

# R&S® SZU100A

## IQ Upconverter

### 58.32-64.8 GHz

# Manual



1425306102

This document describes the R&S®SZU100A, stock. no. 1425.3003.02 and its options:

- R&S®SZU-B1066 (1425.3110.02)

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The following abbreviations are used throughout this manual: R&S®SZU100A is abbreviated as R&S SZU, the R&S®SMW200A is abbreviated as R&S SMW, the R&S®ZCTW is abbreviated as R&S ZCTW.

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# 1 Safety Information

The product documentation helps you use the R&S SZU safely and efficiently. Follow the instructions provided here and in the printed "Basic Safety Instructions". Keep the product documentation nearby and offer it to other users.

## Intended use

The R&S SZU is intended for the development, production and verification of electronic components and devices in industrial, administrative, and laboratory environments. Use the R&S SZU 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 about the potential dangers and gives instructions how to prevent personal injuries or damage caused by dangerous situations. Safety information is provided as follows:

- The printed "Basic Safety Instructions" provide safety information in many languages and are delivered with the R&S SZU.
- Throughout the documentation, safety instructions are provided when you need to take care during setup or operation.

## 2 Documentation Overview

This section provides an overview of the R&S SZU user documentation. You find it on the product page of the R&S SZU, see [www.rohde-schwarz.com/manual/szu100a](http://www.rohde-schwarz.com/manual/szu100a). The User Manual of the R&S SMW is provided at [www.rohde-schwarz.com/product/SMW200A/User Manual](http://www.rohde-schwarz.com/product/SMW200A/User Manual).

The user documentation for the R&S SZU consists of the following parts:

### **Manual**

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

### **Online help**

The online help offers quick, context-sensitive access to the complete information for the base unit and the software options directly on the R&S SMW.

### **General safety instructions**

The brochure delivered with the instrument contains basic safety instructions and operating conditions and further important information.

### **Data sheet and brochure**

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

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

See [www.rohde-schwarz.com/brochure-datasheet/szu100a](http://www.rohde-schwarz.com/brochure-datasheet/szu100a).

### **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.

## 3 About This Manual

This user manual which you have received as printed book with your instrument, provides all the specific information about the R&S SZU. The instrument functions and settings concerning the R&S SMW are described in the main R&S SMW user manual.

The main focus is on the tasks required for setting up the measurement system. The following topics are included:

- **Welcome to the R&S SZU IQ Upconverter**  
Introduction to and getting familiar with the instrument.
- **Preparing for use**  
Basic steps to be taken when setting up the R&S SZU IQ Upconverter for the first time.
- **Startup**  
Description on how to take the R&S SZU IQ Upconverter into operation.
- **Remote control**  
Remote control commands related to the R&S SZU, see the R&S SMW user manual.
- **Glossary**  
Alphabetical list of frequently used terms and abbreviations

## 4 Welcome to the R&S SZU

The Rohde & Schwarz R&S SZU is an IQ upconverter designed for the 60 GHz frequency band. These frequencies are used in modern high-performance wireless communication standards, e.g. IEEE802.11 ad. Operating in the 60 GHz frequency band enables devices to communicate at multi-gigabit speed, with data transfer rates of several Gbit/s.

### Key features

The R&S SZU IQ Upconverter features:

- Compact broadband upconverter providing 57 GHz to 66 GHz frequency
- Power output of at least 5 dBm for over the air (OTA) RF measurements and tests
- Adjustable output power in the range +5 dBm to -80 dBm, with integrated level detector
- RF output signal at the waveguide port
- Support of common mountable test port adapters
- High-level stability and harmonic suppression
- Compatible to all R&S SMW frequency options
- Support of the R&S SMW output level user correction
- Fully calibrated at the waveguide port
- Control via user interface of the R&S SMW
- Small size, easy usage, and operation in any position possible

### About the R&S SZU IQ Upconverter

The R&S SZU generates a vector-modulated signal by converting the baseband signal to the output frequency range of 58.32 GHz to 64.8 GHz (center frequency).

The R&S SZU receives the differential or single ended baseband signals (I/Q), and an LO signal in the range of 1.944 GHz to 2.16 GHz from the R&S SMW.

The USB host interface is the communication port of the R&S SZU to the R&S SMW. As external instrument, the R&S SZU is configured in the "System Configuration" dialog of the R&S SMW, and indicated by a symbol in the GUI. Once connected, the R&S SMW reads the calibration data of the R&S SZU, and



adjusts the frequency and level values to the output values of this downstream instrument.

Thus the R&S SMW controls the R&S SZU almost entirely. You only need to select single ended or differential mode for the baseband connection. It is recommended that you work in differential mode due to better common mode noise suppression over the single ended connection. When you work with two R&S SZUs on one R&S SMW, you must work in single ended mode.

The setting parameters in the R&S SMW remain the same.

## 5 Preparing for Use

This section explains how to take an R&S SZU IQ Upconverter into operation. It includes the controls and connectors of the R&S SZU, and provides all the information necessary for connection.

For information on the equipment required for a basic test setup, see [Chapter 7.1, "System Requirements"](#), on page 19.

### 5.1 Unpacking and Checking the R&S SZU

To remove the instrument from its packaging and to check the equipment for completeness, proceed as follows:

1. Unpack the R&S SZU and the other contents of the shipping container.
2. Check the equipment for completeness using the delivery list.
3. Remove the protective cap from the waveguide port at the front of the R&S SZU. Inspect the instrument carefully, to make sure that it has no damage from shipment.

If there is any damage, immediately contact the freight forwarder, who has delivered the instrument.



#### **Packaging material**

It is recommended that you retain the original packaging material. If the R&S SZU needs to be transported or shipped later, you can use the material to prevent control elements and connectors from being damaged.

Equipment returned or sent in for repair must be packed in an appropriate packaging, if the original packaging is no longer available.

Also use the packaging material for storage of the instrument and the accessories.

---

## 5.2 Putting into Operation

The IQ upconverter is designed for use under laboratory conditions.

General ambient conditions:

- The ambient temperature and humidity must be in the ranges specified for operation and for compliance with specifications (see the data sheet).
- Condensed humidity can cause serious defects to the hardware. To avoid condensed humidity, keep the warm-up time for the R&S SZU to adjust to the ambient temperature.
- All ventilation openings must be unobstructed.

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**NOTICE****Risk of instrument and DUT damage**

To avoid damage of electronic components of the DUT and the R&S SZU, protect the operating site against electrostatic discharge (ESD).

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## 5.3 Adjusting the Feet

The R&S SZU has four adjustable feet you can mount at each side of the unit.






## 6 Instrument Tour

### 6.1 Front View

#### Test port adapter (waveguide port)

At the front, the R&S SZU covers the interface to the DUT, that is the output of the RF signal.

**Table 6-1: R&S SZU IQ Upconverter front views**

		
<p>R&amp;S SZU with standard WR15 waveguide flange, without any adapter</p>	<p>R&amp;S SZU with test port adapter</p>	<p>R&amp;S SZU with waveguide to V-conector adapter</p>

To avoid damage as a result of wear and tear of the waveguide port, it is recommended that you mount a test port adapter for the corresponding frequency band.

The precision waveguide flange of the test port adapter is equipped with two alignment pins and two holes that receive the alignment pins of the DUT. Two additional holes in the middle allow you to insert additional alignment of pins that are included. Use the extra pins, when the flange of the DUT provides the corresponding holes. In particular, if the DUT has thin pins, these additional pins improve the alignment and stability of the connection.



**Figure 6-1: Assignment of the test port adapter**

- 1 = Hole for pin of the DUT
- 2 = Hole for additional pin
- 3 = Alignment pin

Refer to the data sheet for more details on the type of waveguide port.

