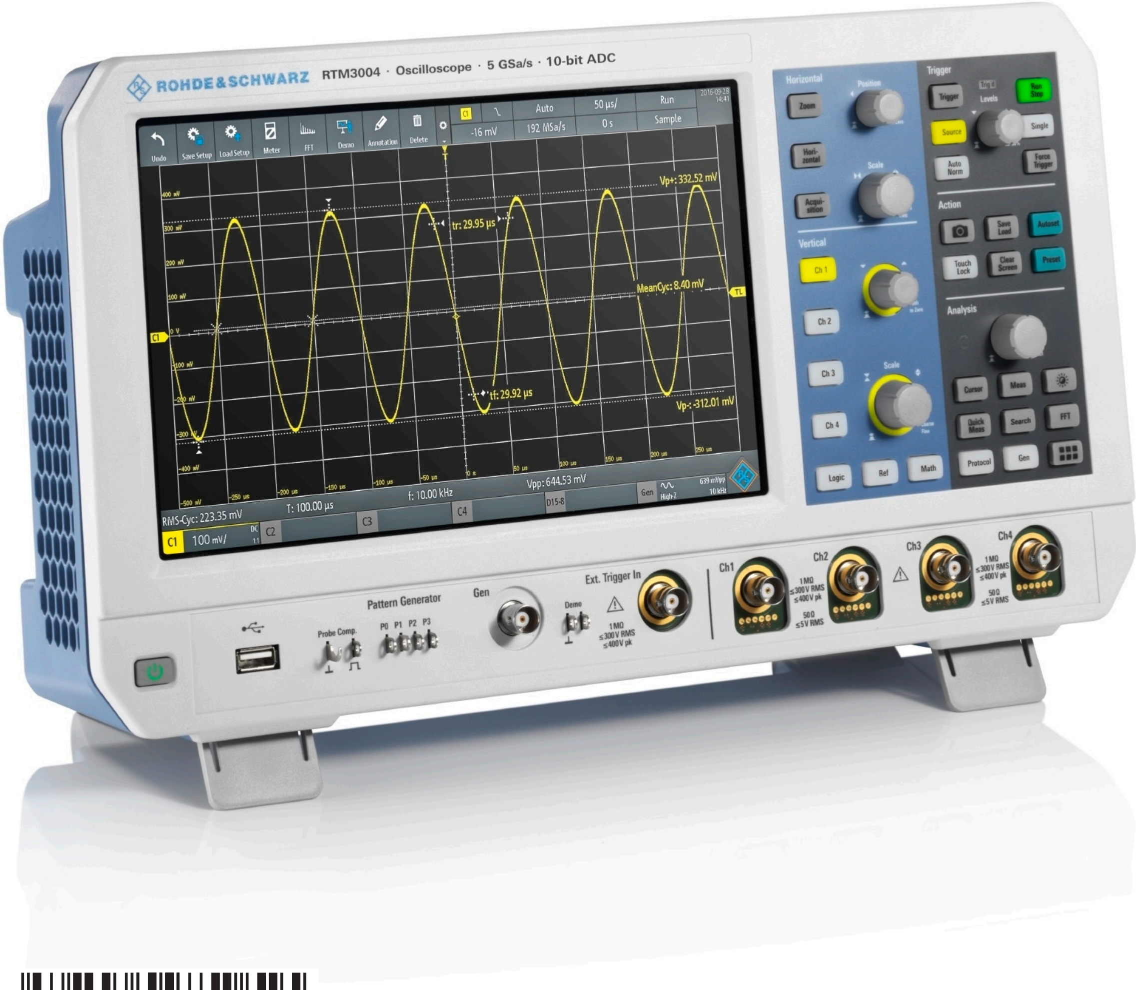
R&S®RTM3000, R&S®RTA4000
Oscilloscope
Service Manual



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ROHDE&SCHWARZ

Service Manual

Version 03

This document describes the following oscilloscope models:

- R&S®RTM3002 (1335.8794K02)
- R&S®RTM3004 (1335.8794K04)
- R&S®RTA4004 (1335.7700K04)

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1335.9103.02 | Version 03 | R&S®RTM3000, R&S®RTA4000

Throughout this manual, products from Rohde & Schwarz are indicated without the ® symbol , e.g. R&S®RTM3000 is indicated as R&S RTM3000, and R&S®RTA4000 is indicated as R&S RTA4000.

Safety Instructions
Instrucciones de seguridad
Sicherheitshinweise
Consignes de sécurité

⚠ WARNING

Risk of injury and instrument damage

The instrument must be used in an appropriate manner to prevent electric shock, fire, personal injury or instrument damage.

- Do not open the instrument casing.
- Read and observe the "Basic Safety Instructions" delivered as printed brochure with the instrument.
- Read and observe the safety instructions in the following sections. Note that the data sheet may specify additional operating conditions.
- Keep the "Basic Safety Instructions" and the product documentation in a safe place and pass them on to the subsequent users.

⚠ ADVERTENCIA

Riesgo de lesiones y daños en el instrumento

El instrumento se debe usar de manera adecuada para prevenir descargas eléctricas, incendios, lesiones o daños materiales.

- No abrir la carcasa del instrumento.
- Lea y cumpla las "Instrucciones de seguridad elementales" suministradas con el instrumento como folleto impreso.
- Lea y cumpla las instrucciones de seguridad incluidas en las siguientes secciones. Se debe tener en cuenta que las especificaciones técnicas pueden contener condiciones adicionales para su uso.
- Guarde bien las instrucciones de seguridad elementales, así como la documentación del producto, y entréguelas a usuarios posteriores.

WARNUNG

Gefahr von Verletzungen und Schäden am Gerät

Betreiben Sie das Gerät immer ordnungsgemäß, um elektrischen Schlag, Brand, Verletzungen von Personen oder Geräteschäden zu verhindern.

- Öffnen Sie das Gerätegehäuse nicht.
- Lesen und beachten Sie die "Grundlegenden Sicherheitshinweise", die als gedruckte Broschüre dem Gerät beiliegen.
- Lesen und beachten Sie die Sicherheitshinweise in den folgenden Abschnitten; möglicherweise enthält das Datenblatt weitere Hinweise zu speziellen Betriebsbedingungen.
- Bewahren Sie die "Grundlegenden Sicherheitshinweise" und die Produktdokumentation gut auf und geben Sie diese an weitere Benutzer des Produkts weiter.

AVERTISSEMENT

Risque de blessures et d'endommagement de l'appareil

L'appareil doit être utilisé conformément aux prescriptions afin d'éviter les électrocutions, incendies, dommages corporels et matériels.

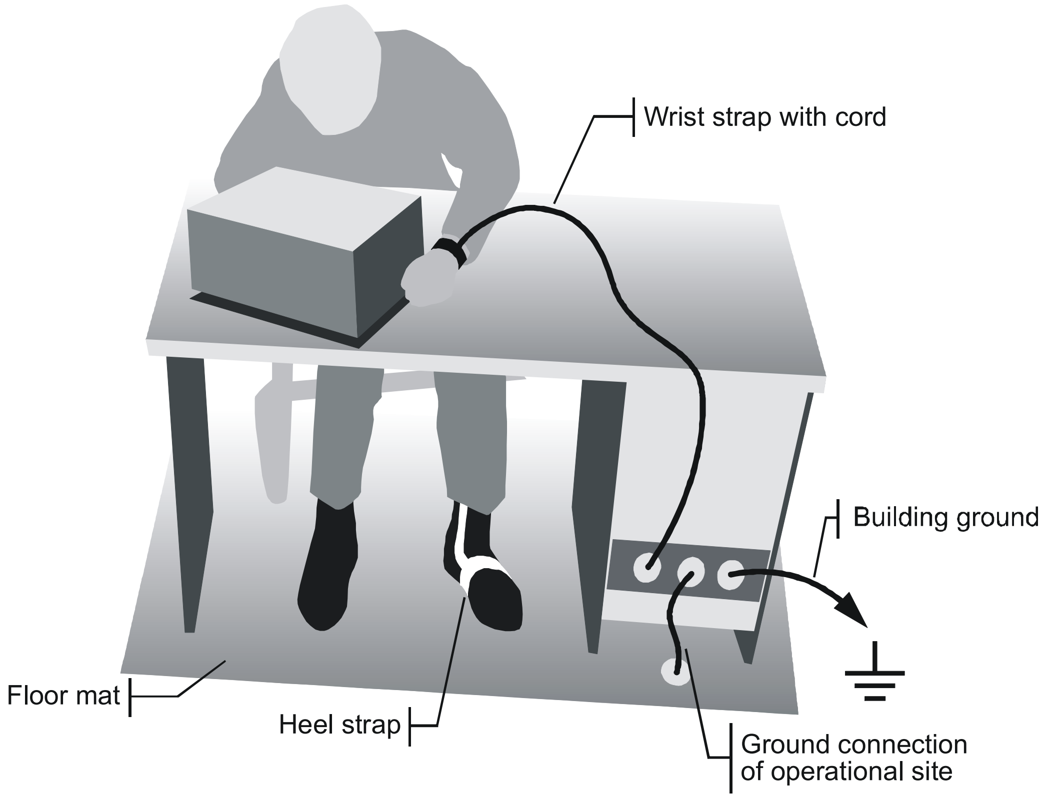
- N'ouvrez pas le boîtier de l'appareil.
- Lisez et respectez les "consignes de sécurité fondamentales" fournies avec l’appareil sous forme de brochure imprimée.
- Lisez et respectez les instructions de sécurité dans les sections suivantes. Il ne faut pas oublier que la fiche technique peut indiquer des conditions d’exploitation supplémentaires.
- Gardez les consignes de sécurité fondamentales et la documentation produit dans un lieu sûr et transmettez ces documents aux autres utilisateurs.

Instructions for Electrostatic Discharge Protection

NOTICE

Risk of damaging electronic components

To avoid damage of electronic components, the operational site must be protected against electrostatic discharge (ESD).



The following two methods of ESD protection may be used together or separately:

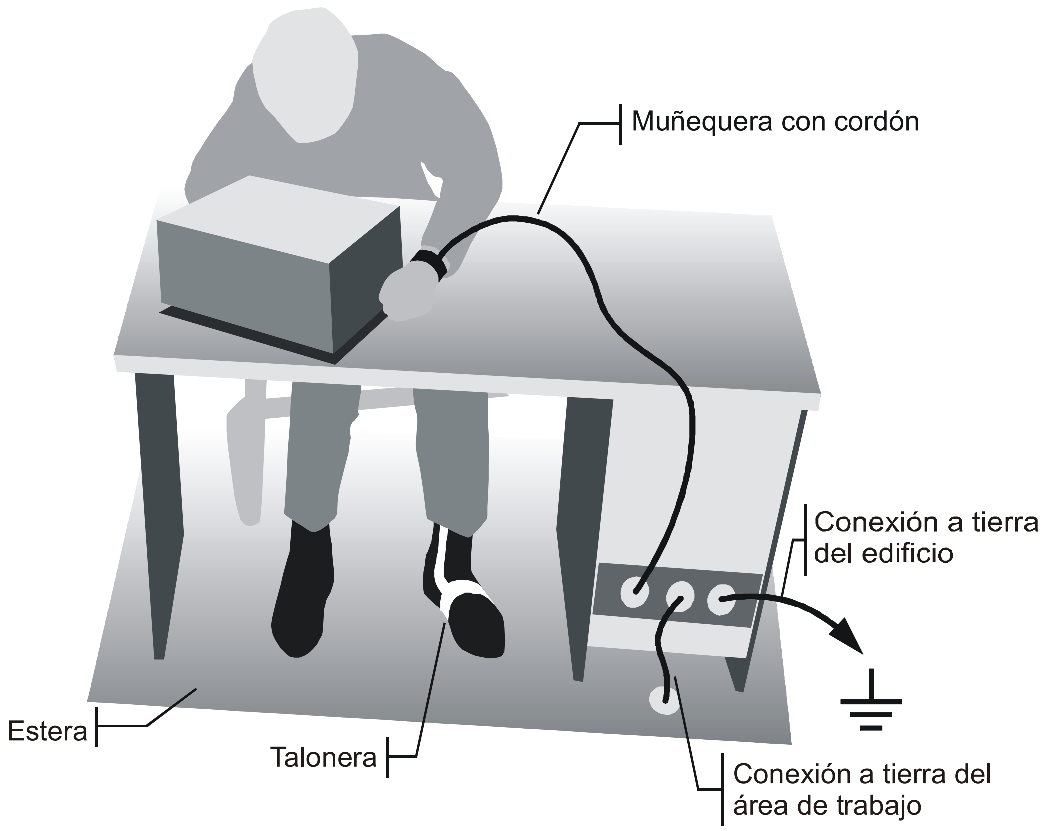
- Wrist strap with cord to ground connection
- Conductive floor mat and heel strap combination

Instrucciones para la protección contra descargas electroestáticas

AVISO

Riesgo de avería de los componentes electrónicos

Para evitar averías en los componentes electrónicos, el área de trabajo tiene que estar protegido contra descargas electroestáticas ESD (electrostatic discharge).



Los siguientes dos métodos de protección ESD pueden ser usados juntos o separados:

- Muñequera con cordón para conexión a tierra
- Combinación de estera antiestática y talonera

Procedure for servicing and repairs

This section contains information on shipping an instrument or module to your service center.

Please contact your local Rohde & Schwarz service center if your equipment needs to be serviced or repaired. You can find the current address of your representative at www.rohde-schwarz.com.

Shipping the instrument or module

We require the following information in order to answer your inquiry quickly and correctly and to determine whether the warranty is still valid for your product:

- Instrument model
- Serial number
- Firmware version
- Does the instrument have to be returned with this firmware?
- Detailed error description in case of repair
- Indication of desired calibration
- Contact person for questions

In many countries, an RMA process is available (pickup and delivery of your product). For details, contact your local representative.

When shipping the product, ensure that there is sufficient mechanical and antistatic protection.

- Where possible, use the original packaging to transport or ship the product. The front and rear protective covers prevent damage to the operating elements and the connectors.
- If you do not use the original packaging, ensure sufficient padding to prevent the product from moving around inside the box. Wrap antistatic film around the product to protect it from electrostatic charging.
- Comply with the relevant safety and security measures for products with batteries.

As the manufacturer, Rohde & Schwarz can ensure that your instruments perform optimally throughout their service life by regularly calibrating them on its own measurement systems. Rohde & Schwarz calibration includes preventative measures such as adjustments. The calibration documentation fulfills ISO 17025 requirements.

Contents

1 Documentation Overview

This section provides an overview of the R&S RTM3000/RTA4000 user documentation.

1.1 Manuals and Instrument Help

You find the manuals on the product page at:

www.rohde-schwarz.com/manual/rtm3000

www.rohde-schwarz.com/manual/rta4000

Getting started manual

Introduces the R&S RTM3000/RTA4000 and describes how to set up the product. A printed English version is included in the delivery.

User 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 and instrument interfaces. Includes the contents of the getting started manual.

The *online version* of the user manual provides the complete contents for immediate display on the internet.

Instrument help

The help offers quick, context-sensitive access to the functional description directly on the instrument.

Basic safety instructions

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

Instrument security procedures manual

Deals with security issues when working with the R&S RTM3000/RTA4000 in secure areas.

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).

1.2 Data Sheet and Brochure

The data sheet contains the technical specifications of the R&S RTM3000/RTA4000. It also lists the options with their order numbers and optional accessories. The brochure provides an overview of the instrument and deals with the specific characteristics.

See www.rohde-schwarz.com/brochure-datasheet/rtm3000

See www.rohde-schwarz.com/brochure-datasheet/rta4000

1.3 Calibration Certificate

The document is available on https://gloris.rohde-schwarz.com/calcert. You need the device ID of your instrument, which you can find on a label on the rear panel.

1.4 Release Notes and Open Source Acknowledgment

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/rtm3000. The open source acknowledgment document can also be read directly on the instrument.

See www.rohde-schwarz.com/firmware/rta4000. The open source acknowledgment document can also be read directly on the instrument.

2 Performance Test

This chapter provides information on executing performance tests. After an overview of the required equipment, the test procedure and the detailed test goals are described. At the end of this chapter, templates for test reports are supplied for your convenience.

Test instructions

To make sure that rated specifications are maintained, the following preparations are required prior to checking the rated characteristics:

- Allow for a minimum warm-up time of 20 minutes at ambient temperature.
- Carry out all internal adjustments.
- The values are specified in the data sheet. Additional uncertainties introduced by the measurement equipment must be taken into account when checking the rated values.

