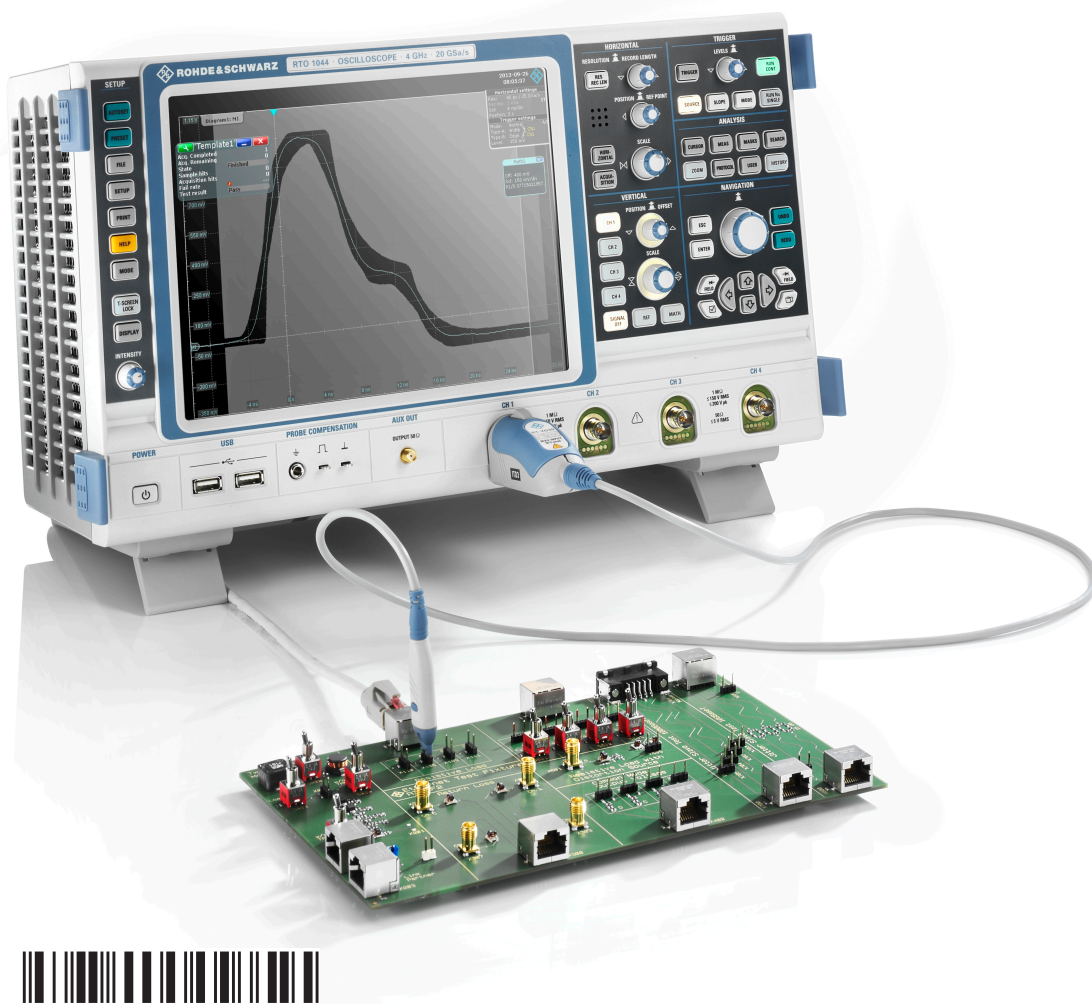


R&S[®] RT-ZF2

Ethernet Compliance

Test Fixture Set

Manual



1317.5551.02 – 07

This manual describes the R&S RT-ZF2 Ethernet Compliance Test Fixture Set (1317.5522.02).

© 2016 Rohde & Schwarz GmbH & Co. KG

Mühlhofstr. 15, 81671 München, Germany

Phone: +49 89 41 29 - 0

Fax: +49 89 41 29 12 164

Email: info@rohde-schwarz.com

Internet: www.rohde-schwarz.com

Subject to change – Data without tolerance limits is not binding.

R&S® is a registered trademark of Rohde & Schwarz GmbH & Co. KG.

Trade names are trademarks of the owners.

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.

Contents

1 Product Description.....	5
1.1 Usage Information.....	5
1.2 Deliveries.....	6
1.3 Test Equipment.....	7
1.4 Specifications.....	8
2 Ethernet Test Fixture Boards.....	9
2.1 Ethernet Test Board.....	9
2.2 Calibration Board.....	13
3 Preparing the Measurements.....	14
3.1 Installing Software and License.....	14
3.2 Setting Up the Network.....	14
3.3 Starting the R&S ScopeSuite.....	16
3.4 Connecting the R&S RTO.....	16
3.5 Connecting the Arbitrary Waveform Generator.....	18
3.6 Connecting the Vector Network Analyzer.....	20
3.7 Connecting the Spectrum Analyzer.....	21
3.8 Report Configuration.....	23

1 Product Description

The R&S RT-ZF2 Ethernet compliance test fixture set is a product for automated compliance testing of various Ethernet standards.