### Mounting the test port adapter

Mount the selected adapter to the waveguide port of the instrument using the delivered screws and the special torque wrench for waveguide flange screws. The R&S ZCTW (order no. 1175.2014.02) is especially designed for these tasks.



**Figure 6-2: Recommended torque wrench R&S ZCTW**

## 6.2 Rear View

The rear panel of the R&S SZU provides the connectors and control elements described below:

- [Power Supply Connector](#)
- [IQ Input Connectors](#)
- [Status LED](#)
- [USB Interface](#)
- [LO In/Out Connectors](#)
- [Trigger Input/Output Connector](#)



**Figure 6-3: Rear view of the R&S SZU**

- 1 = Power supply connector
- 2 = IQ input connectors
- 3 = Status LED
- 4 = USB interface
- 5 = LO signal input and output
- 6 = Trigger connector

### 6.2.1 Power Supply Connector

Connection for the DC power supply (Figure 6-3, (1)).

The IQ upconverter is supplied by an external DC power supply. It supports the AC input voltages between 100 V to 240 V and frequencies between 50 Hz to 60 Hz.



**⚠ WARNING****Shock hazard**

The input voltage and current must not exceed the maximum values according to the labeling or the data sheet. It is recommended that you use the included power supply unit for the operation of the R&S SZU.

When other than the included power supply is used to supply the equipment with DC safety extra low voltage (SELV), the requirement for strengthened / double insulation in line with DIN/EN/IEC 61010 (UL61010, CAN CSA C22.2 No. 61010) or DIN/EN/IEC 60950 (UL60950, CAN CSA C22.2 No. 60950) must be met.

**6.2.2 IQ Input Connectors**

Input connectors for the single ended (I/Q) or differential (I/Q, I/Q BAR) baseband signal ([Figure 6-3](#), (2)).

The I/Q input connectors receive the single-ended signal, or the positive signal components of the differential signal. The I/Q BAR connectors receive the negative signal components of the differential signal.

**6.2.3 Status LED**

Indicates the instrument status ([Figure 6-3](#), (3)).

**Table 6-2: The status of the R&S SZU indicated by the color of LED**

LED	R&S SZU status	Description
● off	Off	R&S SZU is powerless.
● on	Standby	Controller is running, all analog circuitry are powered down.
● blinking (3 Hz)	Booting or busy	Controller is booting or USB transfer is running.
● on	RF Off	R&S SZU is ready for operation with RF deactivated.
● on	RF On	R&S SZU is ready for operation with RF signal activated.
● blinking once	Trigger received	LED switches off for 200 μs when an external trigger event occurred.



LED	R&S SZU status	Description
● on	Internal error	E.g. over temperature, power failure, fan failure.
● blinking (6Hz)	External error	E.g. LO level out of range.

### 6.2.4 USB Interface

Universal serial bus (USB) interface of type B (Figure 6-3, (4)). This port is used to communicate with the host instrument, the R&S SMW.

### 6.2.5 LO In/Out Connectors

Connectors for RF signal input and output (Figure 6-3, (5)). These connectors are SMA coaxial connectors with 50 Ohm impedance. LO In receives the LO signal from the R&S SMW, and LO Out is intended for future use, e.g. to forward the LO signal when using multiple R&S SZU in a daisy chain.

#### **NOTICE**

##### **Risk of instrument damage**

The RF input power at the connector LO In must not exceed the maximum values specified in the data sheet.

### 6.2.6 Trigger Input/Output Connector

Connector for an optional trigger signal (Figure 6-3, (6)). The trigger connector is an SMA coaxial connector with 50 Ohm impedance.

## 7 Startup

This section explains the required steps and components for starting up with R&S SZU. It describes how to connect the IQ upconverter with the R&S SMW, what you have to observe and how to configure the system in the R&S SMW.

### NOTICE

#### Risk of instrument damage during operation

An unsuitable operating site or test setup can damage the instrument and connected devices. Make sure that the following operating conditions are met, before you switch on the instrument:

- All fan openings are unobstructed and the airflow perforations are unimpeded. The recommended distance from the wall is 10 cm.
- The instrument is dry and shows no sign of condensation.
- The instrument is adjusted to the ambient temperature, i.e. the warm-up time was kept.
- The ambient temperature and humidity do not exceed the ranges specified in the data sheet.
- Signal levels at the input connectors are all within the specified ranges.

The R&S SZU IQ Upconverter is designed and tested in accordance with the EC certificate of conformity and has left the manufacturer's plant in a condition fully complying with safety standards.

To maintain this condition and to provide safe operation, observe all instructions and warnings given in the following description.

#### RF input power

The RF input power at the connector LO In must not exceed the maximum values quoted in the data sheet.

The R&S SZU is operated only in combination with the R&S SMW, which adjusts the LO signal level at any time to the optimum for the R&S SZU. Note, that the recommended firmware versions are installed on both instruments.

### Protection of waveguide flanges

Protect the waveguide flanges of the IQ upconverter against mechanical damage. Always use a torque wrench to tighten the screws of the waveguide flanges.

Shield the waveguides from dust and moisture, and avoid scratching the contact surfaces. We recommend that you use a test port adapter.

When the IQ upconverter is not in use, leave the test port adapter mounted and attach one of the included protective caps to the adapter.

### Avoid heavy shocks

Heavy shocks can damage the hardware of the IQ upconverter.

For shipping or storing the device, make sure that it is packed with shockproof packaging materials in a sturdy cardboard box of suitable size, see also "[Packaging material](#)" on page 10.

## 7.1 System Requirements

To operate an IQ upconverter, you need:

- An R&S SZU IQ Upconverter.
- The R&S SMW as signal source, which can generate the local oscillator signal within the frequency range of your R&S SZU and a level as specified in the data sheet.
- A test port adapter, if necessary.
- Cables set:
  - Four I/Q cables, included
  - An RF cable, included
  - The USB cable, included
  - A trigger cable, optionally



### Electromagnetic interference (EMI) affects the measurement results

To suppress generated electromagnetic interference:

- Only use the enclosed cables set, as the R&S SZU has been calibrated with these cables.  
You can find out the corresponding cable set by the serial number, which is the same as the serial number of the R&S SZU.
- Always terminate open cable ends:
  - Terminate the waveguide output with 50 Ohm.  
If it is not possible to terminate the output with 50 Ohm, leave it open.
  - Instead of terminating with 50 Ohm, you can connect a wideband power sensor of the R&S NRPxx series, which also provides a good termination.
- Use only the USB cable included.
- Note the EMC classification in the data sheet.

## 7.2 Measurement Setup

This section provides the first steps for putting the R&S SZU into operation. The startup also comprises the access to the settings made in the R&S SMW.

