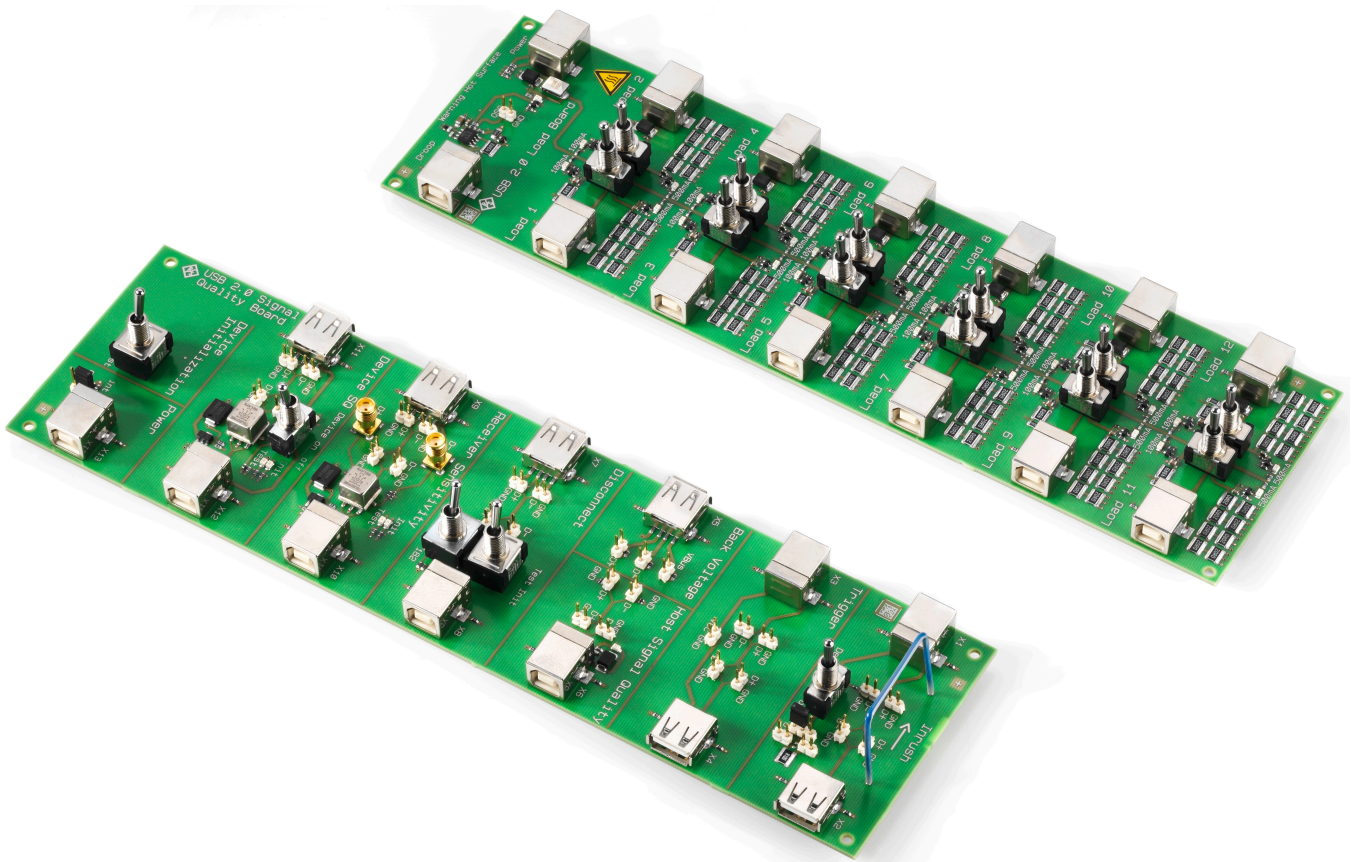


R&S[®] RT-ZF1

USB 2.0 Compliance

Test Fixture Set

Manual



1317.4326.02 – 05

This manual describes the R&S RT-ZF1 USB 2.0 Compliance Test Fixture Set (1317.3420.02).

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The following abbreviations are used throughout this manual: R&S®RTO is abbreviated as R&S RTO, and R&S®ScopeSuite is abbreviated as R&S ScopeSuite.

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1 Usage Information

The equipment under test (EUT) is a USB signal quality test and development board, intended to be used at laboratory or test and measurement areas. These areas are specifically used for analysis, testing and servicing and where equipment is operated by trained personnel (EN 61326-1, 3.8).

The EUT is considered as a test probe, EN 61326-2-1, clause 5.2.401, note 1. Therefore normal operation may display increased emissions above the limits as specified in EN 55011 and/or reduced interference resistance as required in EN 61326-1, table 1, basic requirements.