2.1 Test Equipment

Table 2-1: Test equipment

Item	Type of equipment	Recommended characteristics or features	Recommended model	R&S Order No.	Application
1	DC calibrator	Max. ±40 V Resolution min. 1 mV Current min. 120 mA (±6 V into 50 Ω) Range Accuracy 0.1 V 0.1 % +40 µV 1 V 0.1 % +400 µV 6 V 0.1 % +2.8 mV 40 V 0.1 % +16 mV	Keithley SourceMeter Model 2601A		DC gain accuracy, offset accuracy
2	Digital multimeter	DC voltage range 6 V 0.05 % +1 mV 0.1 V 0.1 % +40 µV	Agilent 34401A		DC gain accuracy
3	Signal generator	RF 10 MHz to 1 GHz, power +16 dBm, frequency error <10^{-6}	R&S SMB100A Opt. SMB-B101 or higher	1406.6000.02 1407.2509.02	Analog bandwidth, crosstalk, internal trigger, external trigger
4	Power sensor	1 MHz to 1 GHz <0.15 dB	R&S NRP-Z91	1168.8004.02	Analog bandwidth, crosstalk, internal trigger, external trigger

Item	Type of equipment	Recommended characteristics or features	Recommended model	R&S Order No.	Application
5a	Powermeter		R&S NRP	1143.8500.02	Analog bandwidth, crosstalk, internal trigger, external trigger
5b	USB adapter for NRP sensors		R&S NRP-Z4	1146.8001.02	Analog bandwidth, crosstalk, internal trigger, external trigger
6	Power splitter	DC to 1 GHz	Agilent 11667A		Analog bandwidth, crosstalk, internal trigger, external trigger
7	Frequency counter	1 GHz < 2*10-9	Advantest R5361B		Reference frequency accuracy
8	BNC Feedthrough termination	Impedance 50 Ω			External trigger
9	Adapter N (m) to BNC (f)				Analog bandwidth, crosstalk, internal trigger, external trigger
10	N cable				Analog bandwidth, crosstalk, internal trigger, external trigger
11	BNC cable				Analog bandwidth, crosstalk, internal trigger, external trigger
12	Adapter BNC (m) to dual banana (f)				DC gain accuracy
13	Banana cable				DC gain accuracy
14	Attenuator BNC	20 dB		0006.9700.00	DC gain accuracy

2.2 Performance Test for Instrument

2.2.1 Prepare and Connect Instrument

Connect all cables to the UCS test system:

- Power supply cord
- LAN cable

Switch on and boot the instrument.

2.2.2 Calibration

Calibration is the verification of adjustment. Parameters are measured and compared to the datasheet.

2.2.3 Oscilloscope Tests on R&S RTM3000/RTA4000

2.2.3.1 DC Gain Accuracy

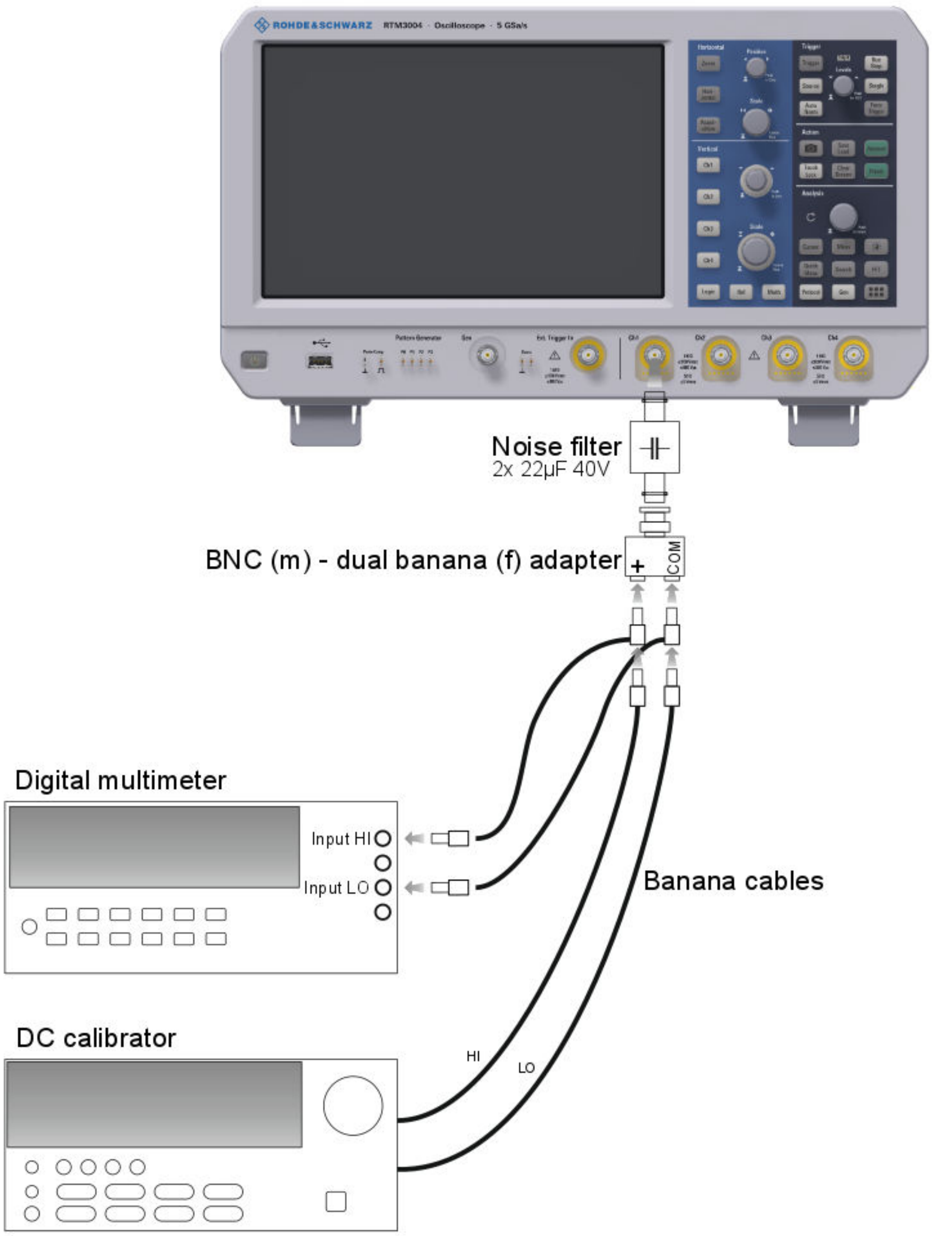


Figure 2-1: Test Setup for DC Gain Accuracy

Test equipment:

- DC calibrator (refer to Test equipment, item 1)
- Digital multimeter (refer to Test equipment, item 2)
- Adapter BNC (m) to dual banana (f) (refer to Test equipment, item 12)

- Attennuator 20 dB BNC (refer to Test equipment, item 14)

Test setup:

1. Switch output voltage of DC calibrator OFF.
2. Connect equipment as shown above.

Due to the voltage measurement accuracy of the Keithley SourceMeter 2601A, for DC voltages below 180 mV the digital multimeter must be used to control the calibrator voltage at the oscilloscope input.

To avoid clipping, reduce noise level of the recommended DC calibrator for sensitivities ≤5 mV/div by using a 20 dB attenuator. Thus, a different signal path is used, which provides a better signal to noise ratio.

DC gain accuracy with input resistance 1 MΩ for all channels simultaneously

R&S oscilloscope settings:

1. [PRESET]
2. [CH1 : Termination 1 MΩ : Bandwidth 20 MHz : Y-Scale see Table 2-2]
3. [HORIZONTAL SCALE 1 ms/div]
4. [Acquisition: Max. Waveform Rate ON]
5. [VERTICAL OFFSET 0.0 V]
   After a preset the offset of channel 2, 3 and 4 are not set to 0.0 V
6. [POSITION: 0.0 DIV]
   After reset channel 2, 3 and 4 are not 0.0 DIV.
   Position setting is valid from R&S RTM3000 firmware version 01.023)
7. [MEAS : DVM DC]

Measurement:

1. Set the calibration voltage to the positive value (refer to Table 2-2).
2. Measure the calibration voltage at the oscilloscope input ($U_{pos,cal}$).
3. Read the mean value from the oscilloscope display ($U_{pos,meas}$).
4. Set the calibration voltage to the negative value (refer to Table 2-2).
5. Measure the calibration voltage at the oscilloscope input ($U_{neg,cal}$).
6. Read the mean value from the oscilloscope display ($U_{neg,meas}$).

Table 2-2: DC Gain Accuracy, input resistance 1 MΩ

Vertical Scale	Calibrator Voltage
10 V/div	±40 V
5 V/div	±22.5 V
2 V/div	±9 V
1 V/div	±4.5 V
500 mV/div	±2.25 V

Vertical Scale	Calibrator Voltage
200 mV/div	±900 mV
100 mV/div	±450 mV
50 mV/div	±225 mV
20 mV/div	±90 mV
10 mV/div	±45 mV
5 mV/div	±22.5 mV
2 mV/div	±9 mV

Evaluation:

Calculate the DC gain accuracy for each measurement. Use the following equation:

$$\text{DC gain accuracy } [\%] = 100 \cdot \left(\frac{U_{pos,meas} - U_{neg,meas}}{U_{pos,cal} - U_{neg,cal}} - 1 \right)$$

Example:

$U_{pos,cal}$ = 124 mV

$U_{neg,cal}$ = -124 mV

$U_{pos,meas}$ = 123 mV

$U_{neg,meas}$ = -126 mV

$$\text{DC gain accuracy } [\%] = 100 \cdot \left(\frac{123\text{ mV} - (-126\text{ mV})}{124\text{ mV} - (-124\text{ mV})} - 1 \right)$$

DC gain accuracy ≈ 0.4%

DC gain accuracy with input resistance 50 Ω

R&S oscilloscope settings:

1. [PRESET]
2. [CH1 : Termination 50 Ω : Bandwidth 20 MHz : Y-Scale see Table 2-3]
3. [HORIZONTAL SCALE 1 ms/div]
4. [Acquisition: Max. Waveform Rate ON]
5. [VERTICAL OFFSET 0.0 V]
   After a preset the offset of channel 2, 3 and 4 are not set to 0.0 V.
6. [POSITION: 0.0 DIV]
   After reset channel 2, 3 and 4 are not 0.0 DIV. Position setting is valid from R&S RTM3000 firmware version 01.023).
7. [MEAS : DVM DC]

Measurement:

1. Set the calibration voltage to the positive value (refer to Table 2-3)

2. Measure the calibration voltage at the oscilloscope input ($U_{pos,cal}$)
3. Read the mean value from the oscilloscope display ($U_{pos,meas}$)
4. Set the calibration voltage to the negative value (refer to Table 2-3)
5. Measure the calibration voltage at the oscilloscope input ($U_{neg,cal}$)
6. Read the mean value from the oscilloscope display ($U_{neg,meas}$)

Table 2-3: DC Gain Accuracy, input resistance 50 Ω

Vertical Scale	Calibrator Voltage
1 V/div	±4.5 V
500 mV/div	±2.25 V
200 mV/div	±900 mV
100 mV/div	±450 mV
50 mV/div	±225 mV
20 mV/div	±90 mV
10 mV/div	±45 mV
5 mV/div	±22.5 mV
2 mV/div	±9 mV

Evaluation:

► Calculate the DC gain accuracy for each measurement. Use the following equation:

$$\text{DC gain accuracy [\%]} = 100 \cdot \left(\frac{U_{pos,meas} - U_{neg,meas}}{U_{pos,cal} - U_{neg,cal}} - 1 \right)$$

Loop:

1. Repeat the measurement with all vertical scale settings simultaneously.
2. Repeat all measurements with the remaining channels.

2.2.3.2 Offset Accuracy

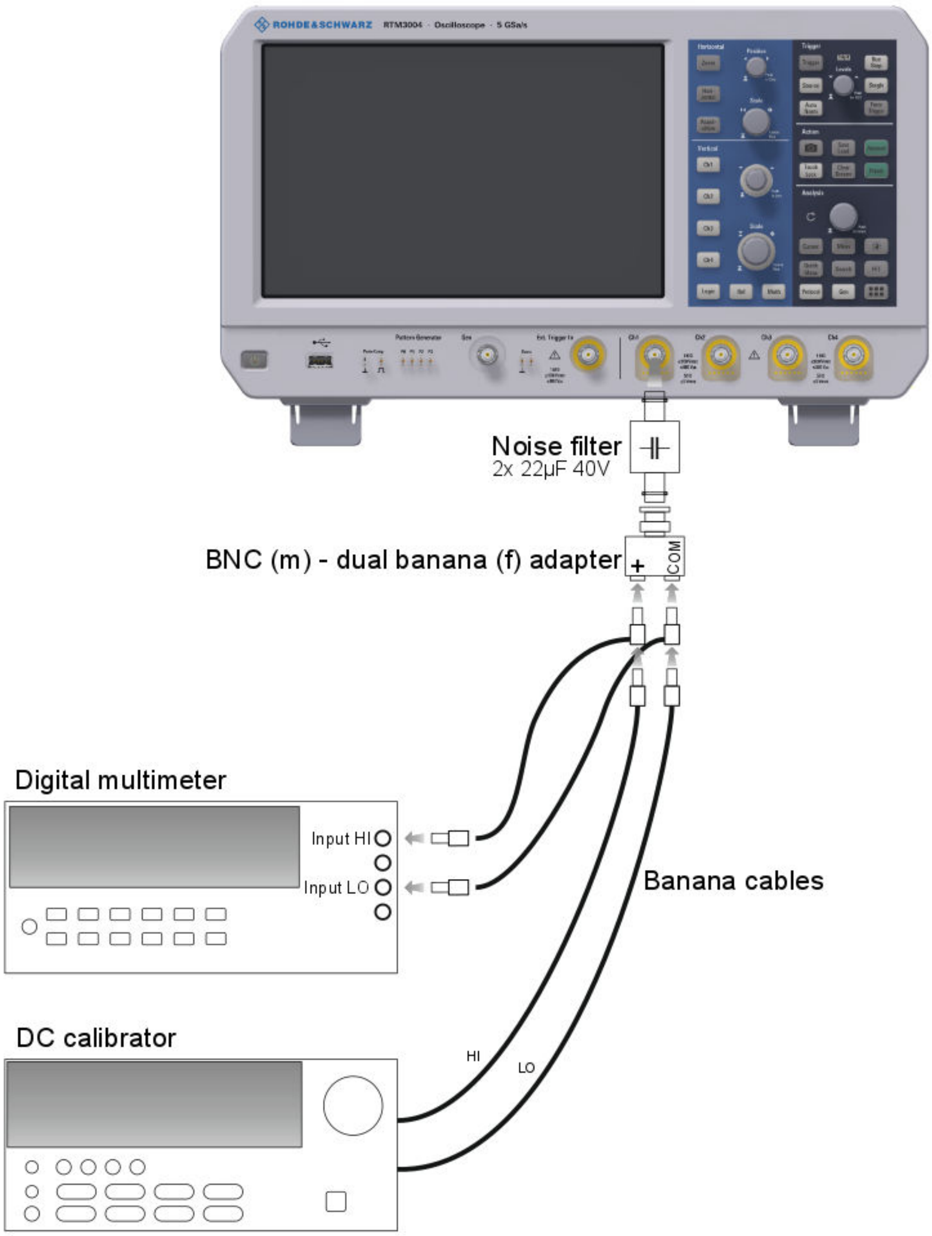


Figure 2-2: Test Setup for Offset Accuracy

Test equipment:

- DC calibrator (refer to Test equipment item 1)
- Digital multimeter (refer to Test equipment item 2)
- Adapter BNC (m) to dual banana (f) (refer to Test equipment, item 12)

Test setup:

1. Switch the output voltage of DC calibrator OFF.
2. Connect equipment as shown above.

Offset accuracy with input resistance 1 MΩ

R&S oscilloscope settings:

1. [PRESET]
2. [CH1 : Termination 1 MΩ : Bandwidth 20 MHz : Offset see Table 2-4 : Y-Scale see Table 2-4]
3. [VERTICAL OFFSET 0.0 V]
   After a preset the offset of channel 2, 3 and 4 are not set to 0.0 V.
4. [HORIZONTAL SCALE 1 ms/div]
5. [Acquisition: Max. Waveform Rate ON]
6. [MEAS:"DVM<n>:TYPE DC"]

Measurement:

1. Set the calibration voltage (refer to Table 2-4)
2. Measure the calibration voltage at the oscilloscope input ($U_{calibrator}$)
3. Read the mean value from oscilloscope display ($U_{DUT\_mean\_reading}$)

Table 2-4: Offset accuracy, 1 MΩ

Vertical Scale	Offset and calibration voltage		
5 mV/div	-1.975 V	0	1.975 V
100 mV/div	-24.5 V	0	24.5 V
1 V/div	-40 V	0	40 V

Evaluation:

The offset deviation from the set value is equal to the difference between the applied voltage and the mean value reading.

$U_{offset\_deviation} = U_{calibrator} - U_{DUT\_mean\_reading}$

Example:

Y-Scale = 50 mV/div

OFFSET = 9.75 V

$U_{calibrator}$ = 9.75 V

$U_{DUT\_mean\_reading}$ = 9.76 V

$U_{offset\_deviation}$ = 9.75 V - 9.76 V = 0.01 V

Loop:

► Repeat the measurement with all vertical scale settings simultaneously

Offset accuracy with input resistance 50 Ω

R&S oscilloscope settings:

1. [PRESET]
2. [CH1 : Termination 50 Ω : Bandwidth 20 MHz : Offset see Table 2-5 : Y-Scale see Table 2-5]
3. [VERTICAL OFFSET 0.0 V]

After a preset the offset of channel 2, 3 and 4 are not set to 0.0 V.

4. [HORIZONTAL SCALE 1 ms/div]
5. [Acquisition: Max. Waveform Rate ON]
6. [MEAS: "DVM<n>:TYPE DC"]

Measurement:

1. Set the calibration voltage (refer to Table 2-5)
2. Measure the calibration voltage at the oscilloscope input ($U_{calibrator}$)
3. Read the mean value from oscilloscope display ($U_{DUT\_mean\_reading}$)

Table 2-5: Offset accuracy, 50 Ω

Vertical Scale	Offset and calibration Voltage		
5 mV/div	-1.975 V	0	1.975 V
50 mV/div	-5 V	0	5 V
500 mV/div	-5 V	0	5 V

Evaluation:

► The offset deviation from the set value is equal to the difference between the applied voltage and the mean value reading.
$U_{offset\_deviation} = U_{calibrator} - U_{DUT\_mean\_reading}$

Loop:

1. Repeat the measurement with all vertical scale settings simultaneously
2. Repeat all measurements with the remaining channels

2.2.3.3 Reference frequency accuracy

Test equipment:

- Frequency counter (refer to Test equipment, item 7)

Test setup:

► Connect the RF input of the frequency counter directly to the oscilloscope's AUX output.