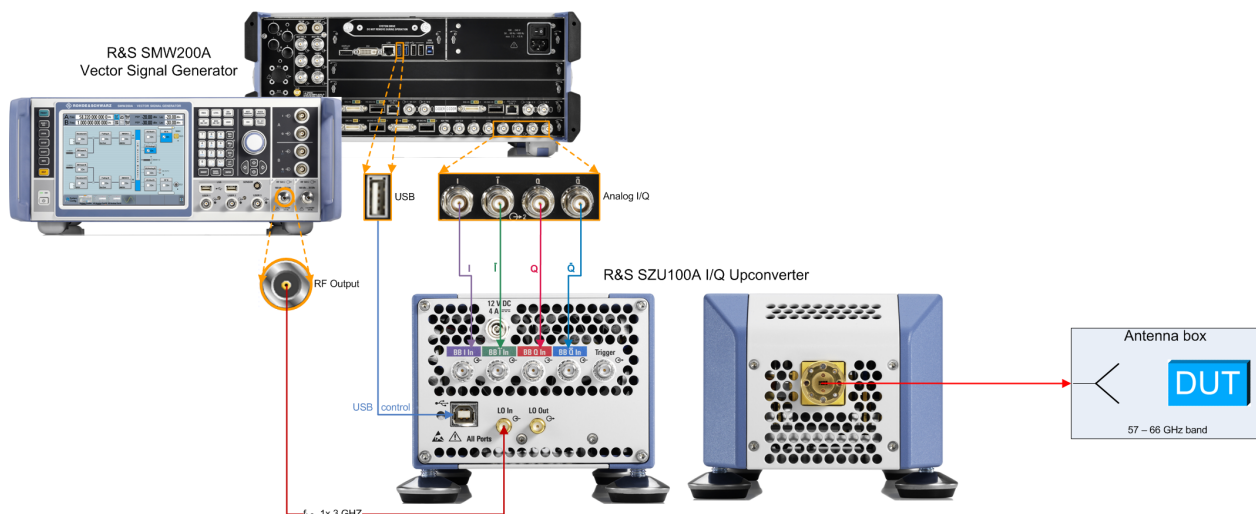
### NOTICE

#### Risk of RF connector and cable damage

Excessive tightening of the connectors can damage the cables and connectors. Too weak tightening leads to inaccurate results.

Always use the torque wrench suitable for this type of connector, see "[Mounting the test port adapter](#)" on page 14.

The figure shows the basic test setup of an application with the R&S SZU IQ Upconverter. The R&S SMW controls the R&S SZU via USB. The R&S SMW also provides the analog baseband signal, and a trigger signal optionally. The R&S SZU transmits the upconverted I/Q signal to the antenna box (DUT).



When setting up the measurement, it is recommended that you consider the following:

- Use only the supplied cables, as described in [Electromagnetic interference \(EMI\) affects the measurement results](#).
- Connect the instruments in the given order. In particular, connect the baseband signals before starting up.
- Switch off the RF of the R&S SMW before connecting the R&S SZU, to prevent damage of the R&S SZU due to high input power.
- Make sure that the input power level is always less than the maximum level specified in the data sheet.

### To set up the measurement...

1. Power on the R&S SMW vector signal generator.
2. Connect the IQ outputs of the signal generator to I/Q connectors of the R&S SZU.
3. Connect the RF A output of the signal generator to LO In of the IQ upconverter.
4. Connect the USB cable plug B to the R&S SZU, and the USB cable plug A to the R&S SMW.
5. Connect the R&S SZU IQ Upconverter to the power supply.
6. Keep the [Warm-up time](#).

7. Before connecting to the DUT, configure the R&S SZU in the R&S SMW, see [Starting Up](#).

With connecting USB, the R&S SMW recognizes the R&S SZU automatically. The R&S SMW reads all parameters for identification and the calibration table of the R&S SZU, and sets the optimum LO level.

At a reboot with a connected R&S SZU, RF can remain active, since the R&S SMW starts with the last used settings.

## 7.3 Starting Up

After connecting the instruments, you need to configure the connection in the "System Configuration" dialog of the R&S SMW. The following instruction guides you through the first steps by the example of one connected IQ Upconverter, assigned to path A.

Another example shows two R&S SZUs connected to the R&S SMW, i.e. one per path, see ["Two R&S SZU connected to the R&S SMW"](#) on page 28.



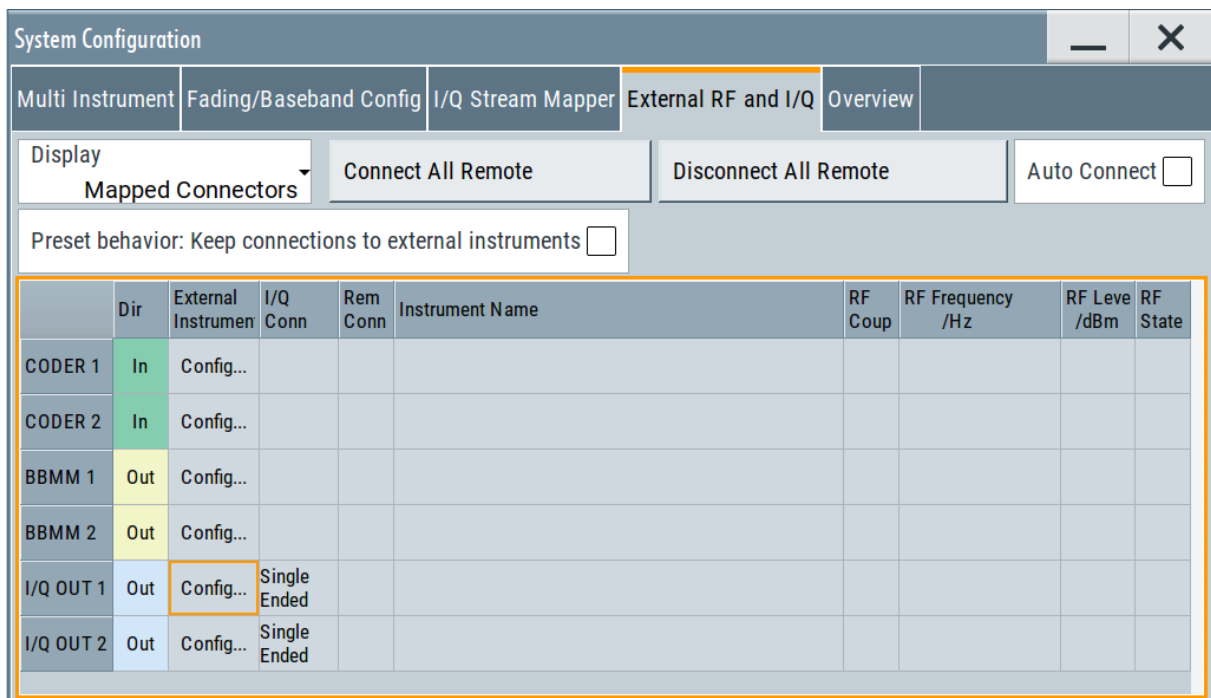
For details to the setting parameters and to the corresponding remote control commands, refer to:

- The [www.rohde-schwarz.com/product/SMW200A/User Manual](http://www.rohde-schwarz.com/product/SMW200A/User Manual), chapter "Signal Routing and System Configuration", sections "System Configuration Settings > External RF and I/Q Settings", and section "System Configuration Settings > Overview".
  - [Chapter 8, "Remote Control of the R&S SZU"](#), on page 36, and the corresponding descriptions in the R&S SMW user manual.
- 