Operation in type 3 (controlled) electromagnetic environments EN 61326-1, table 3 is recommended.

The EUT includes components sensitive to electrostatic discharge.

NOTICE**EN 55011 class A equipment, electromagnetic emissions**

Class A equipment is intended for use in an industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted as well as radiated disturbances.

2 Product Description

The R&S RT-ZF1 USB 2.0 compliance test fixture set is a product for automatic testing of USB 2.0 compliance (high-speed) as well as USB 1.1 (full-speed) and USB 1.0 (low-speed). It is used in combination with the R&S RTO oscilloscopes, with the R&S RTO-K21 USB 2.0 compliance test option (1317.4103.02) and the R&S ScopeSuite software.

2.1 Deliveries

The R&S RT-ZF1 comprises two test boards and accessories.

2.1.1 Boards

The main components of USB 2.0 compliance test fixture set are two test boards:

- Load board (1317.5300.02)
- Signal quality board (1317.5200.02)

The boards are designed for testing USB devices. Make sure to connect only USB interfaces to the boards.

NOTICE**Risk of electrostatic discharge**

Both boards are sensitive to ESD because they are open modules. Protect the work area against electrostatic discharge to avoid damage to electronic components in the modules. Always work at a static-approved workstation.

NOTICE**EMI impact on measurement results**

Electromagnetic interference (EMI) can affect the measurement results. To avoid any impact, use only USB cables shorter 3 m.

⚠ CAUTION**Risk of burning caused by overheating of the load board**

The load board gets hot during testing. To avoid injuries, observe the following instructions:

- Do not touch the board when a test is running.
- After finishing the tests, set all switches to their middle position and wait at least 5 min until the module cools down.
- Touch the board only at switches and edges. Do not touch the surface of the board.

2.1.2 Accessories

The following accessories are supplied with the USB 2.0 test fixture boards:

Item	Quantity	Order number
USB cable type A to type B, length 20 cm	2	3589.2124.00
USB cable type A to type B, length 1.3 m	2	0041.9177.00
USB Adapter, type A to mini	1	3589.2147.00
USB adapter, type A to micro-B	1	3589.2130.00
SMA cable, length 1 m, to connect the signal generator	2	1142.5889.00
Carrying case	1	
Manual	1	

2.2 Test Equipment

For USB 2.0 compliance tests, the following test equipment is recommended:

- R&S RTO oscilloscope with 4 channels and at least 2 GHz bandwidth.
For full speed and low speed compliance tests, a 4-channel R&S RTO with less than 2 GHz bandwidth is sufficient.
- R&S RT-ZF1 USB 2.0 compliance test fixture set, which consists of the load board and the signal quality board.
- Probes:

- 2x single-ended active probes with at least 2 GHz bandwidth
 - 2x differential active probe with at least 2 GHz bandwidth
 - Tabor WX2182B/WX2182C 2.3 GS/s dual channel arbitrary waveform generator for receiver sensitivity tests
 - R&S ScopeSuite software, which can be installed on a computer or directly on the R&S RTO.
 - R&S RTO-K21 USB 2.0 compliance test option (required option, installed on the R&S RTO)
 - Make sure that you use the latest version of the USBHSET tool. Check the following websites for downloads:
 - USB 3.0 host: www.usb.org/developers/tools/
 - USB 2.0 host: www.usb.org/developers/tools/usb20_tools/
- Regularly check the USB-IF website compliance.usb.org/index.asp?Update-File=Electrical&Format=Standard for USB-IF compliance updates.

2.3 Specifications

This section contains the specifications of the R&S USB 2.0 Compliance Test Fixture.

Specifications with limits represent warranted product performance by means of a range of values for the specified parameter.

Temperature loading	operating temperature range	0 °C to +45 °C
	storage temperature range	-40 °C to +70 °C
Power supply		±5.0 V DC ±0.25 V via USB

3 Connections and Switches

3.1 Oscilloscope Connections

The following oscilloscope configuration is suitable for high-speed, full and low speed tests. For most tests, you can use either a differential probe or two single-ended active probes. The signal quality board is designed for comfortable connection of both probe types.

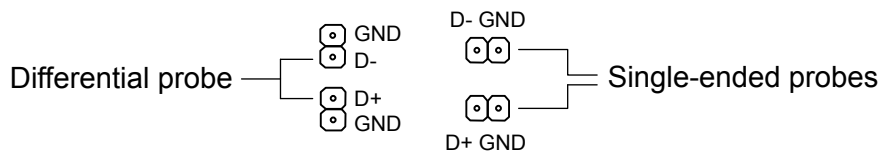


Figure 3-1: Connectors for differential and single-ended probes

CH1	Single-ended probe connected to D+ (RT-ZS30)
CH2	Differential probe connected to D+ and D- (RT-ZD30)
CH3	Single-ended probe connected to D- (RT-ZS30)
CH4	Inrush measurements

The test-specific connections are explained in the R&S ScopeSuite's test wizard.