R&S oscilloscope settings:

1. [PRESET]
2. Set the reference frequency to the TRIGGER OUT:
   a) Menu:
      [SETUP : Trigger Output: "Ref. Freq."]
   b) SCPI:
      `:TRIGger:OUT:MODE REFerence`

Measurement:

1. Set frequency counter to appropriate resolution.
2. Read frequency counter value.

   Error < 2.5ppm (RTM3000)
   Error < 0.5 ppm (RTA4000)

2.2.3.4 Probe Identification

Passive Probes

Test equipment:
- Passive 10:1 Probe (refer to Test equipment, item 11)

Test setup:
► Ensure that no probe is connected to the oscilloscope.

R&S oscilloscope settings:
1. [PRESET]
2. [CH1 : Coupling DC : Termination 50 Ω : Y-Scale 50 mV/div]
3. [HORIZONTAL SCALE 500 µs/div]
4. [TRIGGER LEVEL 50 mV]

Measurement:
1. Connect probe to CH1 input of the oscilloscope.
2. Connect probe tip to Probe Compensation signal output.
3. Check that the impedance at CH1 is switched to 1 MΩ.
4. Check that the Y-scale at CH1 is switched to 500 mV/div.
5. Check the display: square wave with approximated 1.5 Vpp (3 divisions) amplitude.

► Repeat all measurements with the remaining channels.

Active Probes

Test equipment:
- Active 10:1 Probe (refer to Test equipment, item 10)

Test setup:
► Ensure that no probe is connected to the R&S RTM3000/RTA4000.

R&S oscilloscope settings:
1. [PRESET]
2. [CH1 : Coupling DC : Termination 1 MΩ : Y-Scale 50 mV/div]
3. [HORIZONTAL SCALE 500 µs/div]
4. [TRIGGER LEVEL 50 mV]

Measurement:
1. Connect probe to CH1 input of the oscilloscope.
2. Connect probe tip to Probe Compensation signal output.
3. Check that the impedance at CH1 is switched to 50 Ω.
4. Check that the Y-scale at CH1 is switched to 500 mV/div.
5. Check the display: square wave with approximated 1.5 Vpp (3 divisions) amplitude.

Loop:
► Repeat all measurements with the remaining channels.

2.2.3.5 Analog Bandwidth

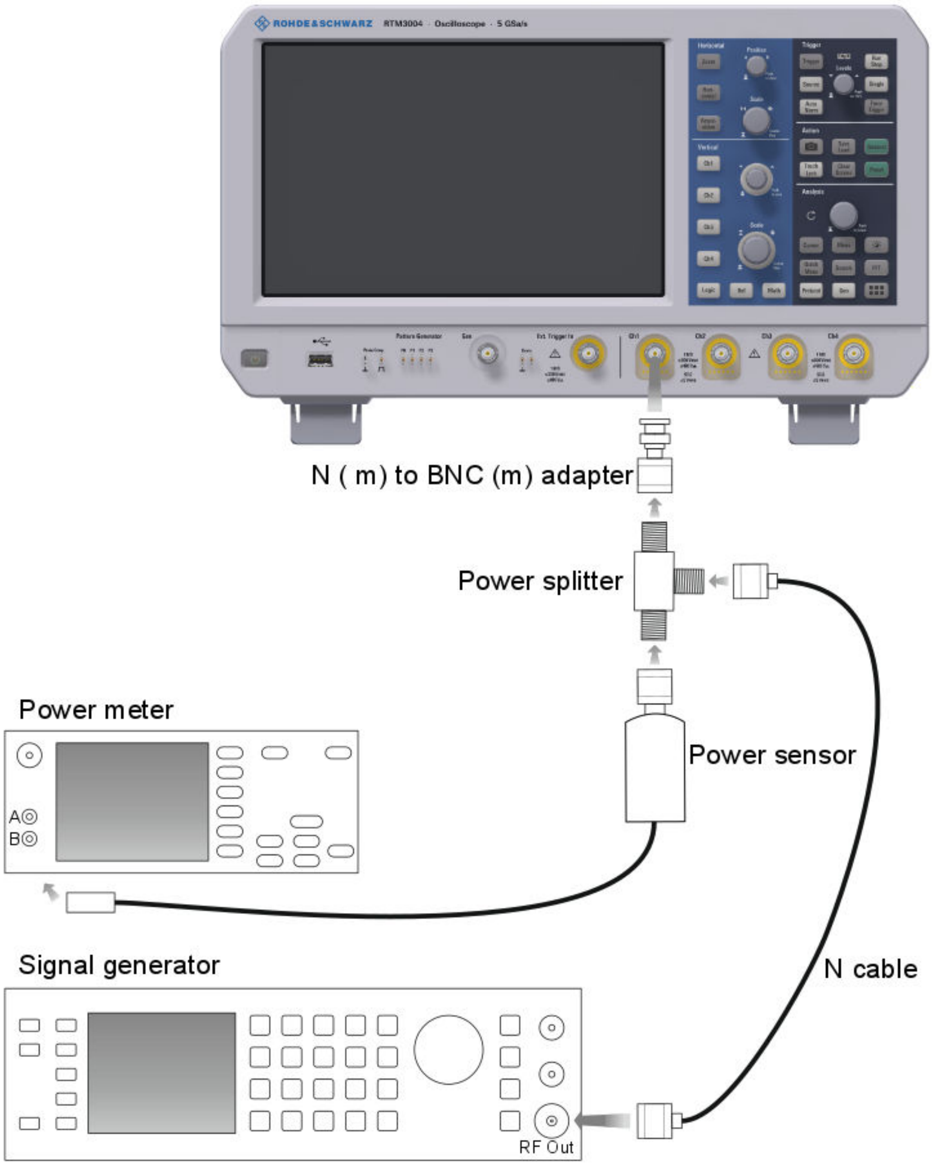


Figure 2-3: Test setup for analog bandwidth

Test equipment:

- Signal generator (refer to Test equipment, item 3)
- Power meter (refer to Test equipment, item 5a or 5b)
- Power sensor (refer to Test equipment, item 4)
- Power splitter (refer to Test equipment, item 6)
- 50 Ω Feed Through Terminator (refer to Test equipment, item 8)
- Cables and adapters:

- N cable (refer to Test equipment, item 10)
- Adapter N (m) to BNC (f) (refer to Test equipment, item 9)

Test setup:

1. Connect the signal generator to the power splitter input.
2. Connect the power sensor to the power splitter output 1.
3. Connect the R&S RTM3000/RTA4000 to the power splitter output 2.

Before using any BNC adapters please check the rated specification. Not all BNC connectors are suitable for higher RF frequencies.

Analog bandwidth

R&S oscilloscope settings:

1. [PRESET]
2. [CH1 : Termination 50 Ω : Coupling DC : Y-Scale see Table 2-6]
3. [HORIZONTAL SCALE 2 µs/div]
4. [TRIGGER SOURCE : Channel x] (depending channel to be measured)
5. [VERTICAL OFFSET 0.0 V]
   After a preset, the offsets of channel 2, 3 and 4 are not set to 0.
6. [POSITION: 0.0 DIV]
   After reset, positions of channel 2, 3 and 4 are not 0.0 DIV! Position setting is valid from R&S RTM3000 firmware version 01.023.
7. [Waveform Rate Max. OFF]
8. [MEAS : Meas. Type "σ-Std. Dev. Wave (STDD)" : Measure 1 "On"]
9. Single Channel Mode

Signal generator settings:

1. [Frequency : see Table 2-6]
2. [Level : see Table 2-6]

Reference measurement:

1. Read the standard deviation value from oscilloscope at input frequency of 10 MHz.
   $U_{RTM\_reference}$ [mV]
2. Read the power sensor level.
   $P_{sensor\_reference}$ [dBm]

R&S oscilloscope settings:

► [HORIZONTAL SCALE 2 µs/div]

Signal generator settings:

Table 2-6: Analog bandwidth, signal generator settings

Option	Reference frequency	Signal generator frequency
RTM3000, basic instrument 2CH/4CH	1.0 MHz	100 MHz
RTA4000 basic instrument RTM3000 with B222/B242	1.0 MHz	200 MHz

Option	Reference frequency	Signal generator frequency
RTA/RTM with B223/B243	1.0 MHz	350 MHz
RTA/RTM with B225/B245	1.0 MHz	500 MHz
RTA/RTM with B2210/B2410	1.0 MHz	1 GHz

► [Level : see Table 2-7]

Bandwidth measurement:

1. Read standard deviation value from the oscilloscope at input frequency (value see Table 2-6).
   U_{RTx} [mV]
2. Read the power sensor level.
   P_{SENSOR} [dBm]

Table 2-7: Analog bandwidth, measurement settings

Vertical Scale	Signal level at oscilloscope input. Due to power splitter, level of signal generator must be 6 dB higher.	
500 mV/div	2.00 Vpp	10 dBm
50 mV/div	400 mVpp	-4 dBm
5 mV/div	40 mVpp	-24 dBm
1 mV/div	8 mVpp	-38 dBm

Evaluation:

$$\text{Attenuation [dB]} = 20 \times \log\left(\frac{U_{RTx}}{U_{RTx\_REF}}\right) - \left(P_{SENSOR} - P_{SENSOR\_REF}\right)$$

Example:

Y-Scale = 500 mV/div

U_{RTx_REF} = 794 mVpp

U_{RTx} = 588.5 mVpp

P_{SENSOR_REF} = 10 dBm

P_{SENSOR} = 9.9 dBm

$$\text{Attenuation [dB]} = 20 \times \log\left(\frac{1483\ \text{mVpp}}{2000\ \text{mVpp}}\right) - \left(9.9\ \text{dBm} - 10\ \text{dBm}\right)$$

Loop:

1. Repeat the measurement with all vertical scale settings.
2. Repeat the measurement with all frequency options.
3. Repeat all measurements with the remaining channels.

Analog Bandwidth, Bandwidth limitation

R&S oscilloscope settings:

1. [PRESET]
2. [CH1 : Termination 50 Ω : Bandwidth 20 MHz : Y-Scale 5 mV/div]
   [CH1 : Termination 50 Ω : Bandwidth 100 MHz : Y-Scale 5 mV/div]
3. [HORIZONTAL SCALE : 2 µs/div] (reference frequency)
4. [TRIGGER SOURCE : Channel 1]
5. [VERTICAL POSITION: 0 div]
   After a preset, the positions of channel 2, 3 and 4 are not set to 0 div.
6. [Waveform Rate Max. OFF]
7. [MEAS : Meas. Type "σ-Std. Dev. Wave (STDD)" : Measure 1 "On"]
8. Single Channel Mode

Signal generator settings:

1. [Frequency: 1 MHz]
2. [Level : 40 mVpp (-24 dBm) (Signal level at R&S RTM3000/RTA4000 input. Due to power splitter, level of signal generator must be 6 dB higher)]

Reference measurement:

1. Read the standard deviation value from R&S RTM3000/RTA4000 at reference generator frequency.
   U_{RTx_REF} [mV]
2. Read the power sensor level.
   P_{SENSOR_REF} [dBm]

R&S oscilloscope settings:

▶ [HORIZONTAL SCALE: 2µs/div]

Signal generator settings:

▶ [Frequency : 20 MHz]
[Frequency : 100 MHz]

Bandwidth measurement:

1. Read the standard deviation value from R&S RTM3000/RTA4000.
   U_{RTx} [mV]
2. Read the power sensor level.
   P_{SENSOR} [dBm]

Evaluation:

$$\text{Attenuation [dB]} = 20 \times \log\left(\frac{U_{RTx}}{U_{RTx\_REF}}\right) - \left(P_{SENSOR} - P_{SENSOR\_REF}\right)$$

Loop:

▶ Repeat all measurements with the remaining channels.

2.2.3.6 Channel to Channel Isolation

Test equipment:

- Signal generator (refer to Test equipment, item 3)
- Cables

Channel-to-channel isolation CH1 to CH2

Test setup:

► Connect the RF output of the signal generator directly to the CH1 input of the oscilloscope.

Signal generator settings:

► [LEVEL: 8 dBm]

Table 2-8: Channel-to-channel isolation settings

Option	Signal generator frequency
RTM3000, basic instrument 2CH/4CH	100 MHz
RTA4000 basic instrument RTM3000 with B222/B242	200 MHz
RTA/RTM with B223/B243	350 MHz
RTA/RTM with B225/B245	500 MHz
RTA/RTM with B2210/B2410	1 GHz

R&S oscilloscope settings:

1. [PRESET]
2. [HORIZONTAL SCALE 2 µs/div]
3. [Waveform Rate Max. OFF]
4. [Spectrum Mode: FFT "(SPEC:MODE FFT")]
5. [CH1 : ON : Termination 50 Ω : Y-Scale 200 mV/div]
6. [CH2 : ON : Termination 50 Ω : Y-Scale 200 mV/div]
7. - **RTM basic instrument:**
     [FFT : FFT Setup : RBW Auto : Span 50 MHz : Center 100 MHz]
   - **RTM with B222/B242, RTA basic instrument:**
     [FFT : FFT Setup : RBW Auto : Span 50 MHz : Center 200 MHz]
   - **RTA/RTM with B223/B243:**
     [FFT : FFT Setup : RBW Auto : Span 50 MHz : Center 350 MHz]
   - **RTA/RTM with B225/B245:**
     [FFT : FFT Setup : RBW Auto : Span 50 MHz : Center 500 MHz]
   - **RTA/RTM with B2210/B2410:**
     [FFT : FFT Setup : RBW Auto : Span 50 MHz : Center 1 GHz]
8. [FFT : Y(t) Setup : Show Channels]
9. [CURSOR : Set cursor 1 with NAVIGATION knob to FFT center frequency]

Measurement:

1. [FFT-Source: CH2], [Cursor-Source CH2]
2. Nx-Single
3. Read curser level L1
   $L1_{CH2}$ [dBm]
4. [FFT-Source: CH1], [Cursor-Source CH1]

5. Nx-Single
6. Read curser level L1
   $L1_{CH1}$ [dBm] (approximated 8 dBm - oscilloscope attenuation of ≈ 2.5 dB)

Loop: Channel-to-channel isolation CH1 to CH2

$a_{CH1-CH2} = L1_{CH1} - L1_{CH2}$[dB]

Channel-to-channel isolation CH4 to CH3 (only for R&S RTM3004 and R&S RTA4000)

Test setup:
- ► Connect the RF output of the signal generator directly to the CH4 input of the oscilloscope.

Loop:
- ► Repeat the measurement above with CH3 and CH4 instead CH1 and CH2.

2.2.3.7 Noise Floor (only for R&S RTA4000)

Test equipment:
- No further test equipment needed

R&S RTA settings:
1. [PRESET]
2. [CH1]
3. [TERMINATION : (refer to Table 2-9)]
4. [MEAS TYPE : Std. Dev. Wave]
5. [VERTICAL : Scale (refer to Table 2-9]
6. [HORIZONTAL : 1ms/DIV]
7. [TRIGGER : Source : EXT]
8. [OFFSET : 0.0 V]

Measurement:

Table 2-9: Noise floor settings

Termination	Horizontal Scale	Vertical Scale	Max. Noise Floor
50 Ω	1 ms/div	1 V/div	38.0 mV
		500 mV/div	24.0 mV
		200 mV/div	13.0 mV
		100 mV/div	5.50 mV
		50 mV/div	2.90 mV
		20 mV/div	1.10 mV
		10 mV/div	0.50 mV
		5 mV/div	0.33 mV
		2 mV/div	0.16 mV

Termination	Horizontal Scale	Vertical Scale	Max. Noise Floor
		1 mV/div	0.14 mV
		0.5 mV/div	0.13 mV
1 MΩ	1 ms/div	10 V/div	370 mV
		5 V/div	230 mV
		2 V/div	100 mV
		1 V/div	60 mV
		500 mV/div	23 mV
		200 mV/div	10 mV
		100 mV/div	5.80 mV
		50 mV/div	2.10 mV
		20 mV/div	1.10 mV
		10 mV/div	0.60 mV
		5 mV/div	0.33 mV
		2 mV/div	0.24 mV
		1 mV/div	0.18 mV
		0.5 mV/div	0.17 mV

Evaluation:

► Read the standard deviation values from oscilloscope display for every channel separately.

Loop:

► Repeat the measurement with the remaining channels.

2.2.3.8 Internal Trigger

Test equipment:

- Signal generator (refer to Test equipment, item 3)
- Cables / adapters:
  – BNC cable (refer to Test equipment, item 11)
  – Adapter N (m) to BNC (f) (refer to Test equipment, item 9)

Test setup:

► Connect the RF output of the signal generator directly to the CH1 input of the oscilloscope.

Trigger Sensitivity A

R&S oscilloscope settings:

1. [PRESET]
2. [CH1 : Termination 50 Ω : Y-Scale 20 mV/div]
3. [VERTICAL POSITION 0 div OFFSET 0 V]
   After a preset the position of channel 2, 3 and 4 are not set to 0 div.
4. [POSITION: 0.0 DIV]

After reset channel 2,3 and 4 are not 0.0 DIV. Position setting is valid from R&S RTM3000 firmware version 01.023.