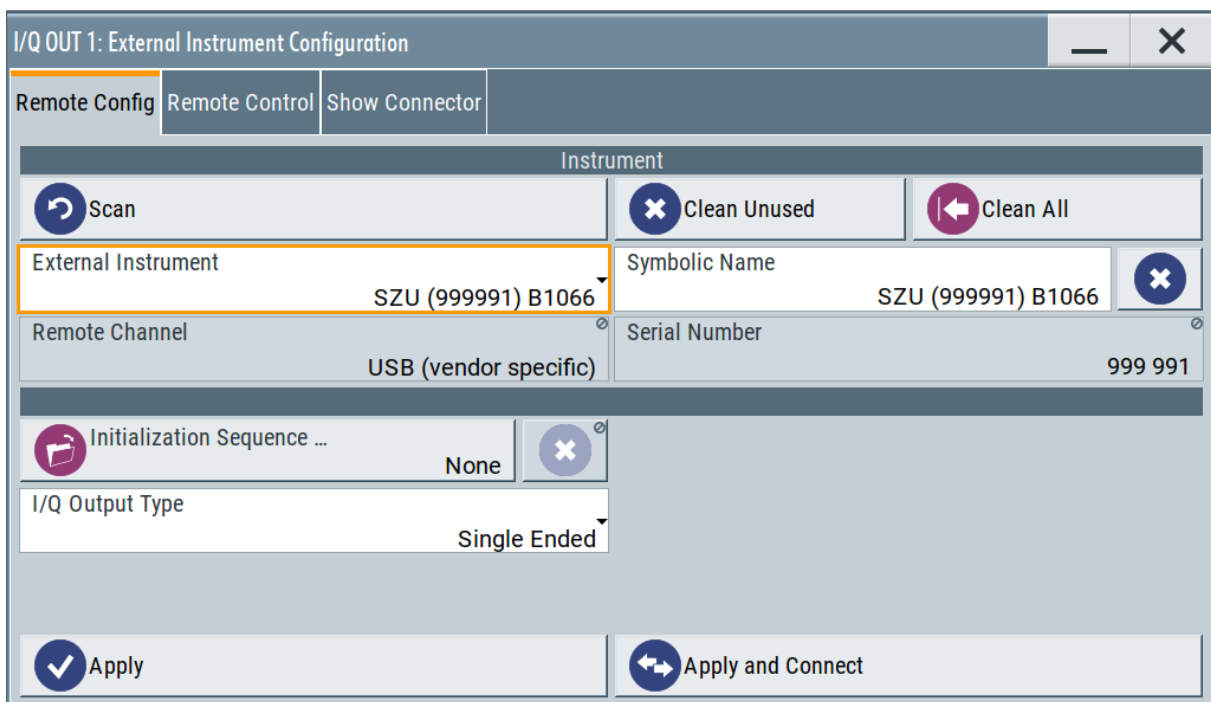
### To configure the R&S SZU in the R&S SMW ...

Access:

1. Select "Taskbar > System Config. > System Configuration > External RF and I/Q".



2. Select "I/Q OUT 1 > Config...".
3. Select "External Instrument > SZU (<Serial No> Bxxxx)".



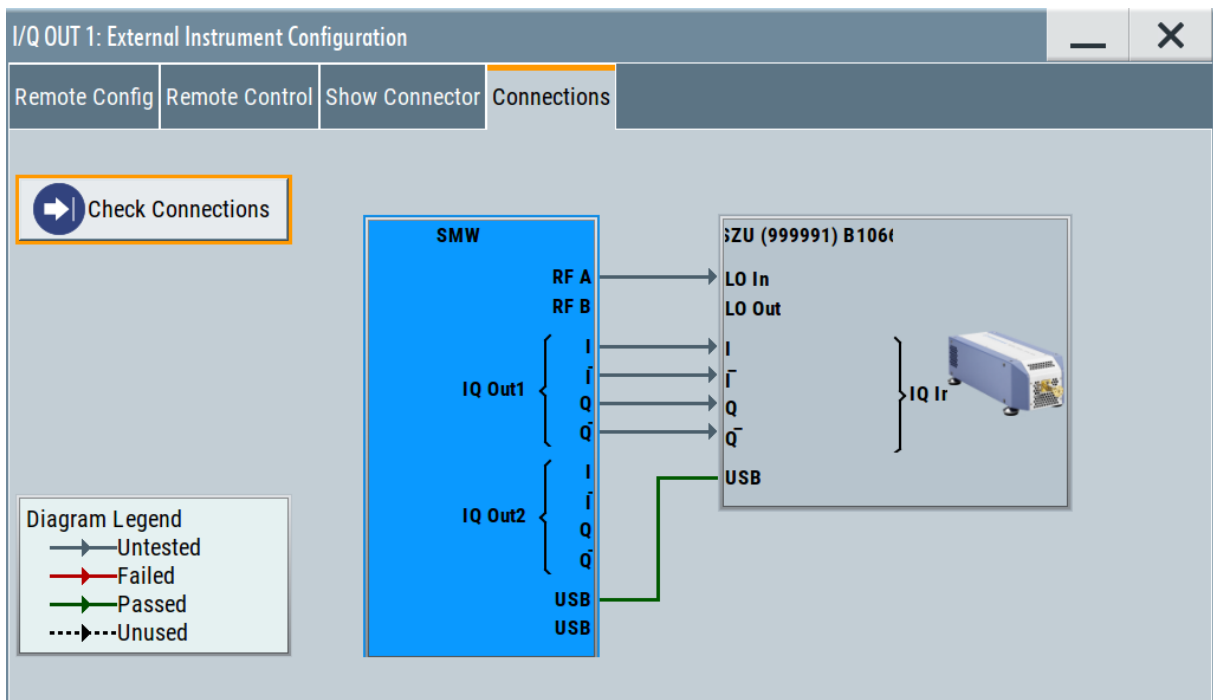
4. Select "I/Q Output Type > Differential".

**Note:** If you are working with an R&S SZU in each path, the R&S SMW only supports the single ended mode in both paths.

- Confirm with "Apply and Connect".

The R&S SMW establishes the connection to the R&S SZU and shows the "Connections" tab.

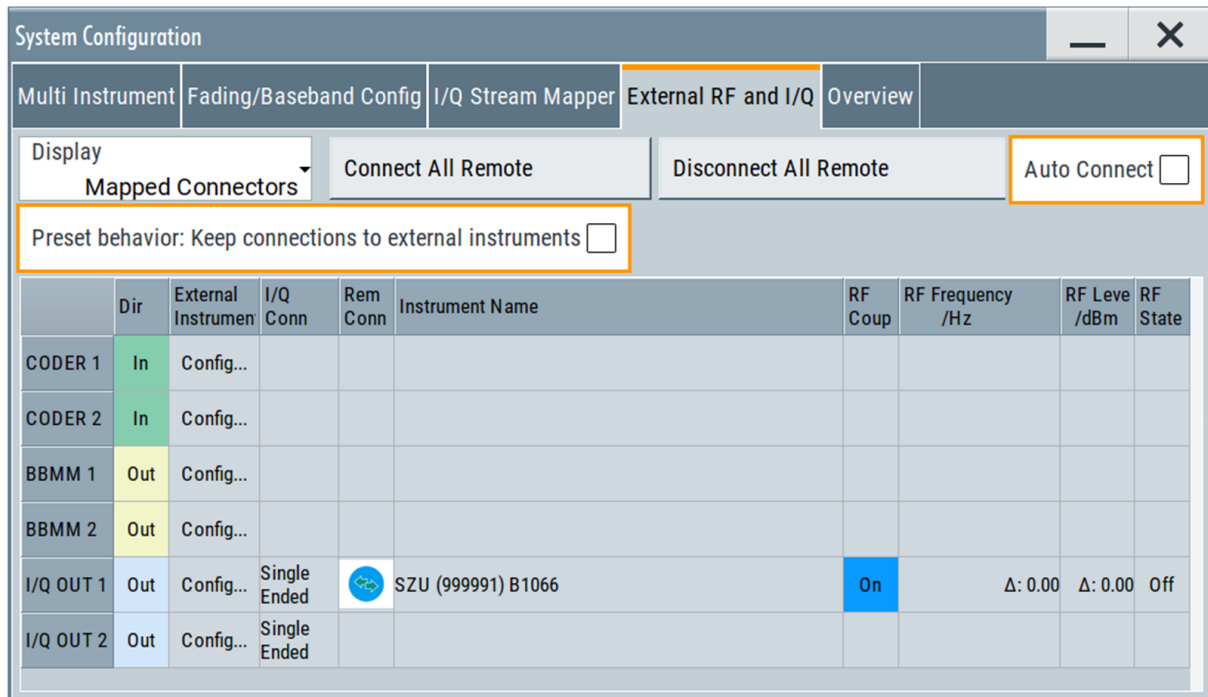
- Select "Check Connections".