3.2 Signal Quality Board

The signal quality board has several labeled sections designed for specific signal quality testing. The connectors and their purpose are shown on [Figure 3-2](#).

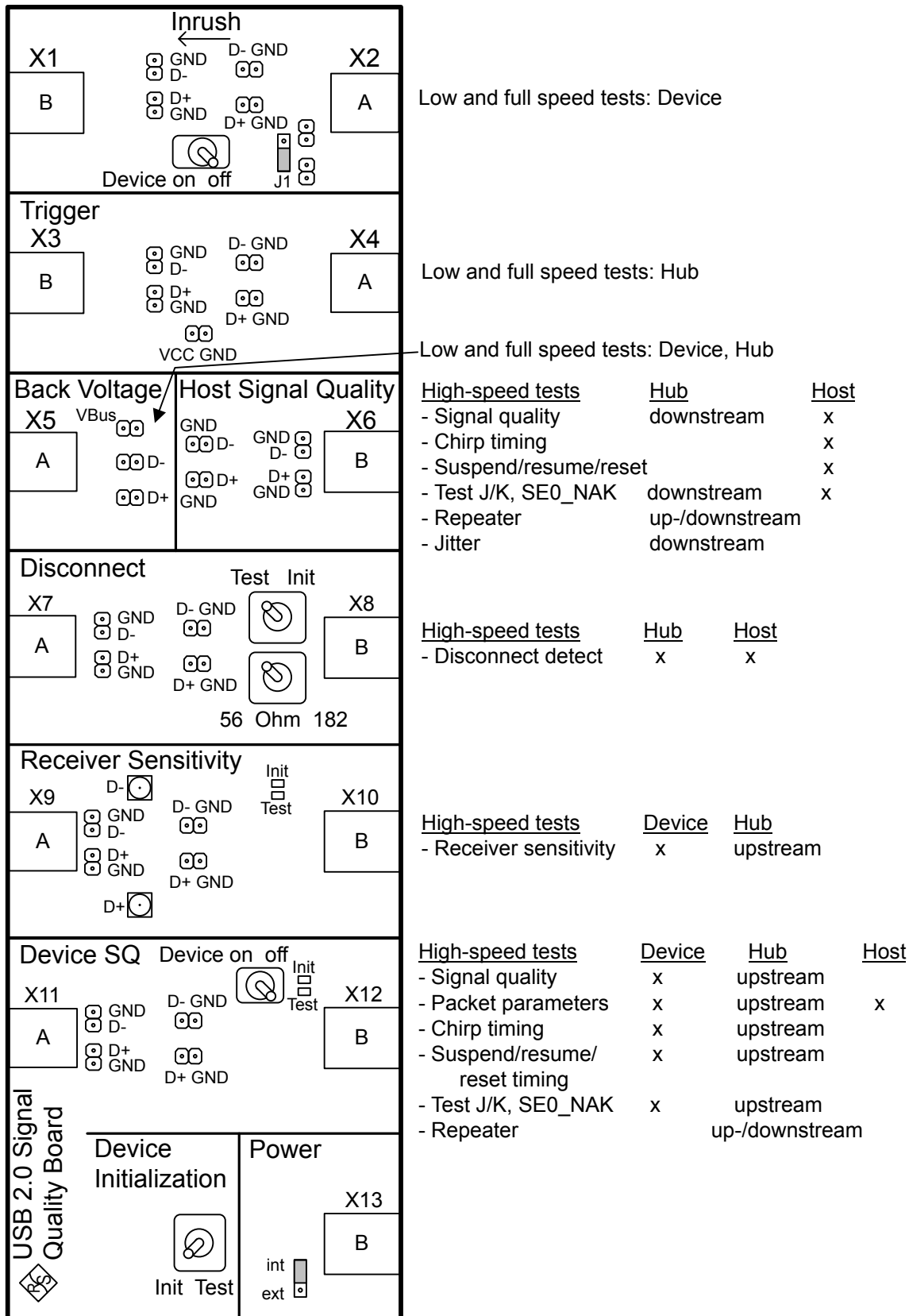


Figure 3-2: Signal quality board

Device Initialization switch

The device initialization switch at the bottom of the board is relevant for device high speed signal quality and device high speed receiver sensitivity tests. The current switch position - init or test - is indicated by LEDs in the relevant test sections.