It is used in combination with:

- R&S RTO oscilloscope
- R&S RTO-K22 Ethernet compliance test option (1317.4678.02) for 10BASE-T, 100BASE-TX, 1000BASE-T tests
- R&S RTO-K23 (1320.6261.02) for 10GBASE-T tests
- R&S RTO-K24 (1320.6684.02) for BroadR-Reach tests
- R&S ScopeSuite software

1.1 Usage Information

The equipment under test (EUT) is an ethernet signal quality test and development board, indented 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.

The Ethernet test fixture boards are designed for testing Ethernet devices using RJ-45 connectors.

⚠ CAUTION**Risk of injury and instrument damage**

Make sure to connect only Ethernet devices with RJ-45 interface that are designed according to IEEE802.3 10BASE-T, 100BASE-T/TX, 1000BASE-T or 10GBASE-T.

Use the boards in an appropriate manner to prevent electric shock, personal injury, or damage. Read and observe the "Basic Safety Instructions" at the beginning of this manual.

1.2 Deliveries

The R&S RT-ZF2 comprises two test boards and accessories.

1.2.1 Boards

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

- Ethernet test fixture (1317.5539.02)
- Calibration board (1317.5539.02)

See also: [Chapter 2, "Ethernet Test Fixture Boards"](#), on page 9.

1.2.2 Accessories

The following accessories are supplied with the Ethernet test fixture boards:

Item	Quantity	Order number
Ethernet cable CAT6	1	3033.9264.00
SMA terminations	3	0249.7823.00
Carrying case	1	
Manual	1	

The following optional accessories are available:

Item	Type	Order number
Gigabit Ethernet Jitter Cable for 1000BASE-T jitter slave mode test 103 m cable with specific sections of different impedance that cause signal distortions	R&S RT-ZF2C	1317.5639.02

1.3 Test Equipment

For Ethernet compliance tests, the following test equipment is needed:

- R&S RT-ZF2 Ethernet test fixture set
- **10/100/1000BASE-T Ethernet compliance tests:**
 - R&S RTO oscilloscope with at least 600 MHz bandwidth
 - Differential probe with at least 1 GHz bandwidth
 - R&S RTO-K22 10/100/1000BASE-T Ethernet compliance test option (required option, installed on the R&S RTO)
 - R&S RT-ZF2 Ethernet test fixture set
- **10GBASE-T Ethernet compliance tests:**
 - R&S RTO oscilloscope with at least 2 GHz bandwidth
For precise power spectral density and power level measurements up to 3 GHz, we recommend to use an oscilloscope and a differential probe with 3 GHz bandwidth each.
 - Differential probe with at least 2 GHz bandwidth
 - R&S RTO-K23 10GBASE-T Ethernet compliance test option (required option, installed on the R&S RTO)
 - R&S RT-ZF2 Ethernet test fixture set
- **BroadR-Reach compliance tests:**
 - R&S RTO oscilloscope with at least 600 MHz bandwidth
 - Differential probe with 1 GHz bandwidth
 - R&S RTO-K24 BroadR-Reach compliance test option (required option, installed on the R&S RTO)
 - R&S RT-ZF2 Ethernet test fixture set
- The free-of-charge R&S ScopeSuite software, which can be installed on a computer or directly on the R&S RTO.
- HMF2550 or Tabor WX2182B/WX2182C arbitrary waveform generator for automatic disturber tests.
- R&S ZVL/ZNB/ZNC/ZND vector network analyzer for automatic return loss measurements.

For manual measurements, also other AWGs and VNAs can be used.

1.4 Specifications

This section contains the specifications of the R&S Ethernet 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

2 Ethernet Test Fixture Boards

The Ethernet test fixture R&S ScopeSuite consists of two boards: the Ethernet test board and the calibration board.

2.1 Ethernet Test Board

The ethernet test board has several labeled sections designed for specific test cases. The board is shown in [Figure 2-1](#). The assignment of the test cases to the board sections is shown in [Table 2-1](#).

You can cut the board at the section limits and use each section as a separate board.