The R&S SMW checks the connections at the corresponding RF and I/Q connectors and displays the results.

- Close the dialog.





1 = see [step 8](#)

2 = see [step 9](#)

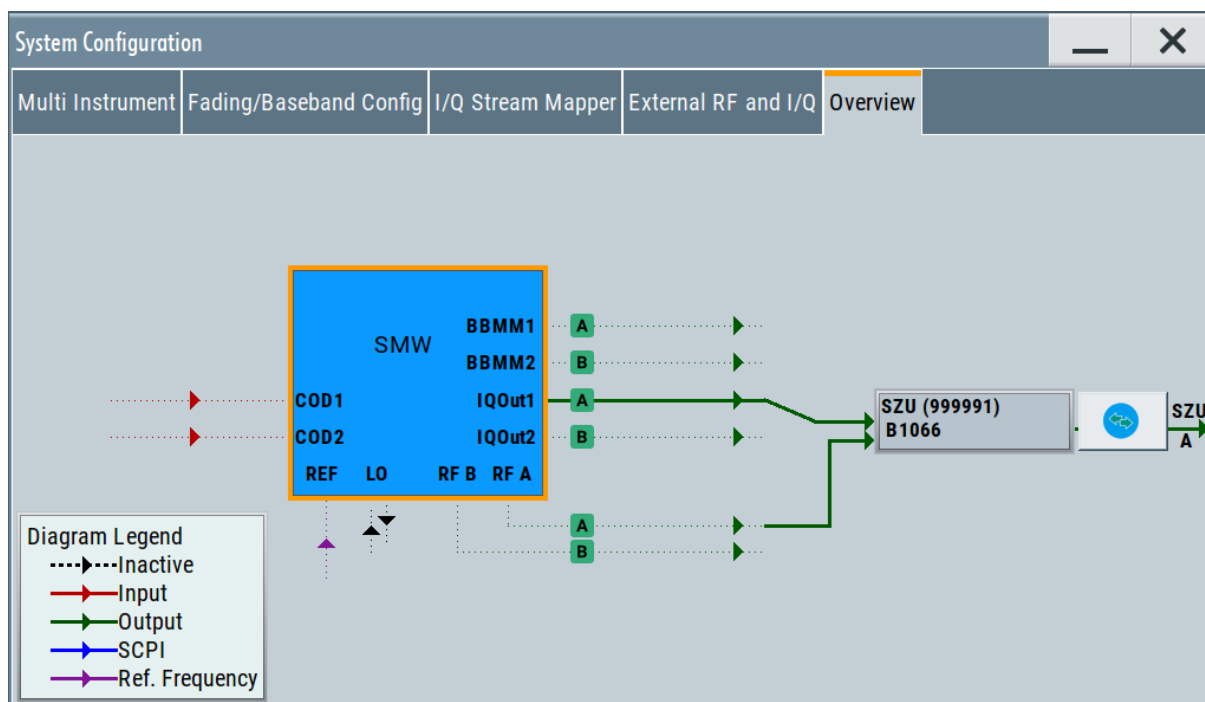
8. In the "System Configuration" dialog, check "Auto Connect".

When enabled, the R&S SMW automatically (re)establishes the connection to the R&S SZU, e.g. after a restart or an instrument preset.

9. Select "Preset behavior: Keep connections to external instruments".

When enabled, the R&S SMW retains the connection to the R&S SZU at an instrument preset, see [Chapter 7.5, "Behavior of the R&S SMW When Working with the R&S SZU"](#), on page 32.

10. Select the "Overview" tab.



The overview tab shows all external instruments connected, in this case one connected R&S SZU. For more, see the user manual of the R&S SMW, chapter "System Configuration Settings", section "Overview".

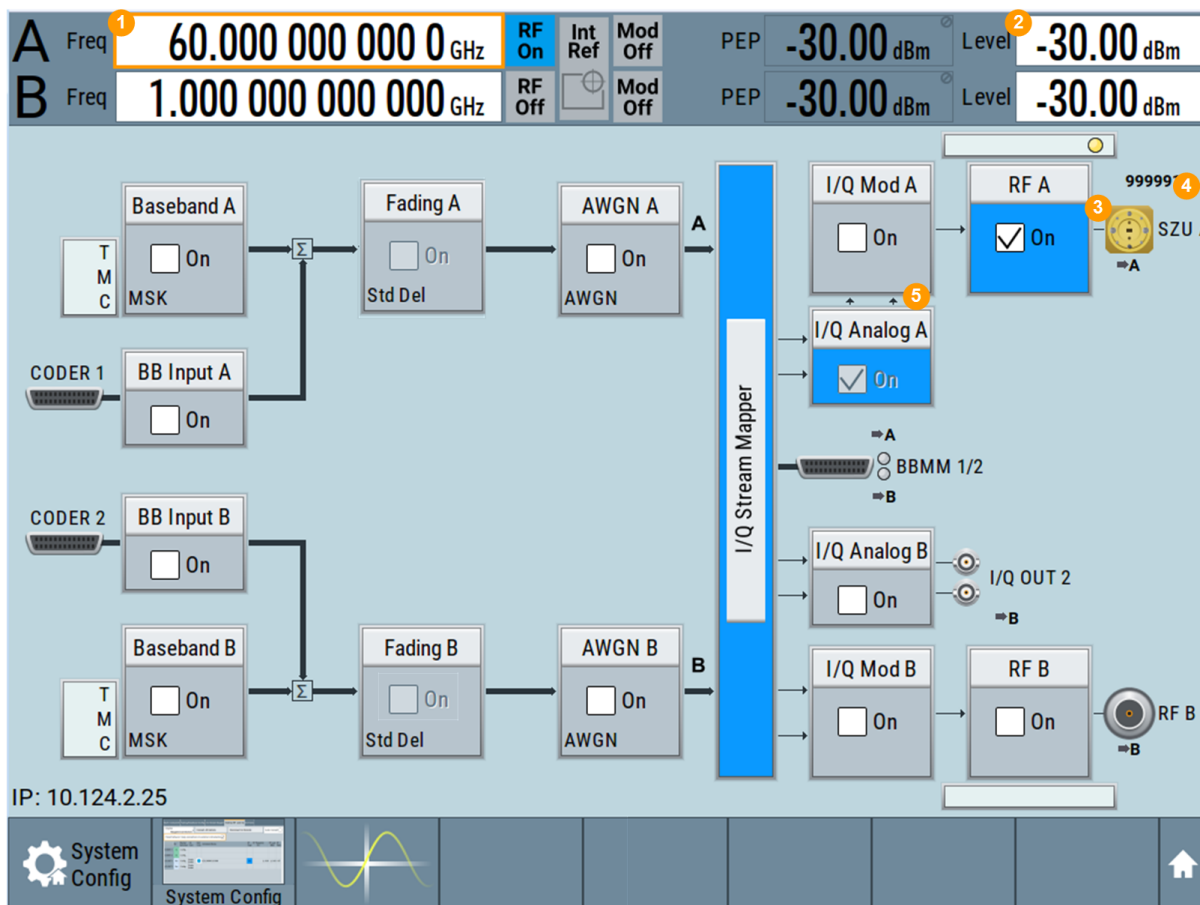
11. Close the dialog.
12. If necessary, perform an internal adjustment, before connecting the DUT and activating the measurement.  
Proceed as described in [Chapter 7.4, "Running Internal Adjustments"](#), on page 30.