5. [HORIZONTAL SCALE see Table 2-10]
6. [TRIGGER SOURCE : Channel 1]
7. [TRIGGER SETUP : Setup : Slope "Both"]
8. [TRIGGER COUPLING : DC]
9. [`TRIGger:A:FINDlevel`]
10. [Measure: Trigger Frequency Counter]
11. Single Channel Mode
12. Verify signal level by measurement of the DUT (STDD wave)

Table 2-10: Internal trigger, signal generator settings

Option	Horizontal scale	Signal generator level	Signal generator frequency
All	200 µs/div	1 division at DUT	10 kHz
RTM3000, basic instrument 2CH/4CH	20 ns/div	1 division at DUT	100 MHz
RTA4000 basic instrument RTM3000 with B222/B242	10 ns/div	1 division at DUT	200 MHz
RTA/RTM with B223/B243	5 ns/div	1.4 division at DUT	350 MHz
RTA/RTM with B225/B245	2 ns/div	1.4 division at DUT	500 MHz
RTA/RTM with B2210/B2410	1 ns/div	1.6 division at DUT	1 GHz

Measurement:

► Read indicated trigger frequency on the oscilloscope within 2 % of generator frequency.

Loop:

► Repeat all measurements with the remaining channels.

Trigger source: AC Line

R&S oscilloscope settings:

1. [PRESET]
2. [TRIGGER SOURCE : AC Line]
3. [Measure : Trigger Frequency Counter]

Measurement:

► Read out Trigger Frequency

Evaluation:

► Depending on the AC line frequency of the location, the frequency reading is 50 Hz or 60 Hz within 5% tolerance.

2.2.3.9 External Trigger

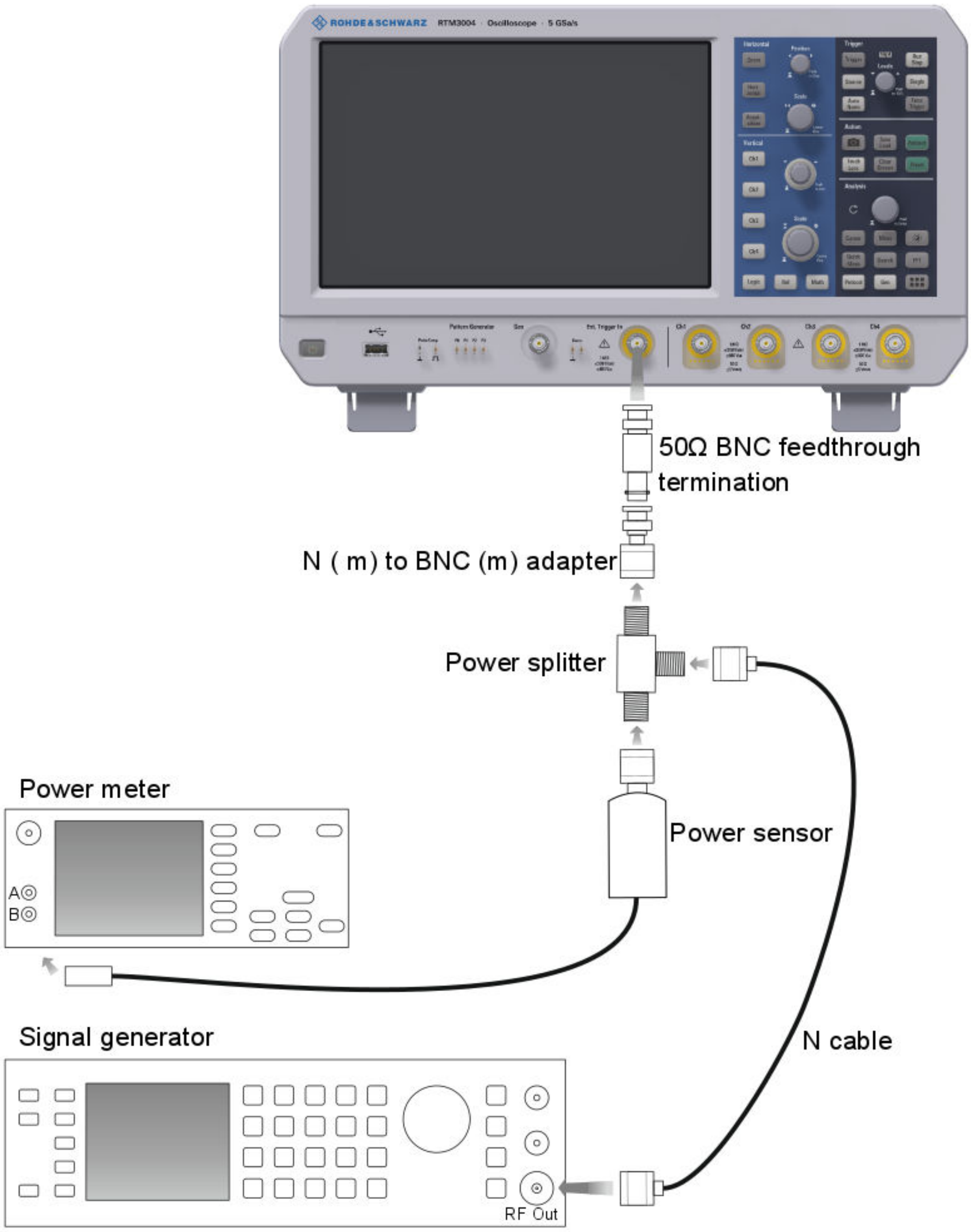


Figure 2-4: Test Setup for External Trigger

Test equipment:

- Signal generator (refer to Test equipment, item 3)
- Power sensor (refer to Test equipment, item 4)
- Power meter (refer to Test equipment, item 5a or 5b)
- Power splitter (refer to Test equipment, item 6)
- Feed through termination 50 Ω (refer to Test equipment, item 8)
- Cables / adapters:

– BNC cable (refer to Test equipment, item 11)
– Adapter N (m) to BNC (f) (refer to Test equipment, item 9)

Test setup:

1. Connect equipment as shown above.
2. Connect the signal generator to the power splitter input.
3. Connect the power splitter output 1 to power sensor.
4. Connect the power splitter output 2 via a 50 Ω feed trough terminator to the external trigger input of the oscilloscope.

Ensure that the cables from the splitter to the power sensor and to the external trigger input are of equal length and are as short as possible.

Ext. Trigger Sensitivity

R&S oscilloscope settings:

1. [PRESET]
2. [TRIGGER SOURCE : Extern : DC]
3. Termination : Feed through termination 50 Ω
4. [TRIGGER LEVEL : 0V]
5. [TRIGGER SETUP : Setup : Slope "Both"]
6. Measure the trigger frequency counter
   SCPI: `TCO:ENAB ON`

Signal generator settings:

Table 2-11: External trigger measurement settings

Signal generator frequency	Voltage at external trigger input	Power meter display
10 kHz	300 mVpp	-6.48 dBm
500 MHz	300 mVpp	-6.48 dBm

Note the 6 dB attenuation of the power splitter for setup signal generators level.

Measurement:

► Read indicated trigger frequency on the oscilloscope within 2 % of generator frequency.

2.2.4 Waveform Generator Test on R&S RTM3000/RTA4000

2.2.4.1 DC Output voltage

DC Output Voltage

Test equipment:

- Voltmeter (Test equipment, item 2)

Test setup:

► Connect the voltmeter to the generator output of the oscilloscope.

R&S oscilloscope settings:

1. [PRESET]
2. [Set generator output type DC]
3. [Set output load to High-Z]

Measurement:

1. Set the oscilloscope's generator DC voltage according to Table 2-12.
2. Measure the voltage with the voltmeter.

Table 2-12: DC output voltage settings

DC Output Voltage						
5 V	1 V	50 mV	0	-50 mV	-1 V	-5 V

Evaluation:

▶ Measure U_{DC} ±3% or U_{DC} ± 5mV, whichever is greater.

2.2.4.2 LF Output Voltage

LF Output Voltage

Test equipment:

- Voltmeter (refer to Test equipment, item 2)

Test setup:

▶ Connect the voltmeter to the generator output of the oscilloscope.

R&S oscilloscope settings:

1. [PRESET]
2. [Set generator output type SINE]
3. [Set output load to High-Z]

Measurement:

1. Set the oscilloscope's generator frequency and amplitude according to the table below.
2. Measure the voltage with the voltmeter.

Table 2-13: LF output voltage settings

Sine wave output voltage				
Frequency	100 Hz	1 kHz	10 kHz	100 kHz
Amplitude 1	5 Vpp	5 Vpp	5 Vpp	5 Vpp
Amplitude 2	100 mVpp	100 mVpp	100 mVpp	100 mVpp

Evaluation:

▶ Measure U_{AC} ±3%

2.3 Performance Test Report

ROHDE&SCHWARZ	Digital Oscilloscope		
	R&S RTM3002	1335.8794.02	
	R&S RTM3004	1335.8794.04	
	R&S RTA4004	1335.7700.04	
Model:			
Serial number:			
Date:			
Person responsible:			
Signature:			

For nominal data and limit values refer to the data sheet supplied with the instrument.

2.3.1 DC Gain Accuracy (for R&S RTM3000 Models)

Channel 1; Input Resistance: 1 MΩ

Vertical Scale	Calibration Voltage	DL	Actual		MU
10 V/div	±36 V	±1.5 %		%	
5 V/div	±18 V	±1.5 %		%	
2 V/div	±7.2 V	±1.5 %		%	
1 V/div	±3.6 V	±1.5 %		%	
500 mV/div	±1.8 V	±1.5 %		%	
200 mV/div	±720 mV	±1.5 %		%	
100 mV/div	±360 mV	±1.5 %		%	
50 mV/div	±180 mV	±1.5 %		%	
20 mV/div	±72 mV	±1.5 %		%	
10 mV/div	±36 mV	±1.5 %		%	
5 mV/div	±18 mV	±2.0 %		%	
2 mV/div	±7.2 mV	±2.0 %		%	

Channel 1; Input Resistance: 50 Ω

Vertical Scale	Calibration Voltage	DL	Actual		MU
1 V/div	±3.6 V	±1.5 %		%	
500 mV/div	±1.8 V	±1.5 %		%	
200 mV/div	±720 mV	±1.5 %		%	
100 mV/div	±360 mV	±1.5 %		%	
50 mV/div	±180 mV	±1.5 %		%	
20 mV/div	±72 mV	±1.5 %		%	
10 mV/div	±36 mV	±1.5 %		%	
5 mV/div	±18 mV	±2.0 %		%	
2 mV/div	±7.2 mV	±2.0 %		%	

Channel 2; Input Resistance: 1 MΩ

Vertical Scale	Calibration Voltage	DL	Actual		MU
10 V/div	±36 V	±1.5 %		%	
5 V/div	±18 V	±1.5 %		%	
2 V/div	±7.2 V	±1.5 %		%	
1 V/div	±3.6 V	±1.5 %		%	
500 mV/div	±1.8 V	±1.5 %		%	
200 mV/div	±720 mV	±1.5 %		%	
100 mV/div	±360 mV	±1.5 %		%	
50 mV/div	±180 mV	±1.5 %		%	
20 mV/div	±72 mV	±1.5 %		%	
10 mV/div	±36 mV	±1.5 %		%	
5 mV/div	±18 mV	±2.0 %		%	
2 mV/div	±7.2 mV	±2.0 %		%	

Channel 2; Input Resistance: 50 Ω

Vertical Scale	Calibration Voltage	DL	Actual		MU
1 V/div	±3.6 V	±1.5 %		%	
500 mV/div	±1.8 V	±1.5 %		%	
200 mV/div	±720 mV	±1.5 %		%	
100 mV/div	±360 mV	±1.5 %		%	
50 mV/div	±180 mV	±1.5 %		%	

Vertical Scale	Calibration Voltage	DL	Actual		MU
20 mV/div	±72 mV	±1.5 %		%	
10 mV/div	±36 mV	±1.5 %		%	
5 mV/div	±18 mV	±2.0 %		%	
2 mV/div	±7.2 mV	±2.0 %		%	

Channel 3; Input Resistance: 1 MΩ (only for R&S RTM3004)

Vertical Scale	Calibration Voltage	DL	Actual		MU
10 V/div	±36 V	±1.5 %		%	
5 V/div	±18 V	±1.5 %		%	
2 V/div	±7.2 V	±1.5 %		%	
1 V/div	±3.6 V	±1.5 %		%	
500 mV/div	±1.8 V	±1.5 %		%	
200 mV/div	±720 mV	±1.5 %		%	
100 mV/div	±360 mV	±1.5 %		%	
50 mV/div	±180 mV	±1.5 %		%	
20 mV/div	±72 mV	±1.5 %		%	
10 mV/div	±36 mV	±1.5 %		%	
5 mV/div	±18 mV	±2.0 %		%	
2 mV/div	±7.2 mV	±2.0 %		%	

Channel 3; Input Resistance: 50 Ω (only for R&S RTM3004)

Vertical Scale	Calibration Voltage	DL	Actual		MU
1 V/div	±3.6 V	±1.5 %		%	
500 mV/div	±1.8 V	±1.5 %		%	
200 mV/div	±720 mV	±1.5 %		%	
100 mV/div	±360 mV	±1.5 %		%	
50 mV/div	±180 mV	±1.5 %		%	
20 mV/div	±72 mV	±1.5 %		%	
10 mV/div	±36 mV	±1.5 %		%	
5 mV/div	±18 mV	±2.0 %		%	
2 mV/div	±7.2 mV	±2.0 %		%	

Channel 4; Input Resistance: 1 MΩ (only for R&S RTM3004)

Vertical Scale	Calibration Voltage	DL	Actual		MU
10 V/div	±36 V	±1.5 %		%	
5 V/div	±18 V	±1.5 %		%	
2 V/div	±7.2 V	±1.5 %		%	
1 V/div	±3.6 V	±1.5 %		%	
500 mV/div	±1.8 V	±1.5 %		%	
200 mV/div	±720 mV	±1.5 %		%	
100 mV/div	±360 mV	±1.5 %		%	
50 mV/div	±180 mV	±1.5 %		%	
20 mV/div	±72 mV	±1.5 %		%	
10 mV/div	±36 mV	±1.5 %		%	
5 mV/div	±18 mV	±2.0 %		%	
2 mV/div	±7.2 mV	±2.0 %		%	

Channel 4; Input Resistance: 50 Ω (only for R&S RTM3004)

Vertical Scale	Calibration Voltage	DL	Actual		MU
1 V/div	±3.6 V	±1.5 %		%	
500 mV/div	±1.8 V	±1.5 %		%	
200 mV/div	±720 mV	±1.5 %		%	
100 mV/div	±360 mV	±1.5 %		%	
50 mV/div	±180 mV	±1.5 %		%	
20 mV/div	±72 mV	±1.5 %		%	
10 mV/div	±36 mV	±1.5 %		%	
5 mV/div	±18 mV	±2.0 %		%	
2 mV/div	±7.2 mV	±2.0 %		%	

2.3.2 DC Gain Accuracy (for R&S RTA4004)

Channel 1; Input Resistance: 1 MΩ

Vertical Scale	Calibration Voltage	DL	Actual		MU
10 V/div	±36 V	±1.0 %		%	
5 V/div	±18 V	±1.0 %		%	

Vertical Scale	Calibration Voltage	DL	Actual		MU
2 V/div	±7.2 V	±1.0 %		%	
1 V/div	±3.6 V	±1.0 %		%	
500 mV/div	±1.8 V	±1.0 %		%	
200 mV/div	±720 mV	±1.0 %		%	
100 mV/div	±360 mV	±1.0 %		%	
50 mV/div	±180 mV	±1.0 %		%	
20 mV/div	±72 mV	±1.0 %		%	
10 mV/div	±36 mV	±1.0 %		%	
5 mV/div	±18 mV	±1.5 %		%	
2 mV/div	±7.2 mV	±1.5 %		%	

Channel 1; Input Resistance: 50 Ω

Vertical Scale	Calibration Voltage	DL	Actual		MU
1 V/div	±3.6 V	±1.0 %		%	
500 mV/div	±1.8 V	±1.0 %		%	
200 mV/div	±720 mV	±1.0 %		%	
100 mV/div	±360 mV	±1.0 %		%	
50 mV/div	±180 mV	±1.0 %		%	
20 mV/div	±72 mV	±1.0 %		%	
10 mV/div	±36 mV	±1.0 %		%	
5 mV/div	±18 mV	±1.5 %		%	
2 mV/div	±7.2 mV	±1.5 %		%	

Channel 2; Input Resistance: 1 MΩ

Vertical Scale	Calibration Voltage	DL	Actual		MU
10 V/div	±36 V	±1.0 %		%	
5 V/div	±18 V	±1.0 %		%	
2 V/div	±7.2 V	±1.0 %		%	
1 V/div	±3.6 V	±1.0 %		%	
500 mV/div	±1.8 V	±1.0 %		%	
200 mV/div	±720 mV	±1.0 %		%	
100 mV/div	±360 mV	±1.0 %		%	
50 mV/div	±180 mV	±1.0 %		%	

Vertical Scale	Calibration Voltage	DL	Actual		MU
20 mV/div	±72 mV	±1.0 %		%	
10 mV/div	±36 mV	±1.0 %		%	
5 mV/div	±18 mV	±1.5 %		%	
2 mV/div	±7.2 mV	±1.5 %		%	

Channel 2; Input Resistance: 50 Ω

Vertical Scale	Calibration Voltage	DL	Actual		MU
1 V/div	±3.6 V	±1.0 %		%	
500 mV/div	±1.8 V	±1.0 %		%	
200 mV/div	±720 mV	±1.0 %		%	
100 mV/div	±360 mV	±1.0 %		%	
50 mV/div	±180 mV	±1.0 %		%	
20 mV/div	±72 mV	±1.0 %		%	
10 mV/div	±36 mV	±1.0 %		%	
5 mV/div	±18 mV	±1.5 %		%	
2 mV/div	±7.2 mV	±1.5 %		%	