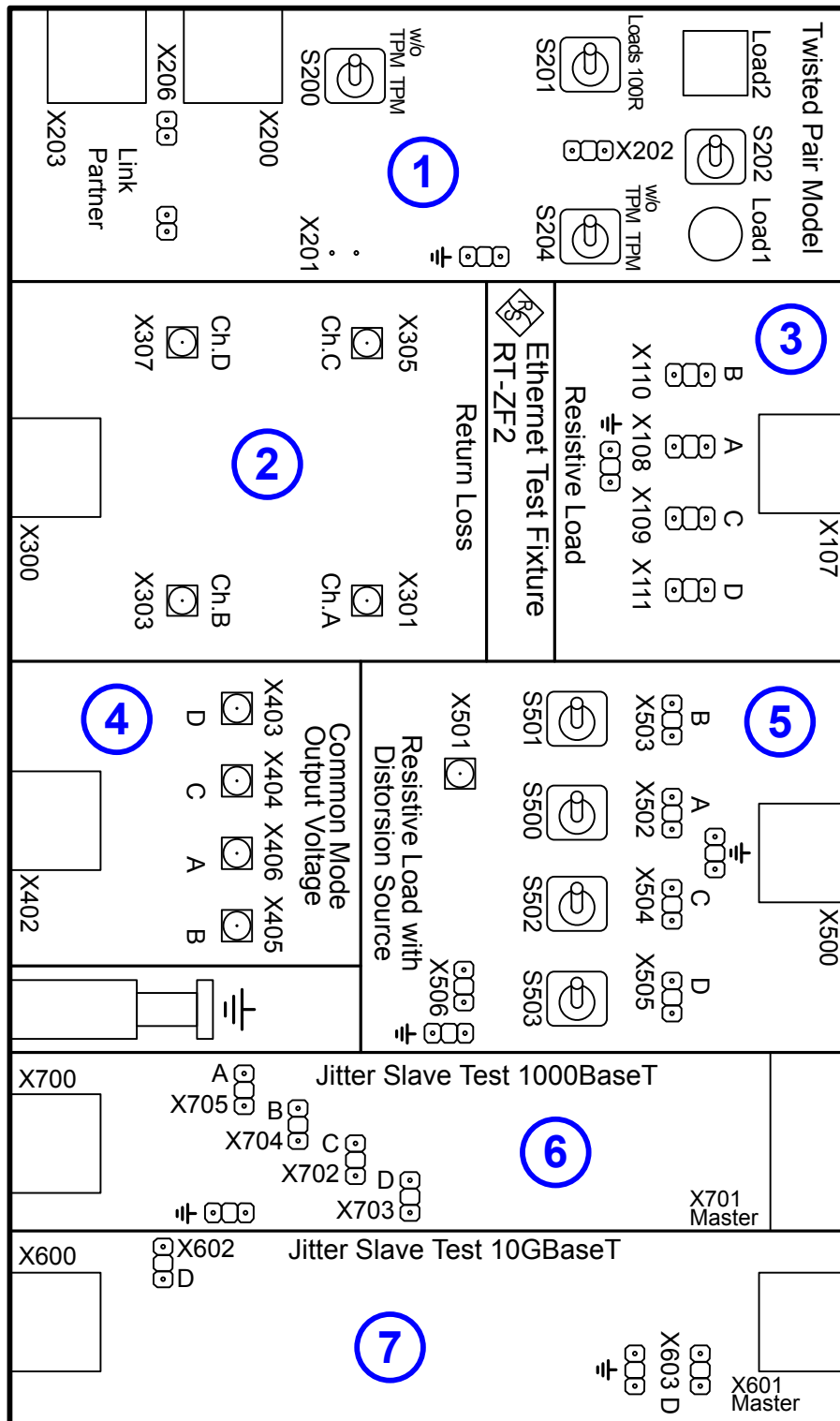


Figure 2-1: Ethernet test board

- 1 = Twisted Pair Model
- 2 = Return Loss
- 3 = Resistive Load

- 4 = Common Mode Output Voltage
 5 = Resistive Load with Distortion Source
 6 = Jitter Slave Test 1000BASE-T
 7 = Jitter Slave Test 10GBASE-T

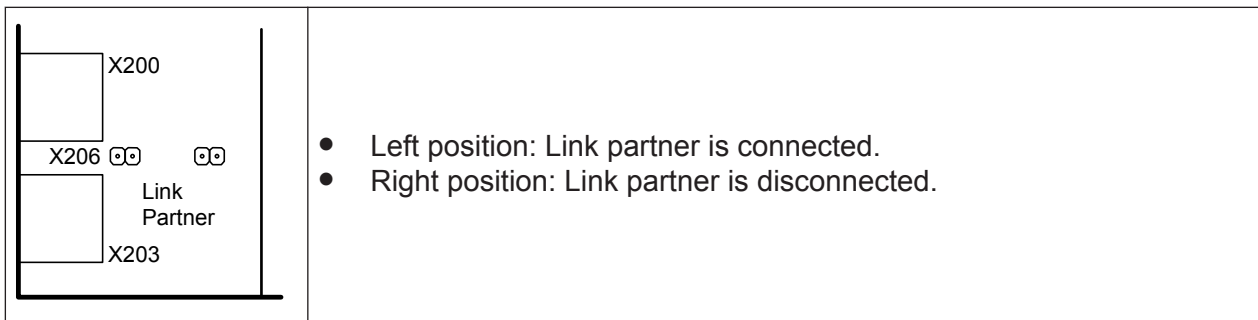
Table 2-1: Test cases supported by the Ethernet test fixture board