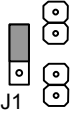
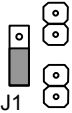
Power jumper

An external power supply is only required for testing DUTs that need more than 420 mA supply current. For tests using additional power supply, set the jumper in the "Power" section to "ext".

For all devices that need less than 420 mA supply current, the VBUS power from the host is sufficient, and the jumper position is "int".

J1 jumper

The J1 jumper switches the inrush current measurement between current measurement and voltage measurement. It is located in the "Inrush" section, the upper section of the board.

 <p>J1</p>	<p>Upper position: A measuring resistance of 0.1 Ω is active. You can measure the voltage using a differential probe and calculate the current consumption.</p>
 <p>J1</p>	<p>Lower position: The measuring resistance is shorted-out. To measure the current consumption, you need a current probe.</p>

SMA connectors

To perform hi-speed device and hub receiver sensitivity tests, a waveform generator is required. The SMA connectors for the generator connection are located in the "Receiver Sensitivity" section of the board.

3.3 Load Board

The load board has 12 USB type B connectors for load testing and a section for clocked droop testing.

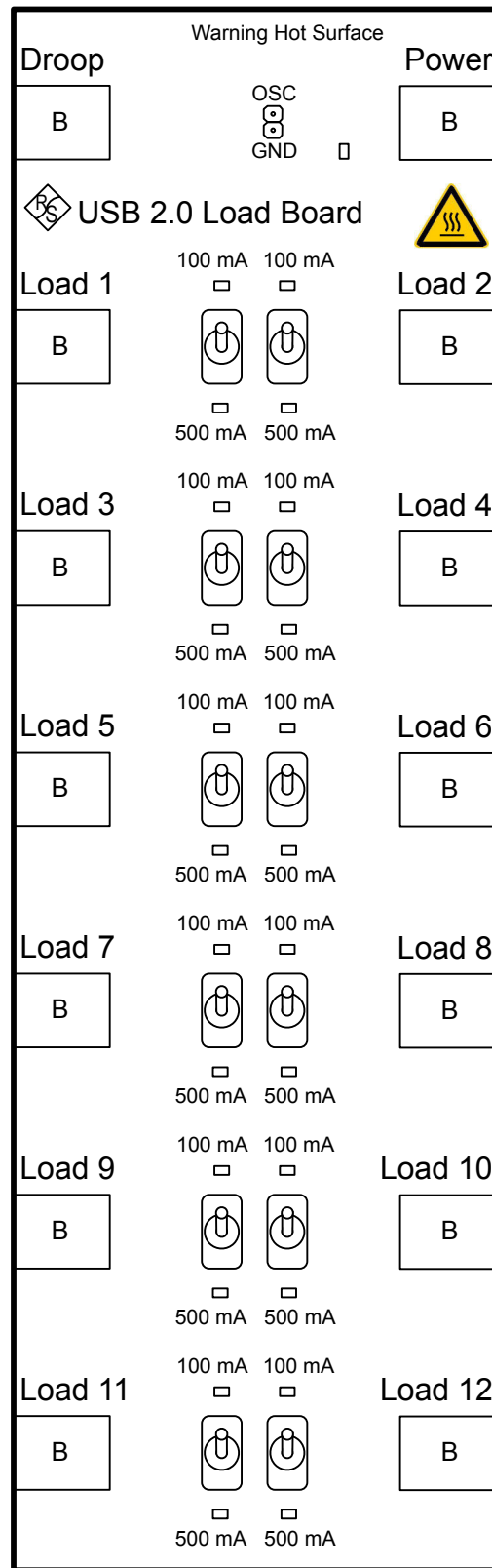


Figure 3-3: Load board

4 Preparing the Measurements

4.1 Installing Software and License

The preparation steps have to be performed only once for each computer and instrument that are used for testing.

NOTICE**Uninstall older versions of the R&S ScopeSuite**

If an older version of the R&S ScopeSuite is installed, make sure to uninstall the old version before you install the new one. You can find the version number of the current installation in "Help" menu > "About". To uninstall the R&S ScopeSuite, use the Windows Control Panel > "Programs".

To install the R&S ScopeSuite

1. Download the R&S ScopeSuite software from the "Software" section on the Rohde & Schwarz R&S RTO website: www.rohde-schwarz.com/product/rto.html.
2. Install the R&S ScopeSuite software:
 - Either on the computer that is used for testing,
 - or on the R&S RTO if the instrument has a Windows 7 operating system.

To install the license key on the R&S RTO

- ▶ When you got the license key of the compliance test option, enable it on the R&S RTO using SETUP > "SW Options".
For a detailed description, refer to the R&S RTO User Manual, chapter "Installing Options", or to the online help on the instrument.