### To activate the signal output...

After the internal adjustments are completed, you can connect the DUT and start with your measurement.

1. Connect the R&S SZU with the DUT.

2. In the block diagram, select the checkbox in the "RF" to activate RF signal output.



**Figure 7-1: Display of one connected R&S SZU on the R&S SMW screen**

- 1 = RF frequency of the R&S SZU RF output
- 2 = RF level, nominal level at the R&S SZU RF output (regulated level)
- 3 = RF<sub>LO</sub>, CW signal for the LO input of the R&S SZU
- 4 = R&S SZU displayed by the waveguide port icon, the label and the serial number
- 5 = Active I/Q output with displayed connection lines

The R&S SMW performs the following:

- Reads all parameters for identification of the R&S SZU.
- Reads the R&S SZU calibration data.
- Indicates the connected R&S SZU at the RF output in the block diagram and displays the waveguide output icon.
- Sets the output signal level and frequency to the default values of the R&S SZU, and indicates these values in the status bar. You can set both parameters directly as usual.

## Two R&S SZU connected to the R&S SMW

The R&S SMW supports one R&S SZU per path, i.e. you can connect another R&S SZU also to path B or vice versa.

For the I/Q and RF ports of the two paths, the R&S SMW allows the following combinations:

- The I/Q signal of the analog I/Q out 1 and the LO output of RF path A
- The I/Q signal of the analog I/Q out 2 and the LO output of RF path B

However, when you are working with two R&S SZU, you can process the IQ signals only in single-ended mode.

## To configure two R&S SZU in one R&S SMW...

The connection and configuration of a second R&S SZU in the R&S SMW are the same as described above.

- ▶ For the second instrument, proceed as described in ["To configure the R&S SZU in the R&S SMW ..."](#) on page 22. As an exception, consider step [step 4](#). Select "I/Q Output Type > Single Ended" in both paths instead.

When completed, the R&S SMW indicates the two IQ upconverters as shown in [Figure 7-2](#), and [Figure 7-3](#).