Test case	Disturber	Section							ARB	
		1	2	3	4	5	6	7		
1000BASE-T test cases (R&S RTO-K22)										
Peak differential output voltage and level accuracy Maximum output droop Differential output templates Transmitter distortion	No			x						
Peak differential output voltage and level accuracy Maximum output droop Differential output templates Transmitter distortion	Yes					x				x
Common-mode output voltage					x					
Transmitter timing jitter (master mode)				x			x			
Transmitter timing jitter (slave mode)				x						
MDI return loss			x							
100BASE-TX test cases (R&S RTO-K22)										
Amplitude domain tests				x						
Time domain test				x						
Total transmit jitter				x						
Duty cycle distortion				x						
AOI template test				x						
Return loss			x							
10BASE-T test cases (R&S RTO-K22)										
Harmonic content		x								

Test case	Disturber	Section							ARB
		1	2	3	4	5	6	7	
Output timing jitter		x							
MAU template	x								
TP_IDL		x							
Link test pulse		x							
Common-mode output voltage					x				
Return loss			x						
10GBASE-T test cases (R&S RTO-K23)									
Maximum output droop				x					
Transmitter linearity			x						
Transmitter timing jitter master mode				x					
Transmitter timing jitter slave mode								x	
Transmitter power spectral density		x							
Transmitter clock frequency				x					
Transmitter power level		x							
MDI return loss		x							
BroadR-Reach test cases (R&S RTO-K24)									
Transmitter output droop				x					
Transmitter distortion, no disturber									
Transmitter timing jitter									
Transmitter power spectral density									
Transmitter clock frequency									
Transmitter distortion, with disturber						x			
MDI return loss		x							

X206 jumper

The X206 jumper switches the link partner on or off. It is used in 10BASE-T test cases.



2.2 Calibration Board

The calibration board is required in return loss measurements. It is used to calibrate the vector network analyzer for the measurement.

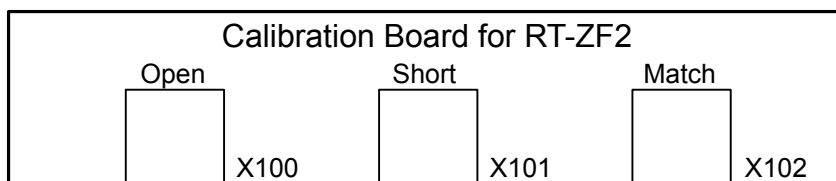


Figure 2-2: Ethernet calibration board

3 Preparing the Measurements

3.1 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.

3.2 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.

For some test cases, you need an additional instrument: arbitrary waveform generator (AWG), vector network analyzer (VNA), or spectrum analyzer. These instruments can be used in automatic or manual mode. For automatic testing, a LAN connection to the additional instrument is required.

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 or WX2182C 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 3.4, "Connecting the R&S RTO"](#), on page 16
- [Chapter 3.5, "Connecting the Arbitrary Waveform Generator"](#), on page 18
- [Chapter 3.6, "Connecting the Vector Network Analyzer"](#), on page 20
- [Chapter 3.7, "Connecting the Spectrum Analyzer"](#), on page 21

3.3 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:

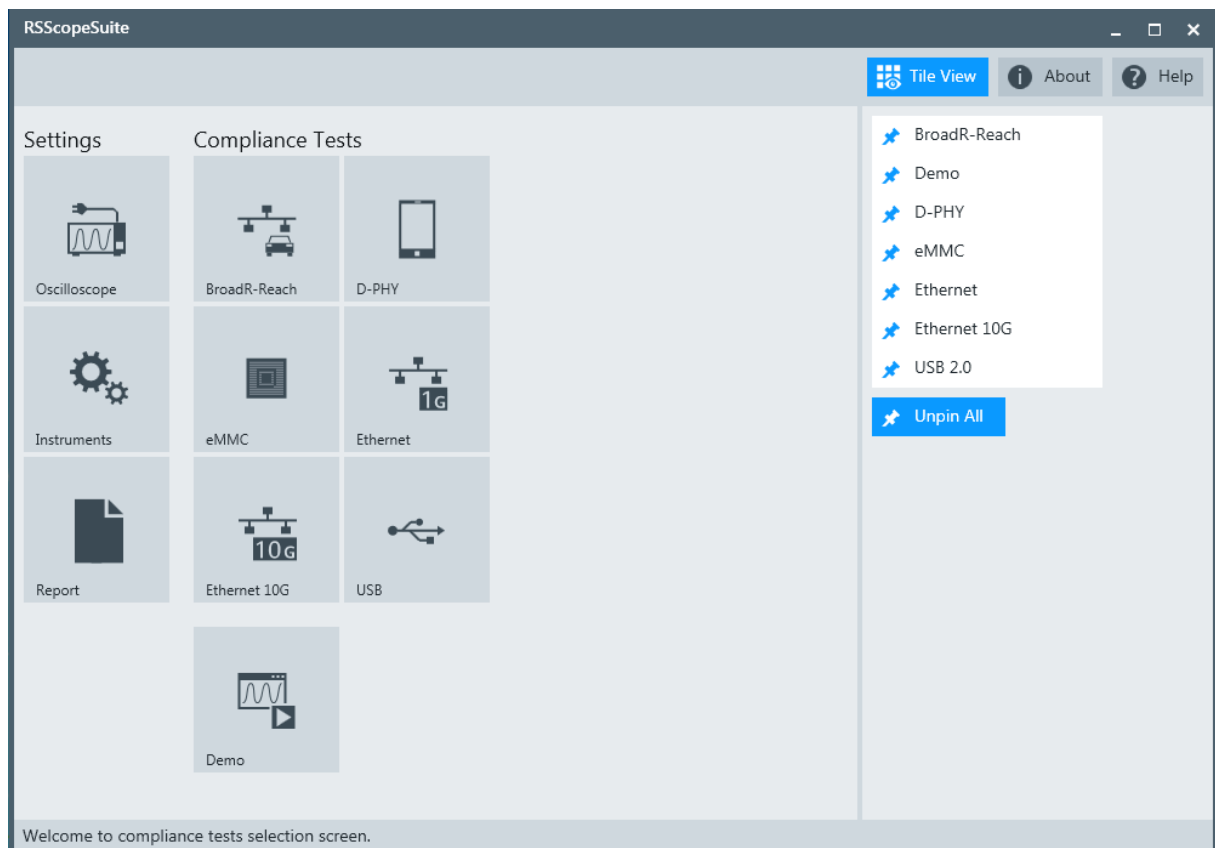
- ▶ On the "Analysis" menu, tap "Start Compliance Test".

3.4 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.

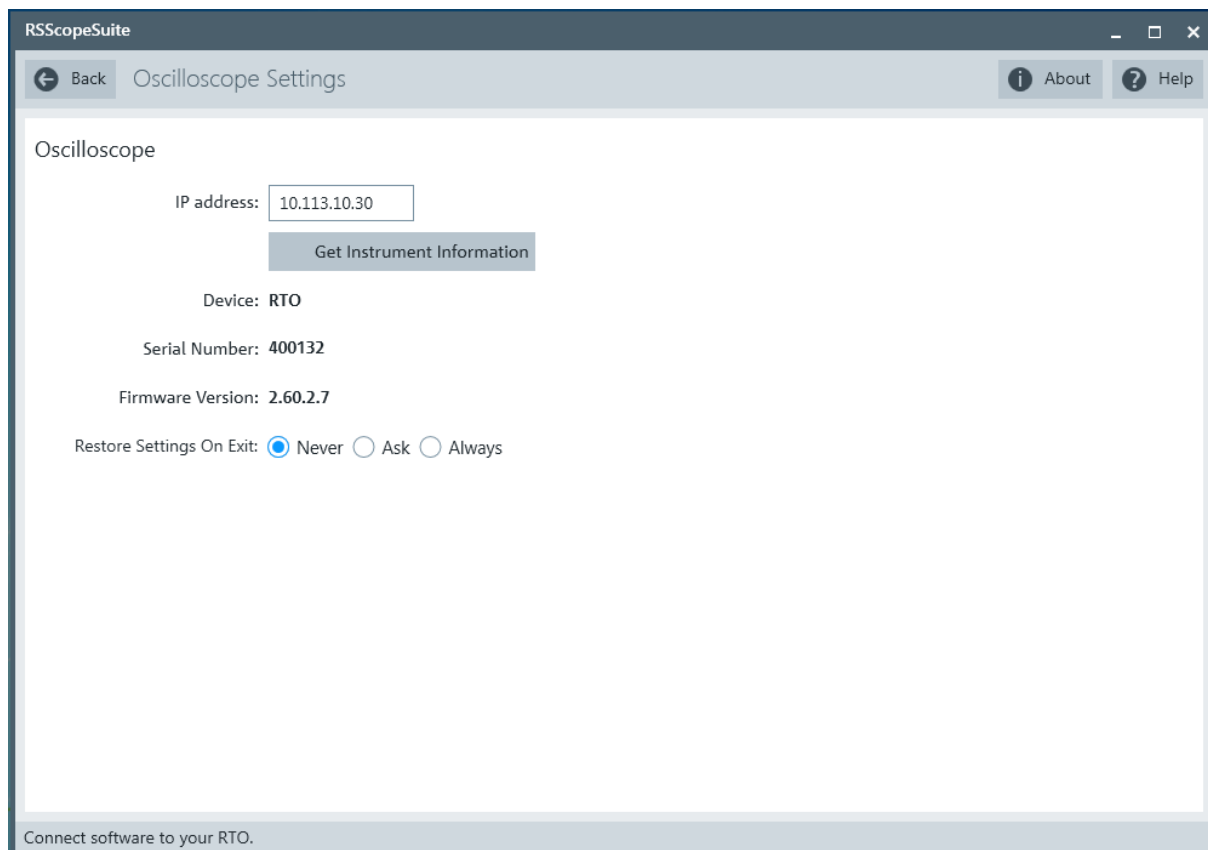
If the R&S ScopeSuite software runs on a test computer, the computer and the testing R&S RTO require a LAN connection, see [Chapter 3.2, "Setting Up the Network"](#), on page 14. The R&S ScopeSuite software needs the IP address of the R&S RTO to establish connection.