To install USBHSET on the USB host

1. Download the USBHSET tool kit (HS Electrical Test Tool):
 - USB 3.0 host: www.usb.org/developers/tools/
 - USB 2.0 host: www.usb.org/developers/tools/usb20_tools/
2. Install USBHSET on the USB host.

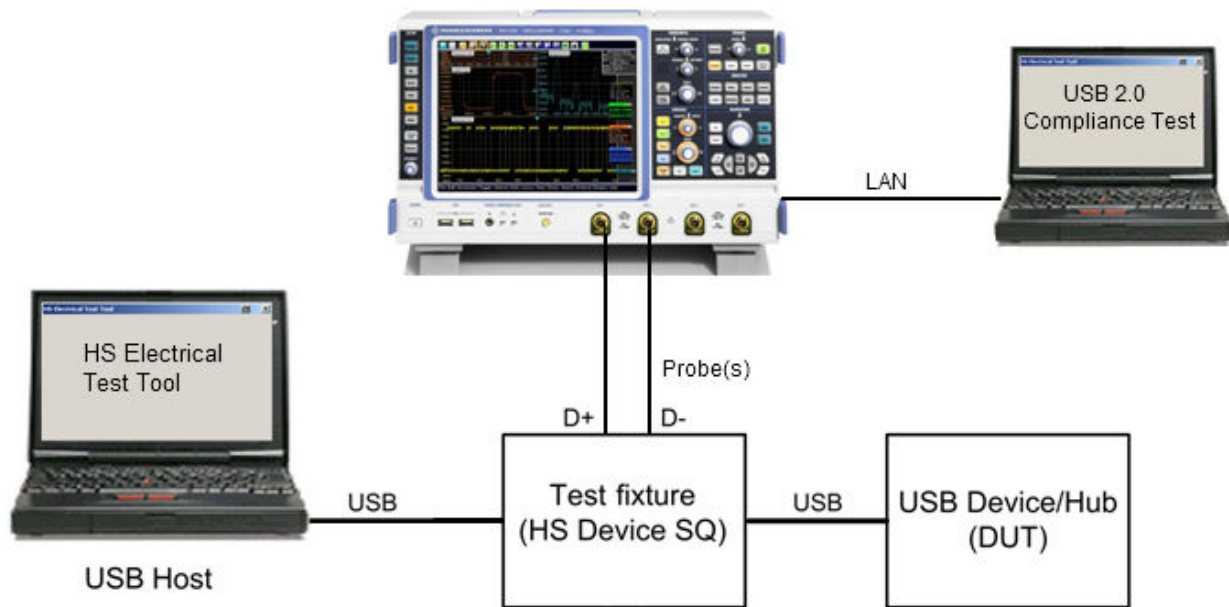


Figure 4-1: Test setup for USB device tests

4.2 Setting Up the Network

If the R&S ScopeSuite software runs on a test computer, the computer and the testing R&S RTO require a LAN connection.

There are two ways of connection:

- LAN (local area network): It is recommended that you connect to a LAN with DHCP server. This server uses the Dynamic Host Configuration Protocol (DHCP) to assign all address information automatically. If no DHCP server is available, or if the Tabor WX2182B is used for automatic testing, assign fixed IP addresses to all devices.
- Direct connection of the instruments and the computer or connection to a switch using LAN cables: Assign fixed IP addresses to the computer and the instruments and reboot all devices.

To set up and test the LAN connection

1. Connect the computer and the instruments to the same LAN.
2. Start all devices.
3. If no DHCP server is available, assign fixed IP addresses to all devices.

4. Ping the instruments to make sure that the connection has been established.
5. If VISA is installed, check if VISA can access the instruments.
 - a) Start VISA on the test computer.
 - b) Validate the VISA address string of each device.

See also:

- [Chapter 4.4, "Connecting the R&S RTO"](#), on page 15
- [Chapter 4.5, "Connecting the Arbitrary Waveform Generator"](#), on page 17

4.3 Starting the R&S ScopeSuite

To start the R&S ScopeSuite on the test computer or on the oscilloscope:

- ▶ Double-click the R&S ScopeSuite program icon.