Channel 3; Input Resistance: 1 MΩ

Vertical Scale	Calibration Voltage	DL	Actual		MU
10 V/div	±36 V	±1.0 %		%	
5 V/div	±18 V	±1.0 %		%	
2 V/div	±7.2 V	±1.0 %		%	
1 V/div	±3.6 V	±1.0 %		%	
500 mV/div	±1.8 V	±1.0 %		%	
200 mV/div	±720 mV	±1.0 %		%	
100 mV/div	±360 mV	±1.0 %		%	
50 mV/div	±180 mV	±1.0 %		%	
20 mV/div	±72 mV	±1.0 %		%	
10 mV/div	±36 mV	±1.0 %		%	
5 mV/div	±18 mV	±1.5 %		%	
2 mV/div	±7.2 mV	±1.5 %		%	

Channel 3; Input Resistance: 50 Ω

Vertical Scale	Calibration Voltage	DL	Actual		MU
1 V/div	±3.6 V	±1.0 %		%	
500 mV/div	±1.8 V	±1.0 %		%	
200 mV/div	±720 mV	±1.0 %		%	
100 mV/div	±360 mV	±1.0 %		%	
50 mV/div	±180 mV	±1.0 %		%	
20 mV/div	±72 mV	±1.0 %		%	
10 mV/div	±36 mV	±1.0 %		%	
5 mV/div	±18 mV	±1.5 %		%	
2 mV/div	±7.2 mV	±1.5 %		%	

Channel 4; Input Resistance: 1 MΩ

Vertical Scale	Calibration Voltage	DL	Actual		MU
10 V/div	±36 V	±1.0 %		%	
5 V/div	±18 V	±1.0 %		%	
2 V/div	±7.2 V	±1.0 %		%	
1 V/div	±3.6 V	±1.0 %		%	
500 mV/div	±1.8 V	±1.0 %		%	
200 mV/div	±720 mV	±1.0 %		%	
100 mV/div	±360 mV	±1.0 %		%	
50 mV/div	±180 mV	±1.0 %		%	
20 mV/div	±72 mV	±1.0 %		%	
10 mV/div	±36 mV	±1.0 %		%	
5 mV/div	±18 mV	±1.5 %		%	
2 mV/div	±7.2 mV	±1.5 %		%	

Channel 4; Input Resistance: 50 Ω

Vertical Scale	Calibration Voltage	DL	Actual		MU
1 V/div	±3.6 V	±1.0 %		%	
500 mV/div	±1.8 V	±1.0 %		%	
200 mV/div	±720 mV	±1.0 %		%	
100 mV/div	±360 mV	±1.0 %		%	
50 mV/div	±180 mV	±1.0 %		%	

Vertical Scale	Calibration Voltage	DL	Actual		MU
20 mV/div	±72 mV	±1.0 %		%	
10 mV/div	±36 mV	±1.0 %		%	
5 mV/div	±18 mV	±1.5 %		%	
2 mV/div	±7.2 mV	±1.5 %		%	

2.3.3 Offset Accuracy

Channel 1; Input Resistance: 1 MΩ

Vertical Scale	Offset and Calibration Voltage	DL	Actual		MU
1 V/div	0 V	±100.00 mV		mV	
1 V/div	+40 V	±300.00 mV		mV	
1 V/div	-40 V	±300.00 mV		mV	
100 mV/div	0 V	±10.00 mV		mV	
100 mV/div	+25 V	±135.00 mV		mV	
100 mV/div	-25 V	±135.00 mV		mV	
5 mV/div	0 V	±0.75 mV		mV	
5 mV/div	+2 V	±10.5 mV		mV	
5 mV/div	-2 V	±10.5 mV		mV	

Channel 1; Input Resistance: 50 Ω

Vertical Scale	Offset and Calibration Voltage	DL	Actual		MU
500 mV/div	0 V	±50.00 mV		mV	
500 mV/div	+5 V	±75.00 mV		mV	
500 mV/div	-5 V	±75.00 mV		mV	
50 mV/div	0 V	±5.50 mV		mV	
50 mV/div	+5 V	±30.50 mV		mV	
50 mV/div	-5 V	±30.50 mV		mV	
5 mV/div	0 V	±1 mV		mV	
5 mV/div	+2 V	±11 mV		mV	
5 mV/div	-2 V	±11 mV		mV	

Channel 2; Input Resistance: 1 MΩ

Vertical Scale	Offset and Calibration Voltage	DL	Actual		MU
1 V/div	0 V	±100.00 mV		mV	
1 V/div	+40 V	±300.00 mV		mV	
1 V/div	-40 V	±300.00 mV		mV	
100 mV/div	0 V	±10.00 mV		mV	
100 mV/div	+25 V	±135.00 mV		mV	
100 mV/div	-25 V	±135.00 mV		mV	
5 mV/div	0 V	±0.75 mV		mV	
5 mV/div	+2 V	±10.5 mV		mV	
5 mV/div	-2 V	±10.5 mV		mV	

Channel 2; Input Resistance: 50 Ω

Vertical Scale	Offset and Calibration Voltage	DL	Actual		MU
500 mV/div	0 V	±50.00 mV		mV	
500 mV/div	+5 V	±75.00 mV		mV	
500 mV/div	-5 V	±75.00 mV		mV	
50 mV/div	0 V	±5.50 mV		mV	
50 mV/div	+5 V	±30.50 mV		mV	
50 mV/div	-5 V	±30.50 mV		mV	
5 mV/div	0 V	±1 mV		mV	
5 mV/div	+2 V	±11 mV		mV	
5 mV/div	-2 V	±11 mV		mV	

Channel 3; Input Resistance: 1 MΩ (only for R&S RTM3004 and R&S RTA4004)

Vertical Scale	Offset and Calibration Voltage	DL	Actual		MU
1 V/div	0 V	±100.00 mV		mV	
1 V/div	+40 V	±300.00 mV		mV	
1 V/div	-40 V	±300.00 mV		mV	
100 mV/div	0 V	±10.00 mV		mV	
100 mV/div	+25 V	±135.00 mV		mV	
100 mV/div	-25 V	±135.00 mV		mV	

Vertical Scale	Offset and Calibration Voltage	DL	Actual		MU
5 mV/div	0 V	±0.75 mV		mV	
5 mV/div	+2 V	±10.5 mV		mV	
5 mV/div	-2 V	±10.5 mV		mV	

Channel 3; Input Resistance: 50 Ω (only for R&S RTM3004 and R&S RTA4004)

Vertical Scale	Offset and Calibration Voltage	DL	Actual		MU
500 mV/div	0 V	±50.00 mV		mV	
500 mV/div	+5 V	±75.00 mV		mV	
500 mV/div	-5 V	±75.00 mV		mV	
50 mV/div	0 V	±5.50 mV		mV	
50 mV/div	+5 V	±30.50 mV		mV	
50 mV/div	-5 V	±30.50 mV		mV	
5 mV/div	0 V	±1 mV		mV	
5 mV/div	+2 V	±11 mV		mV	
5 mV/div	-2 V	±11 mV		mV	

Channel 4; Input Resistance: 1 MΩ (only for R&S RTM3004 and R&S RTA4004)

Vertical Scale	Offset and Calibration Voltage	DL	Actual		MU
1 V/div	0 V	±100.00 mV		mV	
1 V/div	+40 V	±300.00 mV		mV	
1 V/div	-40 V	±300.00 mV		mV	
100 mV/div	0 V	±10.00 mV		mV	
100 mV/div	+25 V	±135.00 mV		mV	
100 mV/div	-25 V	±135.00 mV		mV	
5 mV/div	0 V	±0.75 mV		mV	
5 mV/div	+2 V	±10.5 mV		mV	
5 mV/div	-2 V	±10.5 mV		mV	

Channel 4; Input Resistance: 50 Ω (only for R&S RTM3004 and R&S RTA4004)

Vertical Scale	Offset and Calibration Voltage	DL	Actual		MU
500 mV/div	0 V	±50.00 mV		mV	
500 mV/div	+5 V	±75.00 mV		mV	
500 mV/div	-5 V	±75.00 mV		mV	
50 mV/div	0 V	±5.50 mV		mV	
50 mV/div	+5 V	±30.50 mV		mV	
50 mV/div	-5 V	±30.50 mV		mV	
5 mV/div	0 V	±1 mV		mV	
5 mV/div	+2 V	±11 mV		mV	
5 mV/div	-2 V	±11 mV		mV	

2.3.4 Reference Frequency Accuracy (for R&S RTM3000 Models)

Reference frequency	DL	Actual		MU
10 MHz at TRIGGER OUT	±2.5 ppm		ppm	

2.3.5 Reference Frequency Accuracy (for R&S RTA4004)

Reference frequency	DL	Actual		MU
10 MHz at TRIGGER OUT	±0.5 ppm		ppm	

2.3.6 Noise Floor (for R&S RTA4004)

Channel 1; Input Resistance: 1 MΩ

Vertical Scale	DL	Actual	
10 V/div	370 mV		mV
5 V/div	230 mV		mV
2 V/div	100 mV		mV
1 V/div	60 mV		mV
500 mV/div	23 mV		mV
200 mV/div	10 mV		mV
100 mV/div	5.80 mV		mV

Vertical Scale	DL	Actual	
50 mV/div	2.10 mV		mV
20 mV/div	1.10 mV		mV
10 mV/div	0.60 mV		mV
5 mV/div	0.33 mV		mV
2 mV/div	0.24 mV		mV
1 mV/div	0.18 mV		mV
0.5 mV/div	0.17 mV		mV

Channel 1; Input Resistance: 50 Ω

Vertical Scale	DL	Actual	
1 V/div	38 mV		mV
500 mV/div	24 mV		mV
200 mV/div	13 mV		mV
100 mV/div	5.50 mV		mV
50 mV/div	2.90 mV		mV
20 mV/div	1.10 mV		mV
10 mV/div	0.50 mV		mV
5 mV/div	0.33 mV		mV
2 mV/div	0.16 mV		mV
1 mV/div	0.14 mV		mV
0.5 mV/div	0.13 mV		mV

Channel 2; Input Resistance: 1 MΩ

Vertical Scale	DL	Actual	
10 V/div	370 mV		mV
5 V/div	230 mV		mV
2 V/div	100 mV		mV
1 V/div	60 mV		mV
500 mV/div	23 mV		mV
200 mV/div	10 mV		mV
100 mV/div	5.80 mV		mV
50 mV/div	2.10 mV		mV
20 mV/div	1.10 mV		mV

Vertical Scale	DL	Actual	
10 mV/div	0.60 mV		mV
5 mV/div	0.33 mV		mV
2 mV/div	0.24 mV		mV
1 mV/div	0.18 mV		mV
0.5 mV/div	0.17 mV		mV

Channel 2; Input Resistance: 50 Ω

Vertical Scale	DL	Actual	
1 V/div	38 mV		mV
500 mV/div	24 mV		mV
200 mV/div	13 mV		mV
100 mV/div	5.50 mV		mV
50 mV/div	2.90 mV		mV
20 mV/div	1.10 mV		mV
10 mV/div	0.50 mV		mV
5 mV/div	0.33 mV		mV
2 mV/div	0.16 mV		mV
1 mV/div	0.14 mV		mV
0.5 mV/div	0.13 mV		mV

Channel 3; Input Resistance: 1 MΩ

Vertical Scale	DL	Actual	
10 V/div	370 mV		mV
5 V/div	230 mV		mV
2 V/div	100 mV		mV
1 V/div	60 mV		mV
500 mV/div	23 mV		mV
200 mV/div	10 mV		mV
100 mV/div	5.80 mV		mV
50 mV/div	2.10 mV		mV
20 mV/div	1.10 mV		mV
10 mV/div	0.60 mV		mV
5 mV/div	0.33 mV		mV

Vertical Scale	DL	Actual	
2 mV/div	0.24 mV		mV
1 mV/div	0.18 mV		mV
0.5 mV/div	0.17 mV		mV

Channel 3; Input Resistance: 50 Ω

Vertical Scale	DL	Actual	
1 V/div	38 mV		mV
500 mV/div	24 mV		mV
200 mV/div	13 mV		mV
100 mV/div	5.50 mV		mV
50 mV/div	2.90 mV		mV
20 mV/div	1.10 mV		mV
10 mV/div	0.50 mV		mV
5 mV/div	0.33 mV		mV
2 mV/div	0.16 mV		mV
1 mV/div	0.14 mV		mV
0.5 mV/div	0.13 mV		mV

Channel 4; Input Resistance: 1 MΩ

Vertical Scale	DL	Actual	
10 V/div	370 mV		mV
5 V/div	230 mV		mV
2 V/div	100 mV		mV
1 V/div	60 mV		mV
500 mV/div	23 mV		mV
200 mV/div	10 mV		mV
100 mV/div	5.80 mV		mV
50 mV/div	2.10 mV		mV
20 mV/div	1.10 mV		mV
10 mV/div	0.60 mV		mV
5 mV/div	0.33 mV		mV
2 mV/div	0.24 mV		mV

Vertical Scale	DL	Actual	
1 mV/div	0.18 mV		mV
0.5 mV/div	0.17 mV		mV

Channel 4; Input Resistance: 50 Ω

Vertical Scale	DL	Actual	
1 V/div	38 mV		mV
500 mV/div	24 mV		mV
200 mV/div	13 mV		mV
100 mV/div	5.50 mV		mV
50 mV/div	2.90 mV		mV
20 mV/div	1.10 mV		mV
10 mV/div	0.50 mV		mV
5 mV/div	0.33 mV		mV
2 mV/div	0.16 mV		mV
1 mV/div	0.14 mV		mV
0.5 mV/div	0.13 mV		mV

2.3.7 Probe Identification; Passive Probe

Channel 1; Passive Probe

		Actual
Identification	Pass / Fail	

Channel 2; Passive Probe

		Actual
Identification	Pass / Fail	

Channel 3; Passive Probe (only for R&S RTM3004 and R&S RTA4004)

		Actual
Identification	Pass / Fail	

Channel 4; Passive Probe (only for R&S RTM3004 and R&S RTA4004)

		Actual
Identification	Pass / Fail	

2.3.8 Probe Identification; Active Probe

Channel 1; Active Probe

		Actual
Identification	Pass / Fail	

Channel 2; Active Probe

		Actual
Identification	Pass / Fail	

Channel 3; Active Probe (only for R&S RTM3004 and R&S RTA4004)

		Actual
Identification	Pass / Fail	

Channel 4; Active Probe (only for R&S RTM3004 and R&S RTA4004)

		Actual
Identification	Pass / Fail	

2.3.9 Analog Bandwidth

Channel 1; Analog Bandwidth

Vertical Scale	Level signal generator peak to peak	Reference frequency	Generator frequency	Bandwidth	DLL	Actual		MU
Bandwidth: 100 MHz (only R&S RTM3000)								
500 mV/div	2 V	1 MHz	100 MHz	100 MHz	-3 dB		dB	
50 mV/div	400 mV	1 MHz	100 MHz	100 MHz	-3 dB		dB	
5 mV/div	40 mV	1 MHz	100 MHz	100 MHz	-3 dB		dB	
1 mV/div	8 mV	1 MHz	100 MHz	100 MHz	-3 dB		dB	

Vertical Scale	Level signal generator peak to peak	Reference frequency	Generator frequency	Bandwidth	DLL	Actual		MU
Bandwidth: 200 MHz								
500 mV/div	2 V	1 MHz	200 MHz	200 MHz	-3 dB		dB	
50 mV/div	400 mV	1 MHz	200 MHz	200 MHz	-3 dB		dB	
5 mV/div	40 mV	1 MHz	200 MHz	200 MHz	-3 dB		dB	
1 mV/div	8 mV	1 MHz	200 MHz	200 MHz	-3 dB		dB	
Bandwidth: 350 MHz								
500 mV/div	2 V	1 MHz	350 MHz	350 MHz	-3 dB		dB	
50 mV/div	400 mV	1 MHz	350 MHz	350 MHz	-3 dB		dB	
5 mV/div	40 mV	1 MHz	350 MHz	350 MHz	-3 dB		dB	
1 mV/div	8 mV	1 MHz	350 MHz	350 MHz	-3 dB		dB	
Bandwidth: 500 MHz								
500 mV/div	2 V	1 MHz	500 MHz	500 MHz	-3 dB		dB	
50 mV/div	400 mV	1 MHz	500 MHz	500 MHz	-3 dB		dB	
5 mV/div	40 mV	1 MHz	500 MHz	500 MHz	-3 dB		dB	
1 mV/div	8 mV	1 MHz	500 MHz	500 MHz	-3 dB		dB	
Bandwidth: 1 GHz								
500 mV/div	2 V	1 MHz	1 GHz	1 GHz	-3 dB		dB	
50 mV/div	400 mV	1 MHz	1 GHz	1 GHz	-3 dB		dB	
5 mV/div	40 mV	1 MHz	1 GHz	1 GHz	-3 dB		dB	
1 mV/div	8 mV	1 MHz	1 GHz	1 GHz	-3 dB		dB	

Channel 1; Analog Bandwidth; Bandwidth limitation

Vertical Scale	R&S RTM3000/ RTA4000 band-width set-ting	Level signal generator peak to peak	Generator frequency reference value	Generator frequency	DLL	DUL	Actual		MU
5 mV/div	20 MHz	40 mV	1 MHz	20 MHz	-3.50 dB	-1.80 dB		dB	