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.

3.5 Connecting the Arbitrary Waveform Generator

For Ethernet tests using a disturber, an arbitrary waveform generator (AWG) is required. The tests can be performed manually or automatically, depending on the the available AWG.

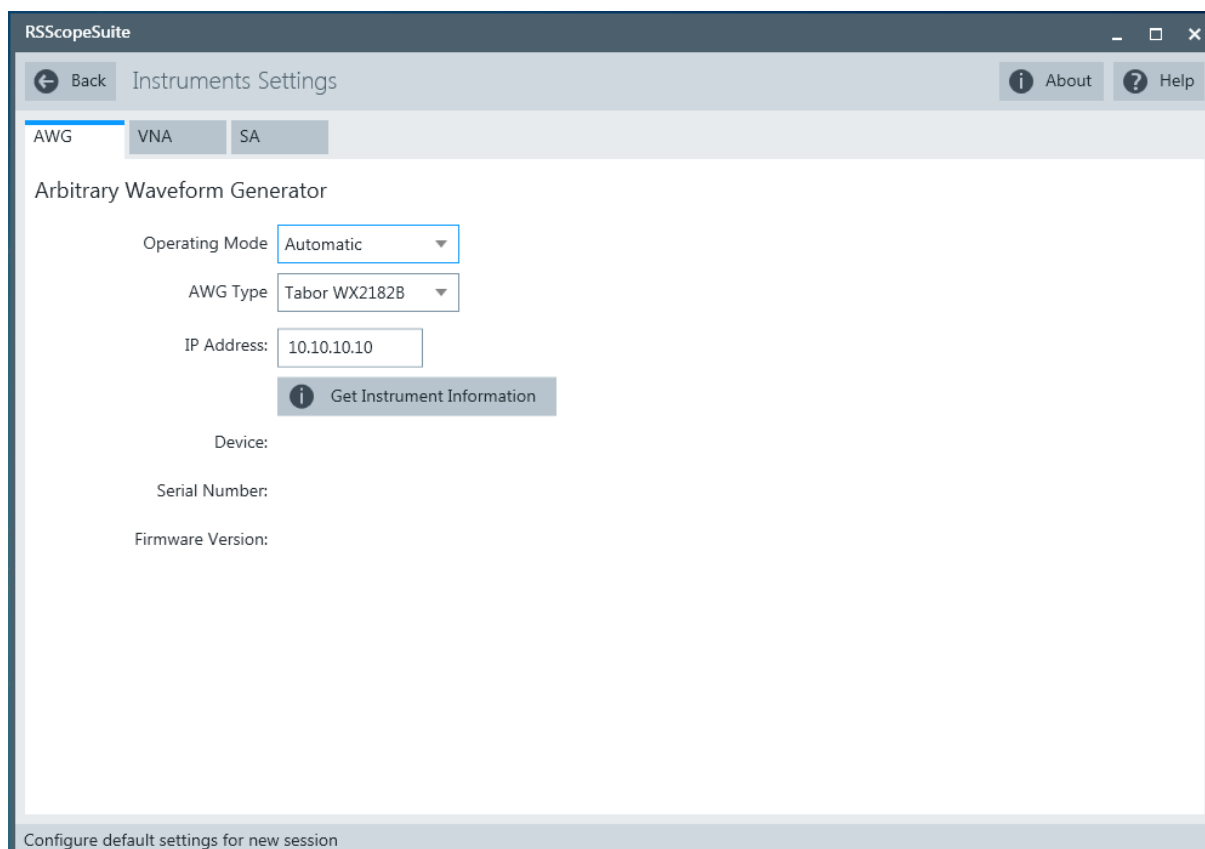
Automatic test execution is possible with all instruments that are listed in the R&S ScopeSuite, in the "Instrument Settings" dialog box. In automatic mode, the R&S ScopeSuite configures the instrument and ensures that the AWG sends the required waveforms. Automatic mode requires a LAN connection and the installation of a VISA implementation (R&S VISA, see www.rohde-schwarz.com/rsvisa) 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 or WX2182C is used for automatic testing, fixed IP addresses are required.