To start the R&S ScopeSuite on the instrument, in the R&S RTO firmware:

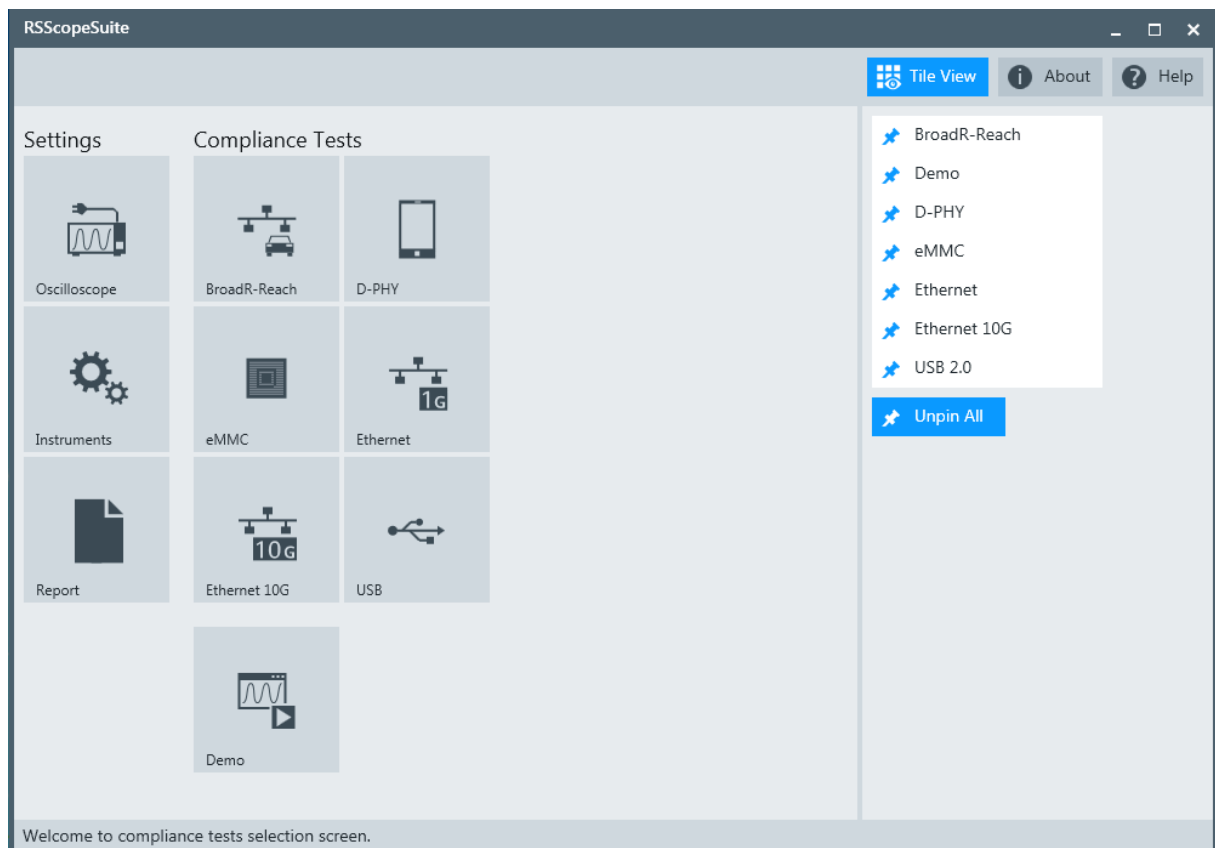
- ▶ On the "Analysis" menu, tap "Start Compliance Test".

4.4 Connecting the R&S RTO

If the R&S ScopeSuite is installed directly on the instrument, the software detects the R&S RTO firmware automatically, and the "Oscilloscope" button is not available in the R&S ScopeSuite.