Channel 2; Analog Bandwidth

Vertical Scale	Level signal generator peak to peak	Reference frequency	Generator frequency	Bandwidth	DLL	Actual		MU
Bandwidth: 100 MHz (only R&S RTM3000)								
500 mV/div	2 V	1 MHz	100 MHz	100 MHz	-3 dB		dB	
50 mV/div	400 mV	1 MHz	100 MHz	100 MHz	-3 dB		dB	
5 mV/div	40 mV	1 MHz	100 MHz	100 MHz	-3 dB		dB	
1 mV/div	8 mV	1 MHz	100 MHz	100 MHz	-3 dB		dB	
Bandwidth: 200 MHz								
500 mV/div	2 V	1 MHz	200 MHz	200 MHz	-3 dB		dB	
50 mV/div	400 mV	1 MHz	200 MHz	200 MHz	-3 dB		dB	
5 mV/div	40 mV	1 MHz	200 MHz	200 MHz	-3 dB		dB	
1 mV/div	8 mV	1 MHz	200 MHz	200 MHz	-3 dB		dB	
Bandwidth: 350 MHz								
500 mV/div	2 V	1 MHz	350 MHz	350 MHz	-3 dB		dB	
50 mV/div	400 mV	1 MHz	350 MHz	350 MHz	-3 dB		dB	
5 mV/div	40 mV	1 MHz	350 MHz	350 MHz	-3 dB		dB	
1 mV/div	8 mV	1 MHz	350 MHz	350 MHz	-3 dB		dB	
Bandwidth: 500 MHz								
500 mV/div	2 V	1 MHz	500 MHz	500 MHz	-3 dB		dB	
50 mV/div	400 mV	1 MHz	500 MHz	500 MHz	-3 dB		dB	
5 mV/div	40 mV	1 MHz	500 MHz	500 MHz	-3 dB		dB	
1 mV/div	8 mV	1 MHz	500 MHz	500 MHz	-3 dB		dB	
Bandwidth: 1 GHz								
500 mV/div	2 V	1 MHz	1 GHz	1 GHz	-3 dB		dB	
50 mV/div	400 mV	1 MHz	1 GHz	1 GHz	-3 dB		dB	
5 mV/div	40 mV	1 MHz	1 GHz	1 GHz	-3 dB		dB	
1 mV/div	8 mV	1 MHz	1 GHz	1 GHz	-3 dB		dB	

Channel 2; Analog Bandwidth; Bandwidth limitation

Vertical Scale	R&S RTM3000/ RTA4000 band-width set-ting	Level signal generator peak to peak	Generator frequency reference value	Generator frequency	DLL	DUL	Actual		MU
5 mV/div	20 MHz	40 mV	1 MHz	20 MHz	-3.50 dB	-1.80 dB		dB	

Channel 3; Analog Bandwidth (only for R&S RTM3004 and R&S RTA4004)

Vertical Scale	Level signal generator peak to peak	Reference frequency	Generator frequency	Bandwidth	DLL	Actual		MU
Bandwidth: 100 MHz (only R&S RTM3000)								
500 mV/div	2 V	1 MHz	100 MHz	100 MHz	-3 dB		dB	
50 mV/div	400 mV	1 MHz	100 MHz	100 MHz	-3 dB		dB	
5 mV/div	40 mV	1 MHz	100 MHz	100 MHz	-3 dB		dB	
1 mV/div	8 mV	1 MHz	100 MHz	100 MHz	-3 dB		dB	
Bandwidth: 200 MHz								
500 mV/div	2 V	1 MHz	200 MHz	200 MHz	-3 dB		dB	
50 mV/div	400 mV	1 MHz	200 MHz	200 MHz	-3 dB		dB	
5 mV/div	40 mV	1 MHz	200 MHz	200 MHz	-3 dB		dB	
1 mV/div	8 mV	1 MHz	200 MHz	200 MHz	-3 dB		dB	
Bandwidth: 350 MHz								
500 mV/div	2 V	1 MHz	350 MHz	350 MHz	-3 dB		dB	
50 mV/div	400 mV	1 MHz	350 MHz	350 MHz	-3 dB		dB	
5 mV/div	40 mV	1 MHz	350 MHz	350 MHz	-3 dB		dB	
1 mV/div	8 mV	1 MHz	350 MHz	350 MHz	-3 dB		dB	
Bandwidth: 500 MHz								
500 mV/div	2 V	1 MHz	500 MHz	500 MHz	-3 dB		dB	
50 mV/div	400 mV	1 MHz	500 MHz	500 MHz	-3 dB		dB	
5 mV/div	40 mV	1 MHz	500 MHz	500 MHz	-3 dB		dB	
1 mV/div	8 mV	1 MHz	500 MHz	500 MHz	-3 dB		dB	
Bandwidth: 1 GHz								
500 mV/div	2 V	1 MHz	1 GHz	1 GHz	-3 dB		dB	
50 mV/div	400 mV	1 MHz	1 GHz	1 GHz	-3 dB		dB	

Vertical Scale	Level signal generator peak to peak	Reference frequency	Generator frequency	Bandwidth	DLL	Actual		MU
5 mV/div	40 mV	1 MHz	1 GHz	1 GHz	-3 dB		dB	
1 mV/div	8 mV	1 MHz	1 GHz	1 GHz	-3 dB		dB	

Channel 3; Analog Bandwidth; Bandwidth limitation (only for R&S RTM3004 and R&S RTA4004)

Vertical Scale	R&S RTM3000/ RTA4000 band-width set-ting	Level signal generator peak to peak	Generator frequency reference value	Generator frequency	DLL	DUL	Actual		MU
5 mV/div	20 MHz	40 mV	1 MHz	20 MHz	-3.50 dB	-1.80 dB		dB	

Channel 4; Analog Bandwidth (only for R&S RTM3004 and R&S RTA4004)

Vertical Scale	Level signal generator peak to peak	Reference frequency	Generator frequency	Bandwidth	DLL	Actual		MU
Bandwidth: 100 MHz (only R&S RTM3000)								
500 mV/div	2 V	1 MHz	100 MHz	100 MHz	-3 dB		dB	
50 mV/div	400 mV	1 MHz	100 MHz	100 MHz	-3 dB		dB	
5 mV/div	40 mV	1 MHz	100 MHz	100 MHz	-3 dB		dB	
1 mV/div	8 mV	1 MHz	100 MHz	100 MHz	-3 dB		dB	
Bandwidth: 200 MHz								
500 mV/div	2 V	1 MHz	200 MHz	200 MHz	-3 dB		dB	
50 mV/div	400 mV	1 MHz	200 MHz	200 MHz	-3 dB		dB	
5 mV/div	40 mV	1 MHz	200 MHz	200 MHz	-3 dB		dB	
1 mV/div	8 mV	1 MHz	200 MHz	200 MHz	-3 dB		dB	
Bandwidth: 350 MHz								
500 mV/div	2 V	1 MHz	350 MHz	350 MHz	-3 dB		dB	
50 mV/div	400 mV	1 MHz	350 MHz	350 MHz	-3 dB		dB	
5 mV/div	40 mV	1 MHz	350 MHz	350 MHz	-3 dB		dB	
1 mV/div	8 mV	1 MHz	350 MHz	350 MHz	-3 dB		dB	
Bandwidth: 500 MHz								
500 mV/div	2 V	1 MHz	500 MHz	500 MHz	-3 dB		dB	

Vertical Scale	Level signal generator peak to peak	Reference frequency	Generator frequency	Bandwidth	DLL	Actual		MU
50 mV/div	400 mV	1 MHz	500 MHz	500 MHz	-3 dB		dB	
5 mV/div	40 mV	1 MHz	500 MHz	500 MHz	-3 dB		dB	
1 mV/div	8 mV	1 MHz	500 MHz	500 MHz	-3 dB		dB	
Bandwidth: 1 GHz								
500 mV/div	2 V	1 MHz	1 GHz	1 GHz	-3 dB		dB	
50 mV/div	400 mV	1 MHz	1 GHz	1 GHz	-3 dB		dB	
5 mV/div	40 mV	1 MHz	1 GHz	1 GHz	-3 dB		dB	
1 mV/div	8 mV	1 MHz	1 GHz	1 GHz	-3 dB		dB	

Channel 4; Analog Bandwidth; Bandwidth limitation (only for R&S RTM3004 and R&S RTA4004)

Vertical Scale	R&S RTM3000/ RTA4000 band-width set-ting	Level signal generator peak to peak	Generator frequency reference value	Generator frequency	DLL	DUL	Actual		MU
5 mV/div	20 MHz	40 mV	1 MHz	20 MHz	-3.50 dB	-1.80 dB		dB	

2.3.10 Channel to channel isolation

Channel-to-channel isolation (CH1 to CH2); Input Resistance 50Ω

Bandwidth	FFT center fre-quency	FFT frequency span	Generator	DLL	Actual		MU
Basic Instru-ment	100 MHz	50 MHz	100 MHz	50.00 dB		dB	

Bandwidth	FFT center fre-quency	FFT frequency span	Generator	DLL	Actual		MU
200 MHz	200 MHz	50 MHz	200 MHz	50.00 dB		dB	

Bandwidth	FFT center fre-quency	FFT frequency span	Generator	DLL	Actual		MU
350 MHz	350 MHz	50 MHz	350 MHz	50.00 dB		dB	

Bandwidth	FFT center frequency	FFT frequency span	Generator	DLL	Actual		MU
500 MHz	500 MHz	50 MHz	500 MHz	50.00 dB		dB	

Bandwidth	FFT center frequency	FFT frequency span	Generator	DLL	Actual		MU
1 Ghz	1 Ghz	50 MHz	1 Ghz	50.00 dB		dB	

Channel-to-channel isolation (CH4 to CH3); Input Resistance 50Ω (only for R&S RTM3004 and R&S RTA4004)

Bandwidth	FFT center frequency	FFT frequency span	Generator	DLL	Actual		MU
Basic Instrument	100 MHz	50 MHz	100 MHz	50.00 dB		dB	

Bandwidth	FFT center frequency	FFT frequency span	Generator	DLL	Actual		MU
200 MHz	200 MHz	50 MHz	200 MHz	50.00 dB		dB	

Bandwidth	FFT center frequency	FFT frequency span	Generator	DLL	Actual		MU
350 MHz	350 MHz	50 MHz	350 MHz	50.00 dB		dB	

Bandwidth	FFT center frequency	FFT frequency span	Generator	DLL	Actual		MU
500 MHz	500 MHz	50 MHz	500 MHz	50.00 dB		dB	

Bandwidth	FFT center frequency	FFT frequency span	Generator	DLL	Actual		MU
1 Ghz	1 Ghz	50 MHz	1 Ghz	50.00 dB		dB	

2.3.11 Internal Trigger

Channel 1; Internal Trigger A Sensitivity

Horizontal scale	Vertical scale	Generator frequency	Option	Input Level		Trigger Check
200 µs/div	20 mV/div	10 kHz	RTM3000, basic Instrument	1.0 div	Pass / Fail	
5 ns/div	20 mV/div	100 MHz		1.0 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Option	Input Level		Trigger Check
200 µs/div	20 mV/div	10 kHz	RTA4000 basic instrument RTM3000 with B222/B242	1.0 div	Pass / Fail	
5 ns/div	20 mV/div	100 MHz		1.0 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Option	Input Level		Trigger Check
200 µs/div	20 mV/div	10 kHz	RTA/RTM with B223/B243	1.4 div	Pass / Fail	
5 ns/div	20 mV/div	100 MHz		1.4 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Option	Input Level		Trigger Check
200 µs/div	20 mV/div	10 kHz	RTA/RTM with B225/B245	1.4 div	Pass / Fail	
5 ns/div	20 mV/div	100 MHz		1.4 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Option	Input Level		Trigger Check
200 µs/div	20 mV/div	10 kHz	RTA/RTM with B2210/B2410	1.6 div	Pass / Fail	
5 ns/div	20 mV/div	100 MHz		1.6 div	Pass / Fail	

Channel 2; Internal Trigger A Sensitivity

Horizontal scale	Vertical scale	Generator frequency	Option	Input Level		Trigger Check
200 µs/div	20 mV/div	10 kHz	RTM3000, basic Instrument	1.0 div	Pass / Fail	
5 ns/div	20 mV/div	100 MHz		1.0 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Option	Input Level		Trigger Check
200 µs/div	20 mV/div	10 kHz	RTA4000 basic instrument RTM3000 with B222/B242	1.0 div	Pass / Fail	
5 ns/div	20 mV/div	100 MHz		1.0 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Option	Input Level		Trigger Check
200 µs/div	20 mV/div	10 kHz	RTA/RTM with B223/B243	1.4 div	Pass / Fail	
5 ns/div	20 mV/div	100 MHz		1.4 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Option	Input Level		Trigger Check
200 µs/div	20 mV/div	10 kHz	RTA/RTM with B225/B245	1.4 div	Pass / Fail	
5 ns/div	20 mV/div	100 MHz		1.4 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Option	Input Level		Trigger Check
200 µs/div	20 mV/div	10 kHz	RTA/RTM with B2210/B2410	1.6 div	Pass / Fail	
5 ns/div	20 mV/div	100 MHz		1.6 div	Pass / Fail	

Channel 3; Internal Trigger A Sensitivity

Horizontal scale	Vertical scale	Generator frequency	Option	Input Level		Trigger Check
200 µs/div	20 mV/div	10 kHz	RTM3000, basic Instrument	1.0 div	Pass / Fail	
5 ns/div	20 mV/div	100 MHz		1.0 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Option	Input Level		Trigger Check
200 µs/div	20 mV/div	10 kHz	RTA4000 basic instrument	1.0 div	Pass / Fail	
5 ns/div	20 mV/div	100 MHz	RTM3000 with B242	1.0 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Option	Input Level		Trigger Check
200 µs/div	20 mV/div	10 kHz	RTA/RTM with B243	1.4 div	Pass / Fail	
5 ns/div	20 mV/div	100 MHz		1.4 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Option	Input Level		Trigger Check
200 µs/div	20 mV/div	10 kHz	RTA/RTM with B245	1.4 div	Pass / Fail	
5 ns/div	20 mV/div	100 MHz		1.4 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Option	Input Level		Trigger Check
200 µs/div	20 mV/div	10 kHz	RTA/RTM with B2410	1.6 div	Pass / Fail	
5 ns/div	20 mV/div	100 MHz		1.6 div	Pass / Fail	

Channel 4; Internal Trigger A Sensitivity

Horizontal scale	Vertical scale	Generator frequency	Option	Input Level		Trigger Check
200 µs/div	20 mV/div	10 kHz	RTM3000, basic Instrument	1.0 div	Pass / Fail	
5 ns/div	20 mV/div	100 MHz		1.0 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Option	Input Level		Trigger Check
200 µs/div	20 mV/div	10 kHz	RTA4000 basic instrument RTM3000 with B242	1.0 div	Pass / Fail	
5 ns/div	20 mV/div	100 MHz		1.0 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Option	Input Level		Trigger Check
200 µs/div	20 mV/div	10 kHz	RTA/RTM with B243	1.4 div	Pass / Fail	
5 ns/div	20 mV/div	100 MHz		1.4 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Option	Input Level		Trigger Check
200 µs/div	20 mV/div	10 kHz	RTA/RTM with B245	1.4 div	Pass / Fail	
5 ns/div	20 mV/div	100 MHz		1.4 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Option	Input Level		Trigger Check
200 µs/div	20 mV/div	10 kHz	RTA/RTM with B2410	1.6 div	Pass / Fail	
5 ns/div	20 mV/div	100 MHz		1.6 div	Pass / Fail	

2.3.12 External Trigger

Generator level	Generator frequency		Trigger Check
-6.48 dBm	10 kHz	Pass / Fail	
-6.48 dBm	500 MHz	Pass / Fail	

2.3.13 Waveform Generator (Option -B6)

2.3.13.1 DC Output Voltage (for R&S RTM3000 models)

DC output voltage	DMM	DL	Actual	MU
5 V	V	±3.0 %	%	%
1 V	V	±3.0 %	%	%
50 mV	mV	±5 mV	mV	mV
0	mV	±5 mV	mV	mV
-50 mV	mV	±5 mV	mV	mV
-1 V	V	±3.0 %	%	%
-5 V	V	±3.0 %	%	%

2.3.13.2 DC Output Voltage (for R&S RTA4004)

DC output voltage	DMM	DL	Actual	MU
5 V	V	±1.5 %	%	%
1 V	V	±1.5 %	%	%
50 mV	mV	±3 mV	mV	mV
0	mV	±3 mV	mV	mV
-50 mV	mV	±3 mV	mV	mV
-1 V	V	±1.5 %	%	%
-5 V	V	±1.5 %	%	%

2.3.13.3 LF Output (for R&S RTM3000 models)

DUT Frequency	Amplitude	DMM	DL	Actual	MU
0.1 kHz	5.0 Vpp	V	±3.0 %	%	%
0.1 kHz	0.1 Vpp	V	±3.0 %	%	%
1 kHz	5.0 Vpp	V	±3.0 %	%	%
1 kHz	0.1 Vpp	V	±3.0 %	%	%
10 kHz	5.0 Vpp	V	±3.0 %	%	%
10 kHz	0.1 Vpp	V	±3.0 %	%	%

DUT Frequency	Amplitude	DMM	DL	Actual	MU
100 kHz	5.0 Vpp	V	±3.0 %	%	%
100 kHz	0.1 Vpp	V	±3.0 %	%	%

2.3.13.4 LF Output (for R&S RTA4004)

DUT Frequency	Amplitude	DMM	DL	Actual	MU
0.1 kHz	5.0 Vpp	V	±1.5 %	%	%
0.1 kHz	0.1 Vpp	V	±1.5 %	%	%
1 kHz	5.0 Vpp	V	±1.5 %	%	%
1 kHz	0.1 Vpp	V	±1.5 %	%	%
10 kHz	5.0 Vpp	V	±1.5 %	%	%
10 kHz	0.1 Vpp	V	±1.5 %	%	%
100 kHz	5.0 Vpp	V	±1.5 %	%	%
100 kHz	0.1 Vpp	V	±1.5 %	%	%

3 Adjustment

The following chapter describes the manual adjustment of the reference sources and the software-controlled adjustment of individual module.