Connecting the Arbitrary Waveform Generator

For manual test execution it is recommended to use one of the listed AWGs, but you can also use another AWG. 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 3.2, "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

- ▶ In the "AWG" tab, enable the "Manual" operating mode.

3.6 Connecting the Vector Network Analyzer

The vector network analyzer (VNA) is required to perform Ethernet return loss measurements.

Similar to the AWG, the VNA can be used in automatic or manual mode. Automatic mode is supported with R&S ZVL, R&S ZNB and R&S ZNC and requires a LAN connection and a VISA installation 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.

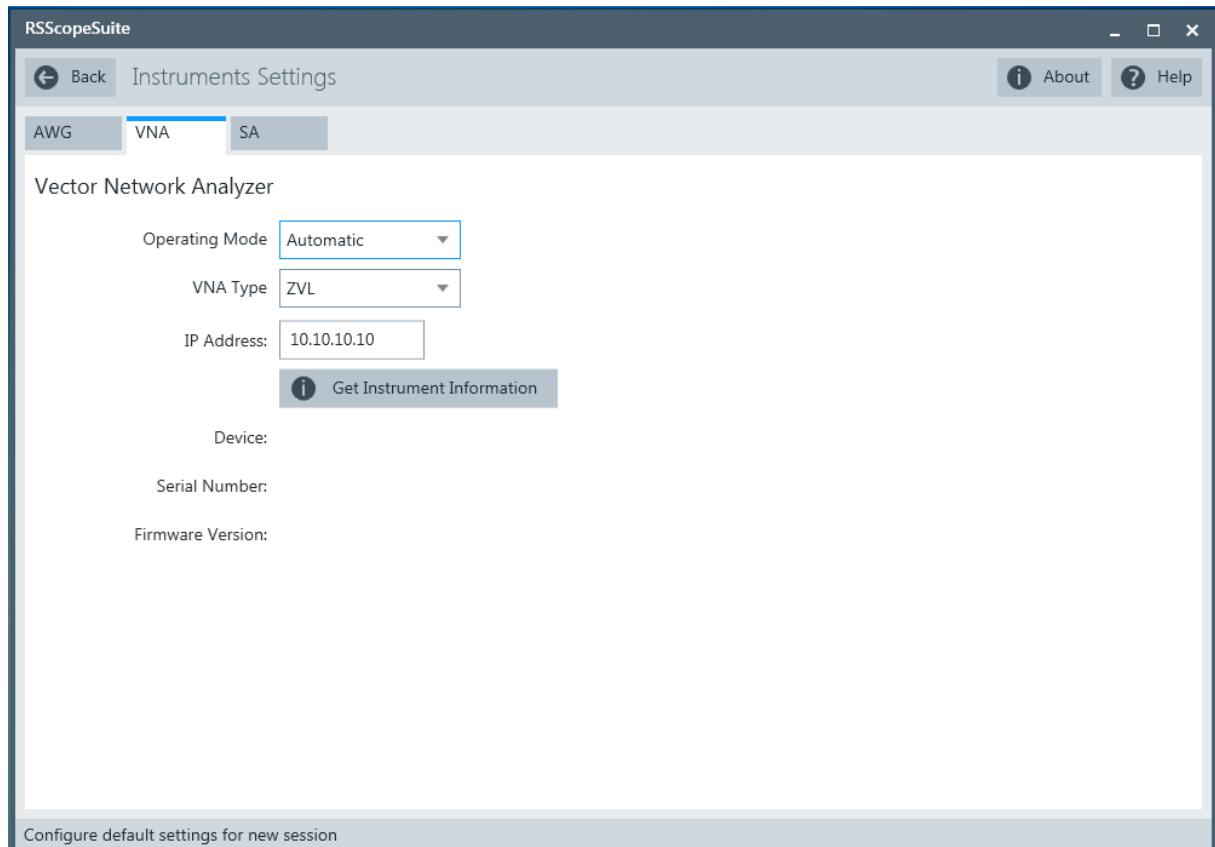
For manual test execution it is recommended to use one of the listed VNAs. Moreover, any VNA can be used that meets the following requirements:

- S11 parameter measurements are possible
- Can export trace data in Touchstone (*.s1p) or *.csv format
- Supports frequency range 1 MHz to 500 MHz

In manual mode, you connect the vector network analyzer to the test board and configure the instrument manually.

To connect the vector network analyzer for automatic testing

1. Connect the computer and the VNA and set up the LAN connection, see [Chapter 3.2, "Setting Up the Network"](#), on page 14.
2. In the R&S ScopeSuite, click "Instruments".
3. Click the "VNA" tab.
4. Select the "Automatic" operating mode.
5. Select the "VNA 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.