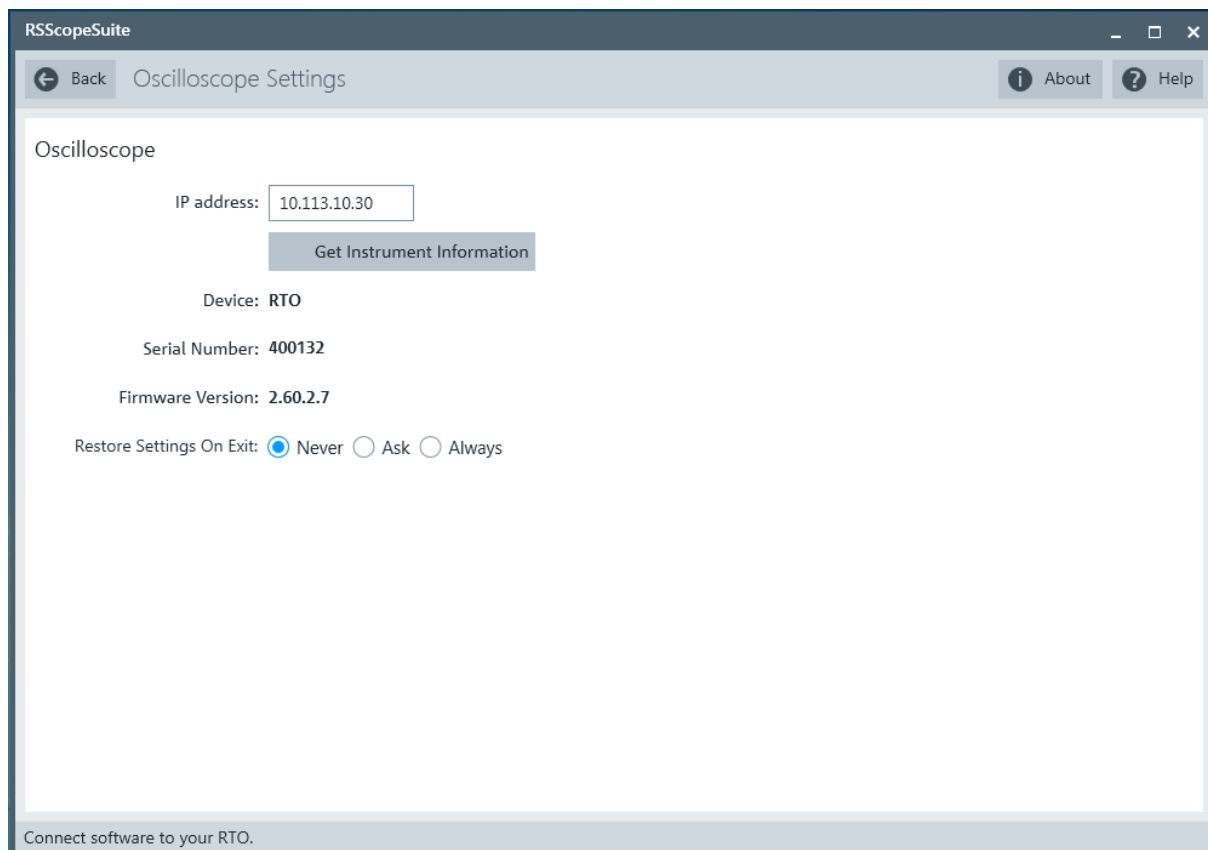
If the R&S ScopeSuite software runs on a test computer, the computer and the testing R&S RTO require a LAN connection, see [Chapter 4.2, "Setting Up the Network"](#), on page 14. The R&S ScopeSuite software needs the IP address of the R&S RTO to establish connection.

1. Start the R&S RTO.
2. Start the R&S ScopeSuite software.
3. Click "Settings" > "Oscilloscope".



4. Enter the IP address of the R&S RTO.
To obtain the IP address: Press the SETUP key on the instrument and tap the "System" tab.
5. Click "Get Instrument Information".
The computer connects with the instrument and gets the instrument data.

Connecting the Arbitrary Waveform Generator



If the connection fails, an error message is shown.

4.5 Connecting the Arbitrary Waveform Generator

For USB receiver sensitivity tests, an arbitrary waveform generator (AWG) is required. The tests can be performed manually or automatically, depending on the the available AWG.

Automatic test execution is possible with all instruments that are listed in the dialog box. In automatic mode, the R&S ScopeSuite configures the instrument and ensures that the AWG sends the required waveforms. Automatic mode requires a LAN connection and the installation of a VISA implementation (NI-VISA, Agilent-VISA, Tektronic-VISA 4.0 and above) on the computer that is running the R&S ScopeSuite. If the R&S ScopeSuite is installed on the R&S RTO, no installation is needed because VISA is already installed on the instrument. If the Tabor WX2182B is used for automatic testing, fixed IP addresses are required.