3.1 Preparing the Instrument

Warm up the instrument for about 20 min.

3.2 Performing the Adjustment

Self-alignment takes up to 12 minutes.

1. Start self-alignment with the SCPI command `CAL`.
2. Query the correct processing with the SCPI command `:DIAG:SERV:CORR:STATE?`.

Return	Description
NEV	Self Alignment was not executed
RUN	Self Alignment is running (Power was turned off during Self Alignment?)
ERR	Self Alignment was canceled with error
SUCC	Self Alignment ok
ABOR	User abort

3.3 Manual Adjustment

The adjustments at the service can be done automatically with the UCS measuring system, in the adjustment menu item: "Frequency Accuracy TX", or manually with the help of a frequency counter.

3.3.1 Adjusting the 10 MHz Reference Frequency

Test equipment:
- Frequency counter (see to Test equipment, item 7)

Test setup:
- ► Connect the RF input of the frequency counter directly to the R&S RTM3000/RTA4000 AUX output.

R&S RTM settings:
1. [PRESET]

2. Set the reference frequency to the TRIGGER OUT:
   a) Menu:
      [SETUP : Trigger Output: "Ref. Freq."]
   b) SCPI:
      `:TRIGger:OUT:MODE REFerence`

Adjustment:

1. Read the current value:
   `:DIAGnostic:SERVice:CORRection:TEST 1,7000,?`
2. Tune the frequency:
   `:DIAGnostic:SERVice:CORRection:TEST 1,7000,<Value>`
   where 0 ≤ `<Value>` ≤ 255
   Increase or decrease the `<Value>` so that the frequency counter shows:
   - R&S RTM3000: 10 MHz with less than 1.5 ppm deviation (10 MHz ±15 Hz)
   - R&S RTA4000: 10 MHz with less than 0.5 ppm deviation (10 MHz ±5 Hz)

Measurement:

1. Set frequency counter to an appropriate resolution.
2. Read frequency counter display.
   Note: If the reference frequency is out of tolerance, the frequency of the reference oscillator must be adjusted.
3. Save the alignment value:
   `:DIAGnostic:SERVice:CORRection:TEST 1,5010,0`
4. Save the alignment value to factory defaults:
   `:DIAGnostic:SERVice:CORRection:TEST 1,5000,0`
   Note: After tuning, the alignment value is only stored in the RAM memory and will be lost after POWER OFF. Use the saving commands to store the value permanently.

3.4 Self-alignment

The instrument is equipped with a self-alignment feature. The alignment values are stored in the serial flash memory of the complexboard. Thus, after exchanging the board, it is only necessary to perform a self-alignment.

4 Repair

This chapter describes the design of the R&S RTM3000/RTA4000, simple measures for repair and troubleshooting, and the replacement of modules.

4.1 Functional Description

The R&S RTM3000/RTA4000 are designed as single application board instruments. Both instrument families have the same mechanical and electrical architecture but the complex board and the key mat are different to match the instrument-specific needs.

- The R&S RTM3000 is available as 2-channel and 4-channel instrument with bandwidth from 100 MHz up to 1 GHz.
- The R&S RTA4000 is only available as 4-channel instrument featuring bandwidth from 200 MHz to 1 GHz.

Both models use the same front controller board, which is mounted to the mainframe.

4.1.1 Frontcontroller Board

The frontcontroller board supports the complex board with following functions:

- Keypad: mechanical underlay for the keypad and processing of the key events.
- Keypad backlight: LED under every transparent key (white). These LEDs are controlled by LED drivers.
- Rotary encoder.
- Power on/off sequencing and standby control.

A Cortex-M3 CPU controls all the front controller board functions.

4.1.2 Probe Detect Board

The probe detect board is connected to the complex board of the instrument. It hosts the probe detection via USB and supplies the operating voltage for the Rohde & Schwarz probes and accessories (e.g. current probes, R&S RT-ZCxxB).

Further, the probe board is equipped with a pattern generator and a two clamps for passive probes adjustment.

4.1.3 Complexboard

The complexboard hosts the complete oscilloscope functionality from the input selection and amplification, the digitalization, trigger functionality and signal analysis up to providing the display content.

4.1.4 Oscilloscope Analog Frontend

The signal from BNC compatible input connectors is divided into two paths depending on the selected input impedance.

At the 1 MΩ path, the signal is routed via an AC/DC coupling sector and a 3-step selectable attenuation network to the input amplifier ASIC.

The 50 Ω path is routed via a 2-step selectable attenuation network to the input ASIC of the oscilloscope. Additionally, a calibration and offset generator controlled via a programmable DAC (called offset DAC) is connected to the input ASIC of the oscilloscope to support the required signals for internal alignment and offset generation.

4.1.5 ADC, FPGA and CPU

ASIC SAD converts the analog signal to the digital domain. The sampled data is transferred via LVDS lines to the acquisition FPGA for further signal processing. The oscilloscope control application runs on the ARM-based processing system of the Cyclone V. The device boots from serial flash memory (as default). Factory alignment and option management data are stored in a flash memory.

4.1.6 Waveform Generator

The waveform generator consists of the high-speed DAC, gain DAC, offset DAC and analog backend including a safety circuit. It opens a relay when the voltage at the output connector is outside -6 V ... +6 V. The output data and settings of the generator are controlled by the Cyclone V FPGA. The waveform generator is switched off during the oscilloscope booting process.

4.1.7 Interfaces

- LAN for remote control of the instrument
- USB type A (host USB) to connect a USB flash device for file transfer
- USB mini type B (device USB) to be used for remote control of the instrument
- 2 MSO PODs
- Probe calibration and pattern generator

4.2 Opening the Instrument

WARNING

Shock hazard

Before opening the housing, make sure that the instrument is switched off and disconnected from all power supplies.

Read all safety instructions at the beginning of this manual carefully!

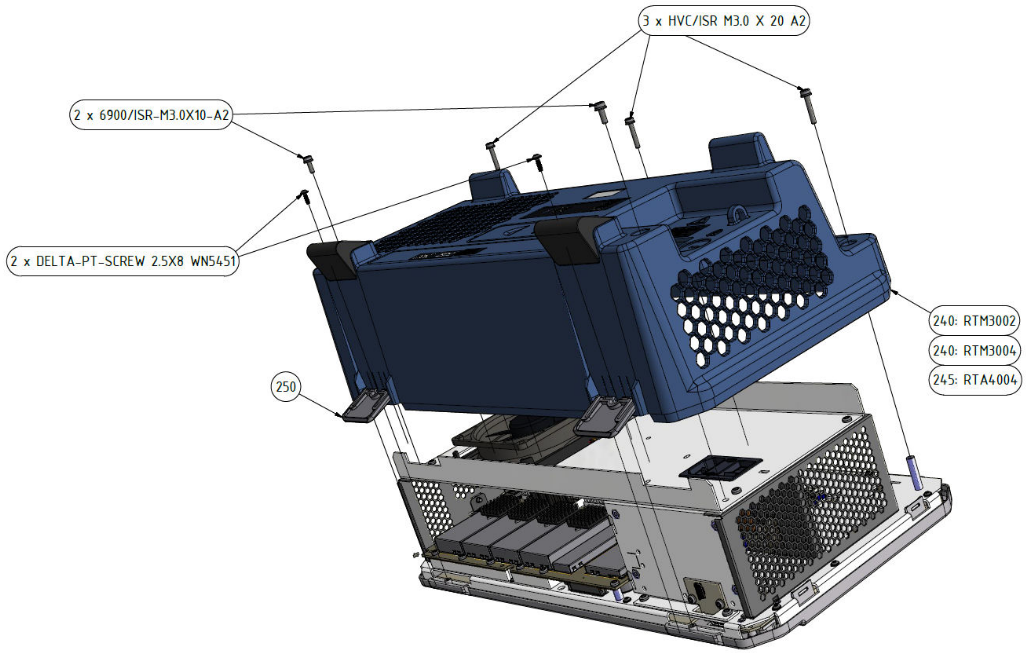
NOTICE

Risk of electrostatic discharge

Protect the work area against electrostatic discharge to avoid damage to electronic components in the modules. For details, refer to the safety instructions at the beginning of this manual.

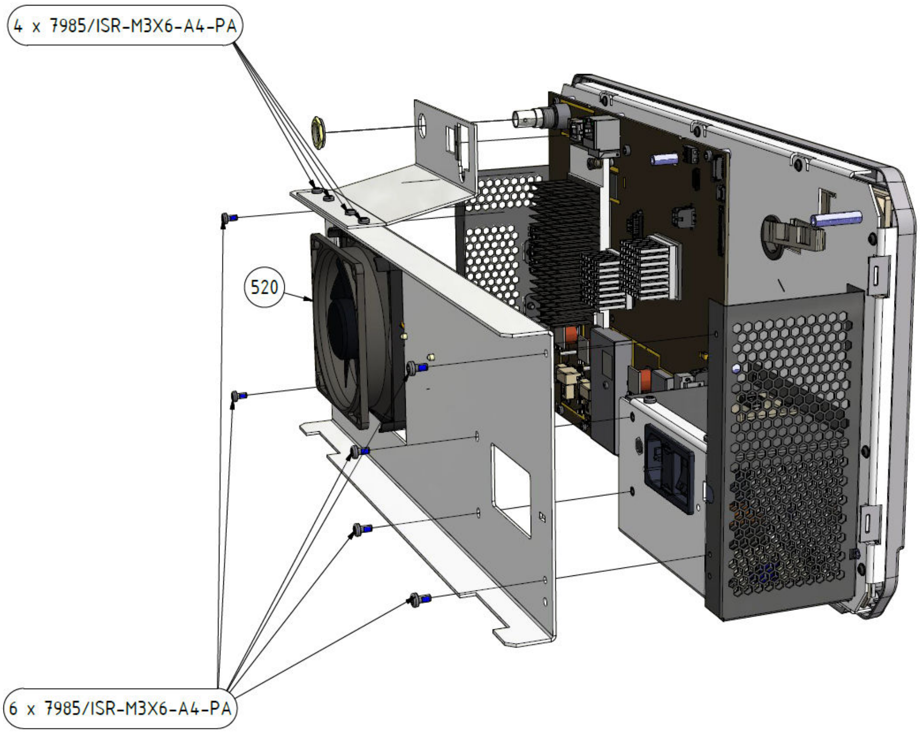
4.2.1 Removing the Housing

1. Switch off the instrument and disconnect the power plug.
2. Place the instrument on the workbench.
3. Turn down the instrument feet (250).
4. Unscrew the 2 screws of the feet using a TORX T8 screwdriver.
5. Unscrew the 5 screws at the rear of the instrument casing using a TORX T10 screwdriver.
6. Gently slide off the housing (240) from the instrument in a vertical direction.



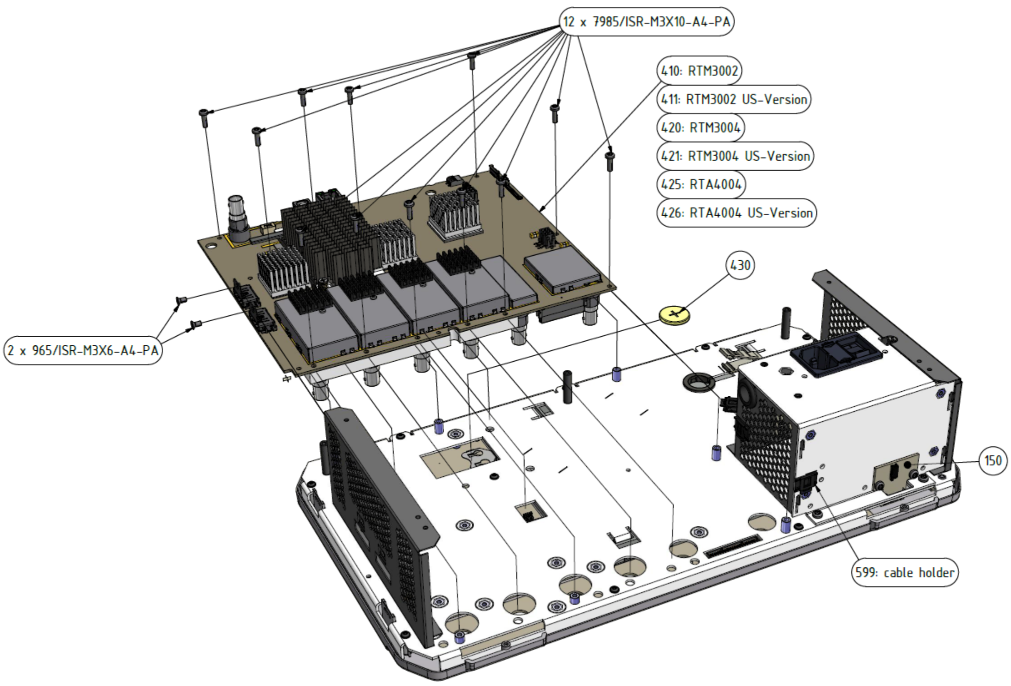
4.2.2 Removing the Back Panel with ESD Angle

1. Remove the housing as described in Chapter 4.2.1, "Removing the Housing", on page 60.
2. Unplug the fan cable from the Complexboard.
3. Place the instrument face down on the workbench.
4. Unscrew the 6 screws of the back panel using a TORX T10 screwdriver.
5. Loosen the BNC nut from the AUX OUT connector using a 16 mm wrench.
6. REmove the back panel with the ESD angle.



4.2.3 Removing the Complexboard

1. Remove the housing as described in Chapter 4.2.1, "Removing the Housing", on page 60.
2. Remove the back panel as described in Chapter 4.2.2, "Removing the Back Panel with ESD Angle", on page 61.
3. Disconnect the remaining cables from complexboard.
4. Unscrew the 14 screws from the complexboard using a TORX T10 screwdriver.
5. Carefully remove the complexboard from the mainframe.



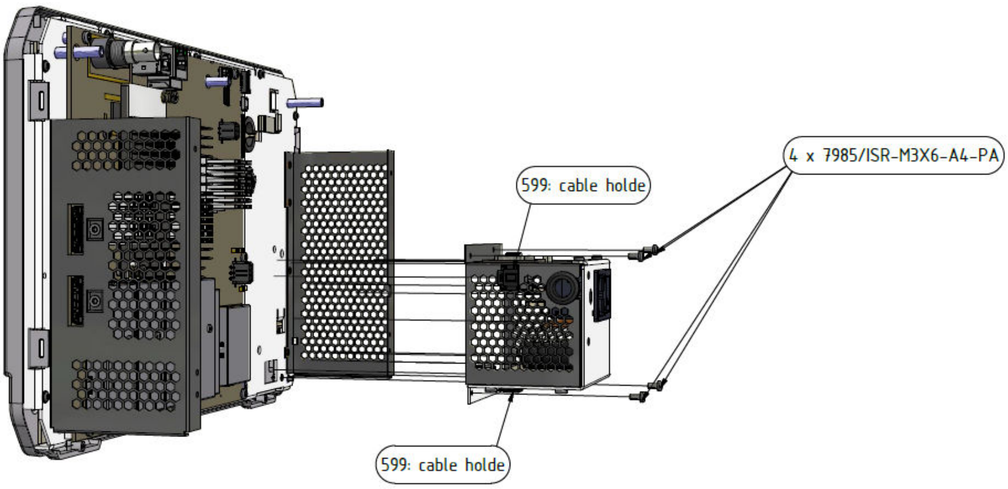
4.2.4 Removing the Front Cover

1. Remove the housing as described in Chapter 4.2.1, "Removing the Housing", on page 60.
2. Remove the complexboard as described in Chapter 4.2.3, "Removing the Complexboard", on page 62.
3. Unscrew the 12 screws fixing the front cover using a TORX T8 screwdriver.
4. Place the instrument face up on the workbench.
5. Pull up the knobs (210,220).
6. Unfix the four flaps and carefully remove the front cover.

4.2.5 Removing the Power Supply Chassis

1. Remove the housing as described in Chapter 4.2.1, "Removing the Housing", on page 60.
2. Remove the back panel as described in Chapter 4.2.2, "Removing the Back Panel with ESD Angle", on page 61.
3. Open the cable holders (599) for the front USB foil cable.
4. Remove the front USB foil cable from the USB board.

5. Unscrew the 4 screws of the power supply chassis using a TORX T10 screwdriver.
6. Remove the power supply chassis.



4.3 Completing the Instrument

Device recovery
Programming of the device data has to be carried out after replacement of the com-plexboard.

4.3.1 Reassembling the Power Supply Chassis

1. Place the mainframe face down on the workbench.
2. Put the Power Supply Chassis on the mainframe and fix the 4 screws using a TORX T10 screwdriver.

4.3.2 Reassembling the Probe Detect Board

1. Place the mainframe face up on the workbench.
2. Place the probe detect board on the mainframe.
3. Fix the 6 screws using a TORX T10 screwdriver.

4. Reassemble the front cover as described in Chapter 4.3.4, "Reassembling the Front Cover", on page 65.
5. Reassemble the complexboard as described in Chapter 4.3.5, "Reassembling the Complexboard", on page 66.
6. Reassemble the rear plate and ESD angle as described in Chapter 4.3.6, "Reassembling the Back Panel and ESD Angle", on page 66.
7. Reassemble the housing as described in Chapter 4.3.7, "Reassembling the Housing", on page 66.