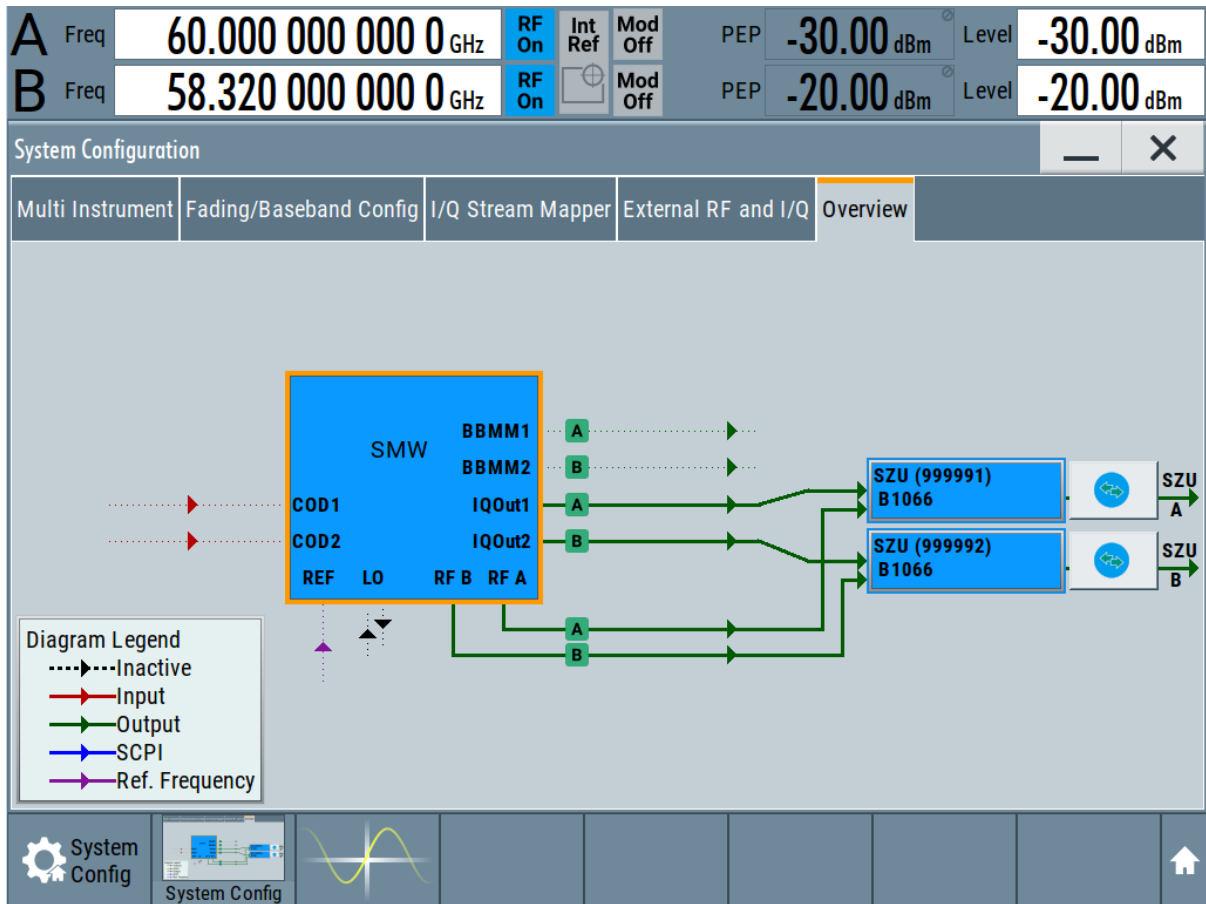


Figure 7-2: Overview tab with two connected R&S SZUs

## Running Internal Adjustments

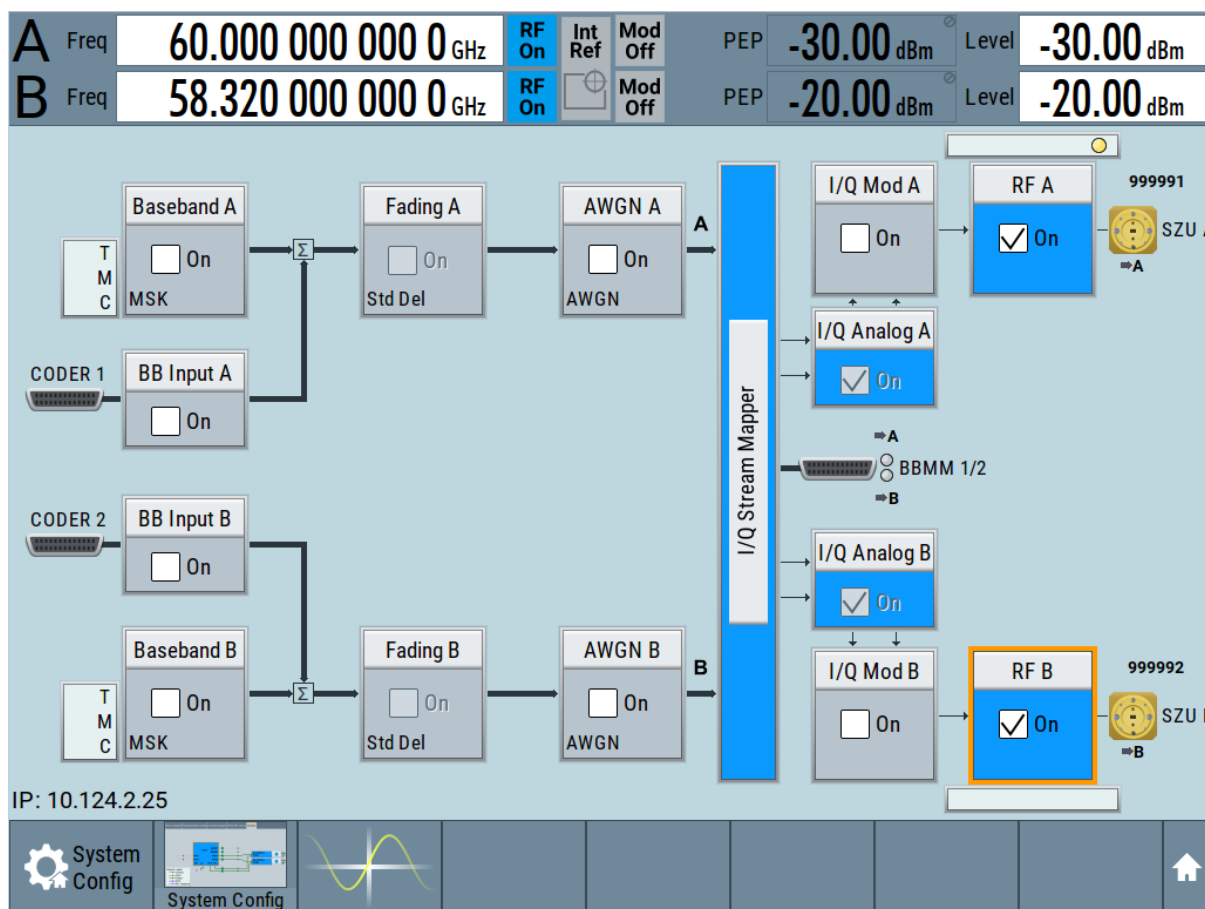


Figure 7-3: R&S SMW screen with an R&S SZU in both paths


## 7.4 Running Internal Adjustments

To optimize the accuracy for the application with the R&S SZU, you can execute calibration routines directly in the R&S SMW.

### When to perform the internal adjustments?

We recommend that you perform the internal adjustment:

- When setting up an application the first time.
  - When changing the I/Q output type of an already set measurement.
- When you have calibrated the R&S SZU with a different I/Q output type (single-ended / differential), the R&S SMW issues the warning message:

(A)SZU settings conflict: At least one adjustment is done in another mode than the SZU is curr ...  Info

"SZU settings conflict: At least one adjustment has been done in another mode than the SZU is currently set to (single-ended / differential). Accuracy may be affected!"

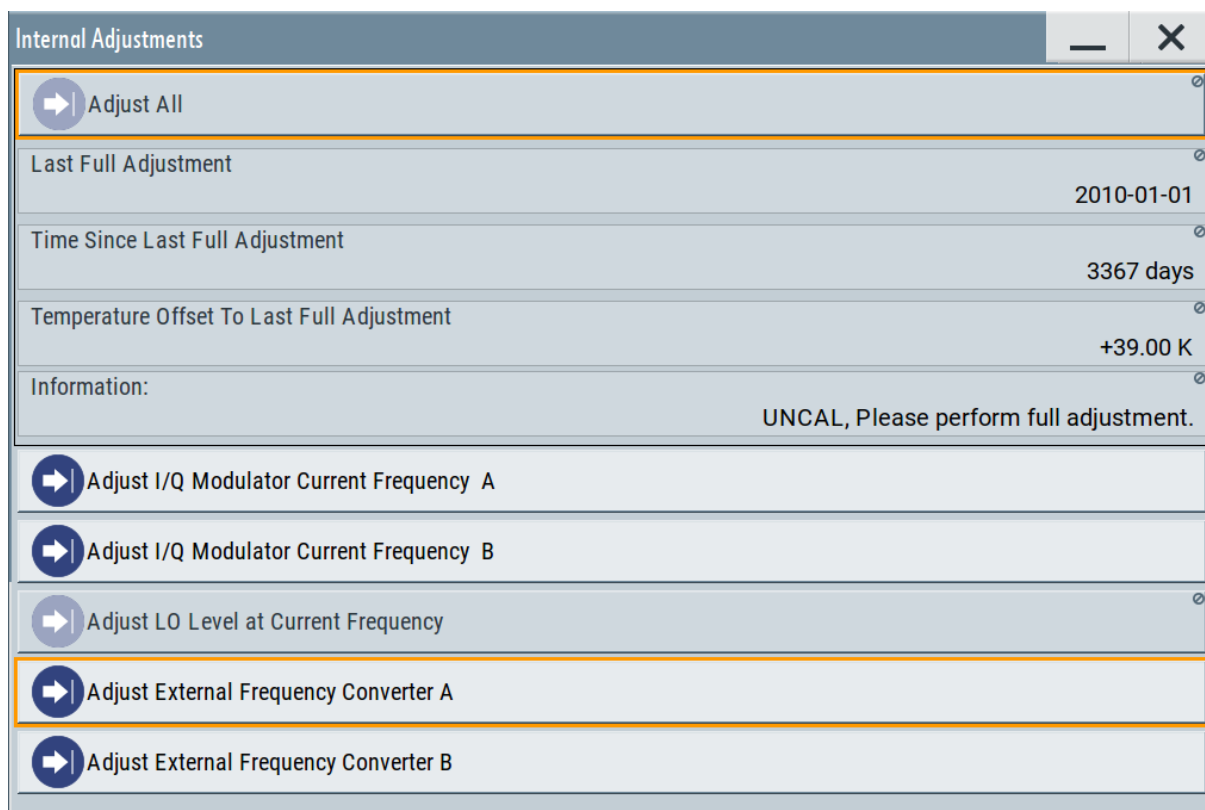
### To adjust the R&S SZU ...

Set up the measurement, if not done yet. Observe the requirements as described under [Chapter 7.1, "System Requirements"](#), on page 19:

1. Make sure that the serial number of the R&S SZU and the cables match.
2. Connect the R&S SZU to the R&S SMW, see [Chapter 7.2, "Measurement Setup"](#), on page 20.
3. Make sure that:
  - You have terminated the waveguide port properly, see [Electromagnetic interference \(EMI\) affects the measurement results](#).  
Do not leave the protective cap plugged on the waveguide output either, as it causes undefined reflections and thus leads to incorrect adjustments.
  - No power is fed into the waveguide output during the internal adjustment processes. It can be caused, e.g. by a connected spectrum analyzer which emits LO power when operating in receiving mode.
4. Configure the R&S SZU in the R&S SMW, see [Chapter 7.3, "Starting Up"](#), on page 22.
5. Make sure, that you have selected the correct I/Q output type (single ended or differential).
6. Perform the connection test, see [To configure the R&S SZU in the R&S SMW ... > step 6](#).
7. In the R&S SMW, select "System Config > Setup > General > Internal Adjustments".

In this dialog you can perform the internal calibration routine for the R&S SZU, when connected.

## Behavior of the R&amp;S SMW When Working with the R&amp;S SZU



The R&S SMW adjusts the internal calibration routines to the R&S SZU. "Adjust All" is disabled, i.e. in this configuration, you cannot execute adjustment routines for the R&S SMW.

8. Select "Adjust External Frequency Converter A/B" for all R&S SZU.

The R&S SMW automatically calibrates the parameters of the externally connected R&S SZU.

9. When completed, check that no errors occurred.

If the internal adjustments detect any errors, see User Manual of R&S SMW, chapter Internal Adjustment Settings for further information on how to proceed.

## 7.5 Behavior of the R&S SMW When Working with the R&S SZU

At startup, the R&S SMW firmware takes control of the R&S SZU almost entirely. You can only select the analog I/Q connection (differential or single ended), provided you are working with only one R&S SZU.



## Behavior of the R&amp;S SMW When Working with the R&amp;S SZU

The R&S SZU behaves as if it is an internal assembly.