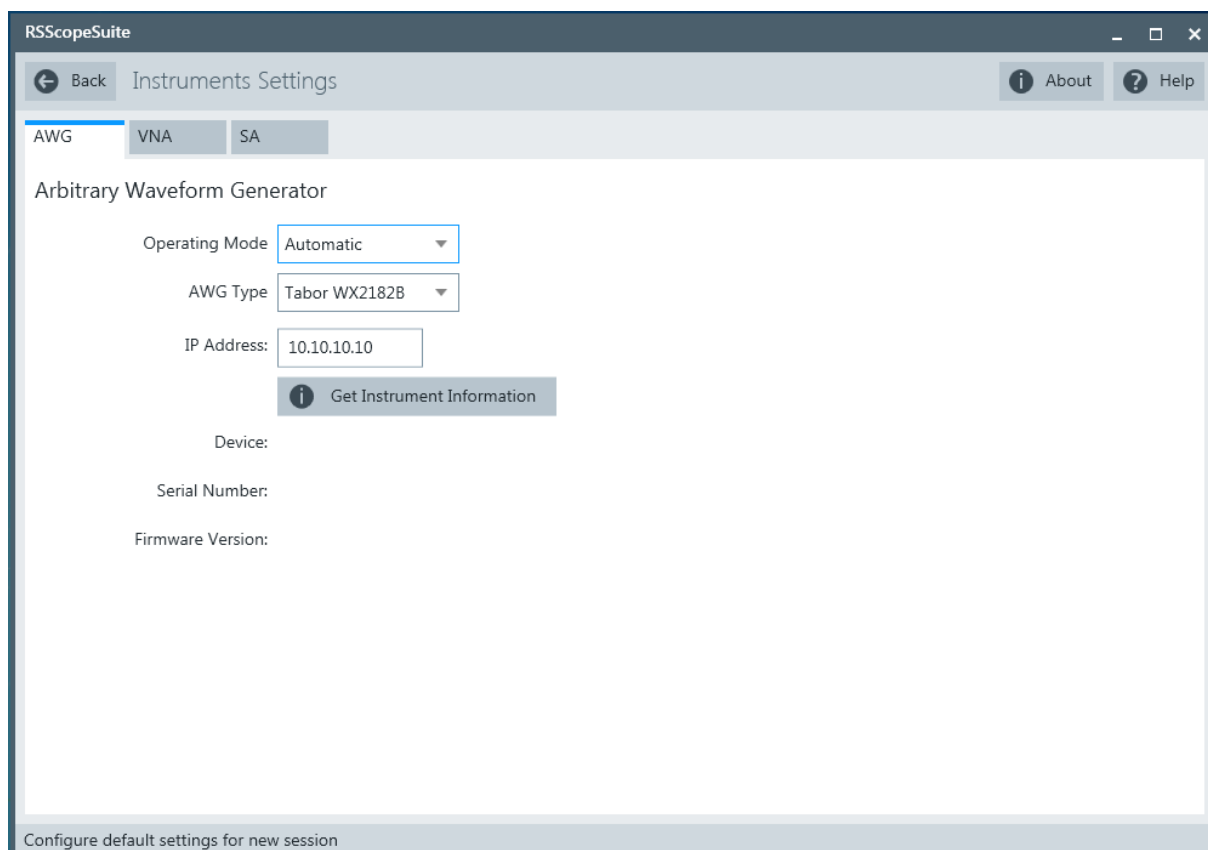
For manual test execution it is recommended to use one of the listed AWGs. Moreover, any AWG can be used that has a sampling rate above 1.44 GSa/sec.

Connecting the Arbitrary Waveform Generator

In manual mode, you connect the AWG to the test board and configure the instrument manually. VISA is not required. The R&S ScopeSuite uses VISA if it is installed, otherwise it uses the VXI-11 protocol.

To configure the arbitrary waveform generator for automatic testing

1. Connect the computer and the AWG and set up the LAN connection, see [Chapter 4.2, "Setting Up the Network"](#), on page 14.
2. In the R&S ScopeSuite, click "Instruments".
3. Click the "AWG" tab.
4. Select the "Automatic" operating mode.
5. Select the "AWG Type" and enter its IP address.



6. Click "Get Instrument Information".
The computer or R&S RTO connects with the instrument and retrieves the instrument data.
7. If the connection to the Tabor arbitrary waveform generator failed, check on the instrument and if the IP address is assigned correctly.

To configure the AWG for manual testing


1. In the "AWG" tab, enable the "Manual" operating mode.
2. Connect the AWG to the test fixture as described in the test wizard. To create the test waveforms, use the files `MIN_ADD1.txt` and `IN_ADD1.txt`, which are provided in the installation directory of the R&S ScopeSuite.

4.6 Report Configuration

In the "Report Configuration" menu, you can select the format of the report and the details to be included in the report. You can also select an icon that will be displayed in the upper left corner of the report.

Additionally, you can enter common information on the test that will be written in the "General Information" section of the test report.

The screenshot shows the "Report Settings" dialog box in the RScopeSuite application. The dialog has a title bar with "RScopeSuite" and standard window controls. Below the title bar, there is a "Back" button and "Report Settings" text. On the right side, there are "About" and "Help" buttons. The main content area is divided into three sections: "Content", "Format", and "Icon".

Content	Format	Icon
Display Summary <input checked="" type="checkbox"/>	<input checked="" type="radio"/> PDF	 <input type="button" value="Change"/>
Display Detail <input checked="" type="checkbox"/>	<input type="radio"/> Word Document	
Display Screenshots <input checked="" type="checkbox"/>	<input type="radio"/> HTML	

Below the "Format" section, there is a "User Input" section with several text input fields:

- Device Under Test (DUT)
- User
- Site
- Temperature
- Comments

At the bottom of the dialog, there is a footer text: "Configure default settings for new session".