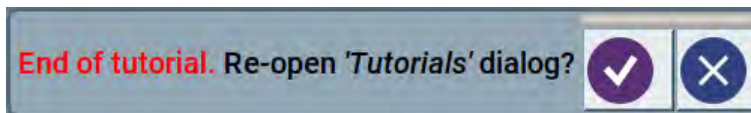
Additional information is displayed in the "Info" line.

To stop the tutorial

The demonstration can be terminated at any time.

- Select the "Stop" button.

The demonstration stops.



You may reopen the "Tutorials" dialog and start another file or exit the tutorial mode.

To use the demonstration mode

1. Start the tutorials as described in ["To start a tutorial in an interactive step-by-step mode"](#) on page 112.
2. In the "Tutorials" dialog, select "Execution Mode > Auto (Looped) 3 sec".

The configurations are performed automatically; your interaction is not required.

Dialogs are opened and closed; changed parameters are highlighted in orange. Additional information is displayed in the "Info" line.

8.7 Remote Control

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

The R&S SMW supports various methods for remote control:

- Connecting the instrument to a LAN (see [Chapter 4.7, "Connecting to LAN"](#), on page 24)

- 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".

8.8 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 SMW, 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 SMW user manual, chapter "How to Set Up Remote Operation via VNC".

9 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 9-1: QR code to the Rohde & Schwarz support page

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