The following section outlines the behavior at the corresponding states.

**At startup or repeated plugging**

- The R&S SMW adds a connected R&S SZU to the list of external instruments. Vice versa, the R&S SMW removes an R&S SZU from the list, when it is disconnected.
- If "Auto connect" is enabled, the R&S SMW establishes the connection automatically, provided the R&S SZU is assigned to an I/Q output.
- The R&S SMW adopts the related minimum and maximum values of the R&S SZU.

Furthermore, it obtains the calibration data of the R&S SZU. If these calibration data confirm a wider frequency range as given in the data sheet, you can enable the frequency overrange in the "RF Frequency" setting dialog of the R&S SMW.

RF Frequency		Phase	
Frequency	60.000 000 000 0 GHz		
Offset	0.0 Hz	Multiplier	1.000
Frequency Overage			
Frequency Overage Active	<input checked="" type="checkbox"/>		
Minimal Frequency	56.940 000 000 0 GHz	Maximal Frequency	66.180 000 000 0 GHz
User Variation			
Variation Active	<input type="checkbox"/>		
		Variation Step	1.000 000 0 MHz

The R&S SMW adjusts the resulting frequency range also in the status bar.

A Freq	60.000 000 000 0 GHz	Frequency A	60.000 000 000 0 GHz	Min = 58.32 GHz	Max = 64.80 GHz
B Freq	60.000 000 000 0 GHz				
	Min = 56.94 GHz				
	Max = 66.18 GHz				

## Behavior of the R&amp;S SMW When Working with the R&amp;S SZU

- 1 = Frequency range with overrange enabled
- 2 = Frequency range with overrange disabled

**Note:** The performance in the extended range can deviate from the specified values given in the data sheet.

- You can connect and configure the R&S SZUs only in the predetermined paths, see ["Two R&S SZU connected to the R&S SMW"](#) on page 28. The R&S SMW displays error messages, if the connection and the assigned ports do not match, or, e.g., the connection is interrupted.
- When disconnected in the "External RF and I/Q" dialog (or via remote control), the R&S SMW retains the R&S SZU in the list of instruments and at the assigned output. It presets the R&S SZU and the parameters of the "I/Q Analog Outputs", the "I/Q Modulator" and the "RF" path, and turns off the RF output. Not affected settings remain.

### During operation

- In the status bar, the indicated frequency and level values correspond to the RF signal at the output of the R&S SZU. Settings like, e.g. level offset or level limit also affect the RF output of the R&S SZU.
- The firmware of the R&S SMW controls the affected I/Q output parameters automatically, i.e. except of the "I/Q Output Type", the settings are read only.
- The R&S SMW disables list mode, analog modulations and LO coupling.

### At preset

- If "Preset behavior: Keep connections to external instruments" is enabled, the R&S SZU remains connected to the R&S SMW, if the USB and I/Q connections still exist physically. The R&S SMW presets the RF parameters to the R&S SZUs default values ("RF Off", **"RF Freq = 60 GHz"**, "RF Level = 30 dBm"). The "Frequency Overrange" setting is not affected. It is reset only by factory preset.
- If "Preset behavior: Keep connections to external instruments" is disabled, the R&S SMW presets the R&S SZU, cuts the connection and presets to its default values. It also resets the "Frequency Overrange".
- If no R&S SZU is connected, the R&S SMW presets to its default values ("RF Off", **"RF Freq = 1 GHz"**, "RF Level = 30 dBm").

**At reboot**

- If "Auto connect" is enabled, the R&S SMW establishes the connection automatically, provided the USB connection exists and the R&S SZU is assigned to an I/Q output
- If "Auto connect" is disabled, the state remains disconnected, the entry in the list of external instruments still exists.

**At recall**

Applies the settings from a saved configuration.



For a proper configuration, load saved configurations that fit to the current setup.

Do not load a saved configuration of a connected R&S SZU and R&S SMW in a standalone R&S SMW and vice versa.

Mismatch between the setup and the loaded configuration leads to wrong frequency indication in the status bar. The output frequency is correct and corresponds to the current setup.

---

In setups with R&S SZU and R&S SMW, always establish the connection between the two instruments and load a saved configuration with a connected setup.

## 8 Remote Control of the R&S SZU

For description of the remote control commands required to connect and configure the connection between the R&S SZU in the R&S SMW, see the [www.rohde-schwarz.com/product/SMW200A/User Manual](http://www.rohde-schwarz.com/product/SMW200A/UserManual) of the R&S SMW, chapter "Remote Control Commands > SCONfiguration Subsystem" .

When connected to the R&S SMW, the R&S SZU is remotely controlled with the same commands as the R&S SMW.

The following remote control commands apply also to the R&S SZU:

- "SOURce:FREQUency Subsystem"  
`[ :SOURce<hw> ] :FREQUency [ :CW | FIXed ]`  
 Value range of command: 58.32 GHz to 64.8 GHz
- "SOURce:PHASe Subsystem"
- "SOURce:POWER Subsystem"  
`[ :SOURce<hw> ] :POWER [ :LEVel ] [ :IMMediate ] [ :AMPLitude ]`  
 Value range of command: -80 dBm to 12 dBm  
`[ :SOURce<hw> ] :POWER:ATTenuation`  
 Value range of the command: 0 dB to 50 dB  
 The ALC remote control commands are queries only.
- "SOURce:OUTPut Subsystem"
- "SOURce:CORRection Subsystem"
- "SENSe, READ, INITiate and SLISt Subsystems"
- "SOURce:IQ:OUTPut:ANALog Subsystem"  
`[ :SOURce<hw> ] :IQ:OUTPut [ :ANALog ] :TYPE`  
 All other commands in the "SOURce:IQ:OUTPut:ANALog Subsystem" are queries only.
- "SOURce:BB:IMPairment Subsystem"  
`[ :SOURce<hw> ] :BB:IMPairment:OPTimization:MODE`  
 Analog impairments (`[ :SOURce<hw> ] :IQ:IMPairment:...`)  
 Digital impairments (`[ :SOURce ] :BB:IMPairment:IQOutput<ch>:...`)
- `[ :SOURce<hw> ] :IQ:STATe`  
 All other commands in the "SOURce:IQ Subsystem" are queries only.
- The commands of the "SOURce:IQ:DPD Subsystem"

When the R&S SZU is connected to the R&S SMW, the following remote control commands for the particular RF output are disabled also for the R&S SMW:

- "Analog Modulation Subsystems"
- "SOURce:LIST Subsystem"
- "SOURce:SWEEP Subsystem"
- The commands of the "SOURce:IQ:OUTPut:ENVELOPE Subsystem"

# Glossary: List of Frequently Used Terms and Abbreviations

## D

**DUT:** Device Under Test

## G

**Glossary:** List of the often used terms and abbreviations

**GUI:** Graphical User Interface

## O

**OS:** Operating System

**OTA:** Over The Air

## P

**PC:** Personal Computer, desktop or laptop PC

## R

**RF:** Radio Frequency

## S

**Serial number:** Unique device identification, provided at the rear panel of the R&S SZU IQ upconverter and required to build the Computer name.

The serial number are the last 6 digits in the string `<stock no.>-<serial number>`, e.g. 1425.8563.02-**100099**

## T

**Trigger:** Internally generated or externally supplied signal which starts signal generation at a particular point in time.

**Trigger event:** A trigger event is caused by the received trigger signal or executed manual trigger.

## U

**USB:** Universal Serial Bus. A standard type of connection for many different kinds of devices.

## W

**Warm-up time:** Minimum time the device needs to reach operating temperature and to adjust to the ambient temperature. The R&S SZU requires at least 30 minutes.

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