3.7 Connecting the Spectrum Analyzer

A spectrum analyzer is required to perform Ethernet 10GBASE-T transmitter linearity tests.

Similar to the AWG, the spectrum analyzer can be used in automatic or manual mode. Automatic mode is supported with R&S FSV and R&S FSQ. It requires a LAN connection and a VISA installation 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.

Connecting the Spectrum Analyzer

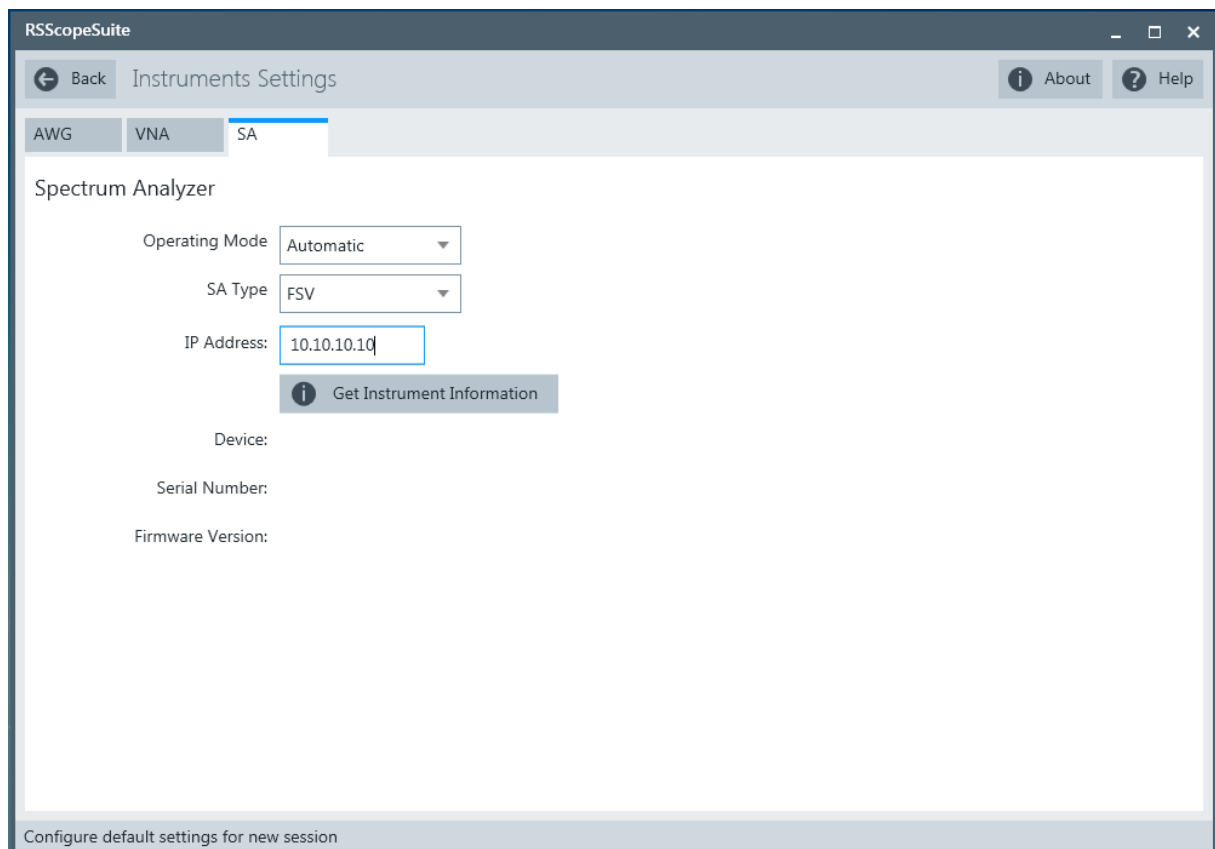
For manual test execution it is recommended to use one of the listed spectrum analyzers. Moreover, any spectrum analyzer can be used that meets the following requirements:

- Frequency range from 1 MHz to 400 MHz
- RF input attenuation greater than 35 dB

In manual mode, you connect the spectrum analyzer to the test board and configure the instrument manually.

To connect the spectrum analyzer for automatic testing

1. Connect the computer and the spectrum analyzer and set up the LAN connection, see [Chapter 3.2, "Setting Up the Network"](#), on page 14.
2. In the R&S ScopeSuite, click "Instruments".
3. Click the "SA" tab.
4. Select the "Automatic" operating mode.
5. Select the "SA 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.


3.8 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.

RScopeSuite

Back Report Settings About Help

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	

User Input

Device Under Test (DUT)

User

Site

Temperature

Comments

Configure default settings for new session