4.3.3 Reassembling the Frontcontroller Board

1. Place the instrument face up.
2. Take a new frontcontroller and connect the USB and complexboard foil cables.
3. Mount the frontcontroller with 6 screws on the chassis.
4. Place the keymat on the frontcontroller.
5. Reassemble the front cover as described in Chapter 4.3.4, "Reassembling the Front Cover", on page 65.
6. Reassemble the complexboard as described in Chapter 4.3.5, "Reassembling the Complexboard", on page 66.
7. Reassemble the back panel as described inChapter 4.3.6, "Reassembling the Back Panel and ESD Angle", on page 66.
8. Reassemble the housing as described in Chapter 4.3.7, "Reassembling the Housing", on page 66.

4.3.4 Reassembling the Front Cover

1. Place the instrument face up.
2. Make sure the keymat and the standby softkey are positioned correctly.
3. Carefully press the front cover over the keymat until the flaps snap into chassis.
4. Fix the 12 screws using a TORX T10 screwdriver.
5. Reassemble the complexboard as described in chapter Chapter 4.3.5, "Reassembling the Complexboard", on page 66.
6. Reassemble the back panel and ESD angle as described in Chapter 4.3.6, "Reassembling the Back Panel and ESD Angle", on page 66.

7. Reassemble the housing as described in Chapter 4.3.7, "Reassembling the Housing", on page 66.

4.3.5 Reassembling the Complexboard

1. Place the mainframe face down on the workbench.
2. Carefully insert the complexboard.
3. Fix the 12 screws of complexboard using a TORX T10 screwdriver.
4. Connect the cables to the complexboard connectors including display cable, touchscreen cable, the USB foil cable, line trigger wire and frontcontroller foil cable.
5. Reassemble the back panel and ESD angle as described in Chapter 4.3.6, "Reassembling the Back Panel and ESD Angle", on page 66.
6. Reassemble the housing as described in Chapter 4.3.7, "Reassembling the Housing", on page 66.

4.3.6 Reassembling the Back Panel and ESD Angle

1. Place the mainframe face down on the workbench.
2. Fix the 4 screws of the back panel using a TORX T10 screwdriver.
3. Place the ESD angle with the hole over the AUX IN BNC connector.
4. Fix the angle with 4 screws on the back panel using a TORX T10 screwdriver.
5. Put the washer and screw nut over the BNC connector and fix the nut using a 16 mm wrench.

4.3.7 Reassembling the Housing

1. Place the mainframe with the assembled modules face down on the workbench.
2. Put on the housing with care. Ensure proper alignment of both parts.
3. Fix the housing with 7 screws using a TORX T10 screwdriver.

4.4 Module Replacement

4.4.1 Replacing the Fuse

The instrument is protected by a fuse. You can find it on the rear panel between the main power switch and AC power supply.

Type of fuse: Size 5x20 mm, 250V~, T3.15H (slow-blow), IEC60127-2/5

WARNING

Risk of electric shock

The fuse is part of the main power supply. Therefore, handling the fuse while power is on can lead to electric shock. Before opening the fuse holder, make sure that the instrument is switched off and disconnected from all power supplies.

Always use fuses supplied by Rohde & Schwarz as spare parts, or fuses of the same type and rating.

1. Pull the fuse holder out of its slot on the rear panel.
2. Exchange the fuse.
3. Insert the fuse holder carefully back in its slot until it latches.

4.4.2 Replacing the Lithium Battery

WARNING

Risk of short-circuit

Use isolated tools to remove the battery.

Do not connect the housing of the battery with the mainframe when the battery is mounted in the battery holder.

The lithium battery is located on the backside of front controller board. There is an opening in the mainframe allowing to replace the battery.

1. Remove the complexboard as described in Chapter 4.2.3, "Removing the Complexboard", on page 62.
2. Use an isolated tool in the right 45° corners of the battery holder and push the battery to the left.
3. Remove the old battery.
4. Carefully put a new battery into the battery holder.

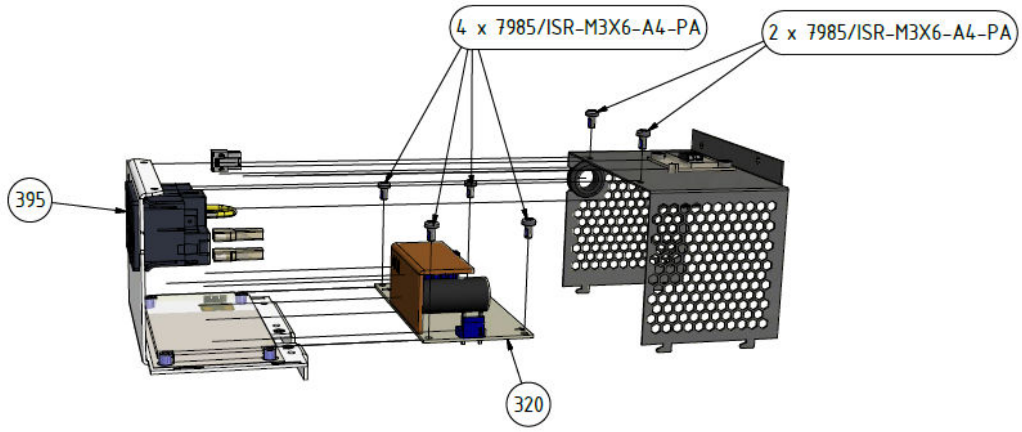
5. Reassemble the complexboard according to Chapter 4.3.5, "Reassembling the Complexboard", on page 66.

4.4.3 Replacing the Fan

1. Remove the housing as described in Chapter 4.2.1, "Removing the Housing", on page 60.
2. Disconnect the fan cable from the complexboard.
3. Remove the fan holder with the fan from the back panel.
4. Pick the old fan from the fan holder and put a new fan in the holder.
5. Insert the holder with the new fan into the back panel.
6. Connect the fan cable to the fan connector of the complexboard.
7. Reassemble the housing as described in Chapter 4.3.7, "Reassembling the Housing", on page 66.

4.4.4 Replacing the Power Supply

1. Remove the Power Supply Chassis as described in Chapter 4.2.5, "Removing the Power Supply Chassis", on page 63.
2. Unscrew the 2 screws fixing the metal hood.
3. Carefully remove the metal hood by pulling it back.
4. Unscrew the 4 screws of the power supply.
5. Remove the power supply.
6. Insert a new power supply and fix it with 4 screws on the power supply chassis.
7. Install the power supply chassis by executing the steps above in reversed order.



4.4.5 Replacing the Complexboard

1. Remove the complexboard as described in Chapter 4.2.3, "Removing the Complexboard", on page 62.
2. Put in a new complexboard.
3. Reassemble the complexboard as described in Chapter 4.3.5, "Reassembling the Complexboard", on page 66.
4. Install the back panel and the ESD angle as described in Chapter 4.3.6, "Reassembling the Back Panel and ESD Angle", on page 66.
5. Reassemble the housing as described in Chapter 4.3.7, "Reassembling the Housing", on page 66.

4.4.6 Replacing the Probe Detect Board

1. Remove the complexboard as described in Chapter 4.2.3, "Removing the Complexboard", on page 62.
2. Remove the front cover as described in Chapter 4.2.4, "Removing the Front Cover", on page 63.
3. Unscrew the 6 screws fixing the Probe Detect board using a TORX T10 screwdriver.
4. Remove the Probe Detect board.
5. Install a new Probe Detect board.
6. Reassemble the new Probe Detect board as described in Chapter 4.3.2, "Reassembling the Probe Detect Board", on page 64.

4.4.7 Replacing the Frontcontroller Board

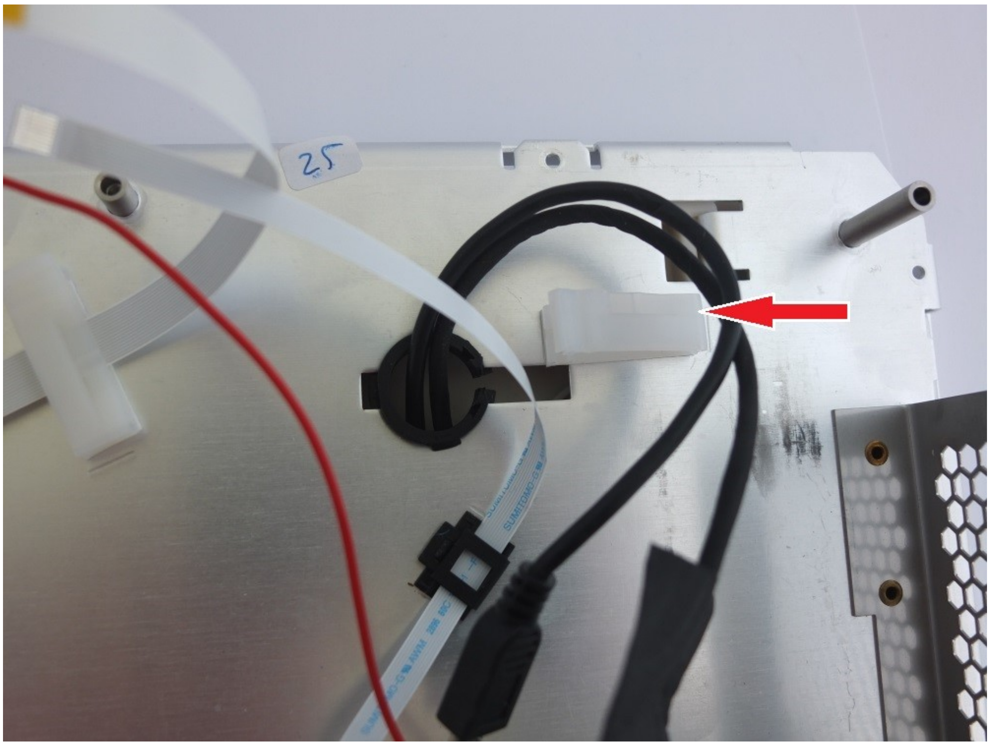
1. Remove the complexboard as described in Chapter 4.2.3, "Removing the Complexboard", on page 62.
2. Remove the front cover as described in Chapter 4.2.4, "Removing the Front Cover", on page 63.
3. Unscrew 5 screws using a TORX T10 screwdriver.
4. Carefully remove the frontcontroller board from the mainframe and disconnect the foil cable from the complexboard and the Standby key.
5. Take a new frontcontroller board and connect the Standby and complexboard foil cables.
6. Fix the frontcontroller with 6 screws on the mainframe using a TORX T10 screwdriver.

4.4.8 Replacing the Keymat

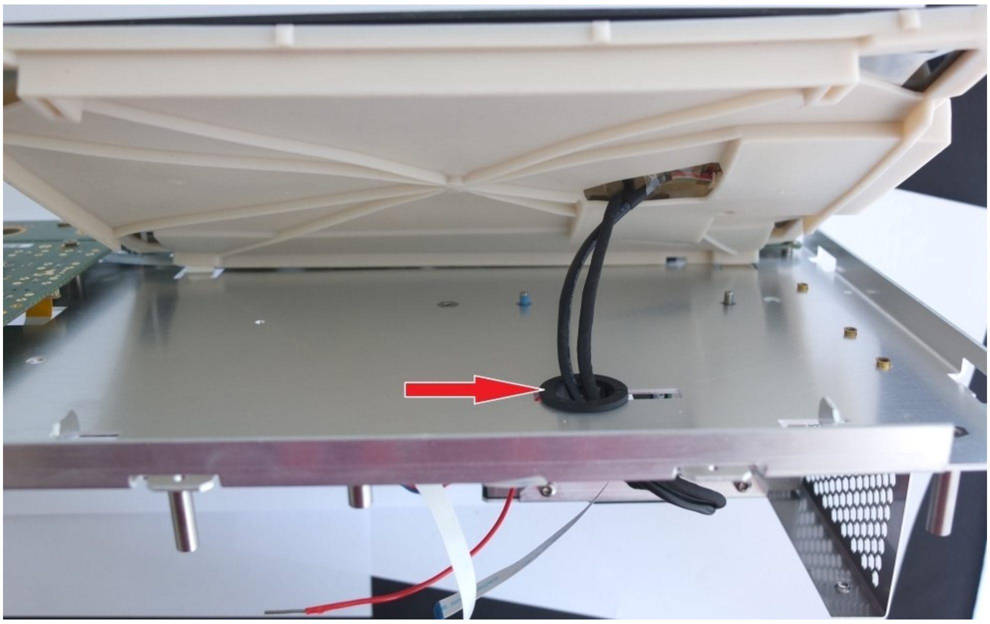
1. Remove the complexboard as described in Chapter 4.2.3, "Removing the Complexboard", on page 62.
2. Remove the front cover as described in Chapter 4.2.4, "Removing the Front Cover", on page 63.
3. Replace the keymat.
4. Reassemble the front cover as described in Chapter 4.3.4, "Reassembling the Front Cover", on page 65.
5. Reassemble the complexboard as described in Chapter 4.3.5, "Reassembling the Complexboard", on page 66.

4.4.9 Replacing the Touch Display

1. Remove the complexboard as described in Chapter 4.2.3, "Removing the Complexboard", on page 62.
2. Remove the front cover as described in Chapter 4.2.4, "Removing the Front Cover", on page 63.
3. Loosen the display cable and the touch cable from the cable holder.



4. Carefully unmount the display holder from the chassis at the upper ends and pull both cables through the cable bushing slot.
5. Remove the display holder from chassis at the lower ends.
6. Take out the display from the holder and remove the sticky tape.
7. Disconnect the display and touchscreen cable at the back side of the display.
8. Replace the display with a new one.
9. Connect display and touch screen cable to the display and fix them with sticky tape.
10. Insert the display into display holder.
11. Lead the display cable and touchscreen cable through the bushing slot and cable holder.



12. Mount the display with holder on the chassis.
13. Close the cable holder.
14. Reassemble the front cover as described in Chapter 4.3.4, "Reassembling the Front Cover", on page 65.
15. Reassemble the complexboard as described in Chapter 4.3.5, "Reassembling the Complexboard", on page 66.
16. Reassemble the housing as described in Chapter 4.3.7, "Reassembling the Housing", on page 66.

4.4.10 Replace the Front USB Assembly

1. Remove the housing as described in Chapter 4.2.1, "Removing the Housing", on page 60.
2. Turn the device top side down.
3. Remove the foil cable from the connector on the front USB board (150).
4. Unscrew the 2 screws fixing the board using TORX T10 screwdriver.
5. Exchange the front USB assembly with a new one.
6. Fix the new front USB board with 2 screws on the PSU using TORX T10 screwdriver.
7. Install the foil cable into the connector on the front USB board.
8. Reassemble the housing as described in Chapter 4.3.7, "Reassembling the Housing", on page 66.

5 Software Update / Installing Options

5.1 Updating the Firmware

Your instrument is delivered with the latest firmware version. Firmware updates are provided on the Internet at

www.rohde-schwarz.com/firmware/rta4000.

www.rohde-schwarz.com/firmware/rtm3000.

Along with the firmware file, you find the Release Notes describing the improvements and modifications.

Make sure to update the firmware if a new version is available.

1. Download the firmware installation file `*.fwu` to a USB flash drive.
2. Connect the USB flash drive to the USB connector at the front of the instrument.
3. Tap the "Menu" icon in the lower right corner of the screen.
4. Scroll down the menu. Tap "Setup".
5. Select "Firmware Update"
   Now you can see an info window with information about the installed and new firmware and front controller firmware. If you have no newer firmware than the installed one, a message appears.
6. Tap "Execute" to start the firmware update.

   Wait until the update has finished. After installation, the instrument restarts automatically.

5.2 Options

All options are activated by license keys. No additional installation or hardware change is required.

Unregistered licenses

Unregistered licenses are not assigned to a particular instrument. The instrument accepts only registered licenses. If your license is delivered unregistered, use the online tool R&S License Manager to register the license for your instrument. The registration of a permanent license is irreversible, so ensure that you register it for the correct instrument. The address of the tool is https://extranet.rohde-schwarz.com/service.

The "Active Options" tab provides information on installed software options. Here you can install new options or deactivate existing options using license keys.

The "Inactive Options" tab lists all deactivated and expired options.

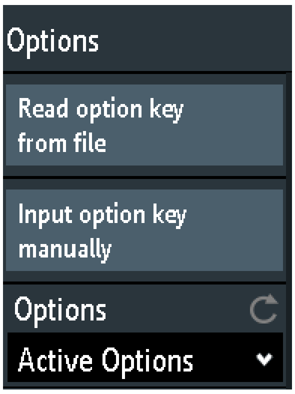
The "Deactivated Options" tab shows all deactivated options with their deactivation information and provides a function to export the deactivation response. The response is required by the R&S License Manager.

5.2.1 Activating Options

Consult your sales representative and provide the material number, serial number, and the device ID of your instrument to get a license key. You find this information in "Setup" menu > "Device Information".

The license key is provided in written form or in a file. Unregistered licenses must be registered in the R&S License Manager before they can be activated on the instrument.

1. If you received the option key in a file, save the file to a USB flash drive.
2. Connect the drive to the R&S RTM3000/RTA4000.
3. Tap the "Menu" icon in the lower right corner of the screen.
4. Scroll down the menu. Tap "Setup".
5. Select "Options".
6. If you received a key in written form, tap "Input option key manually". Enter the key. If you received a key in digital form as a file, tap "Read option key from file". Select path `/USB_FRONT` and the option key file.



7. If you want to activate several options, repeat step 5 for each option.
8. Restart the instrument.

6 Documents

6.1 Spare Parts

The stock numbers necessary for ordering replacement parts and modules are listed in the following spare part lists for R&S RTM3000/RTA4000 and R&S RTM3000/RTA4000-B1.

Risk of damaging a module

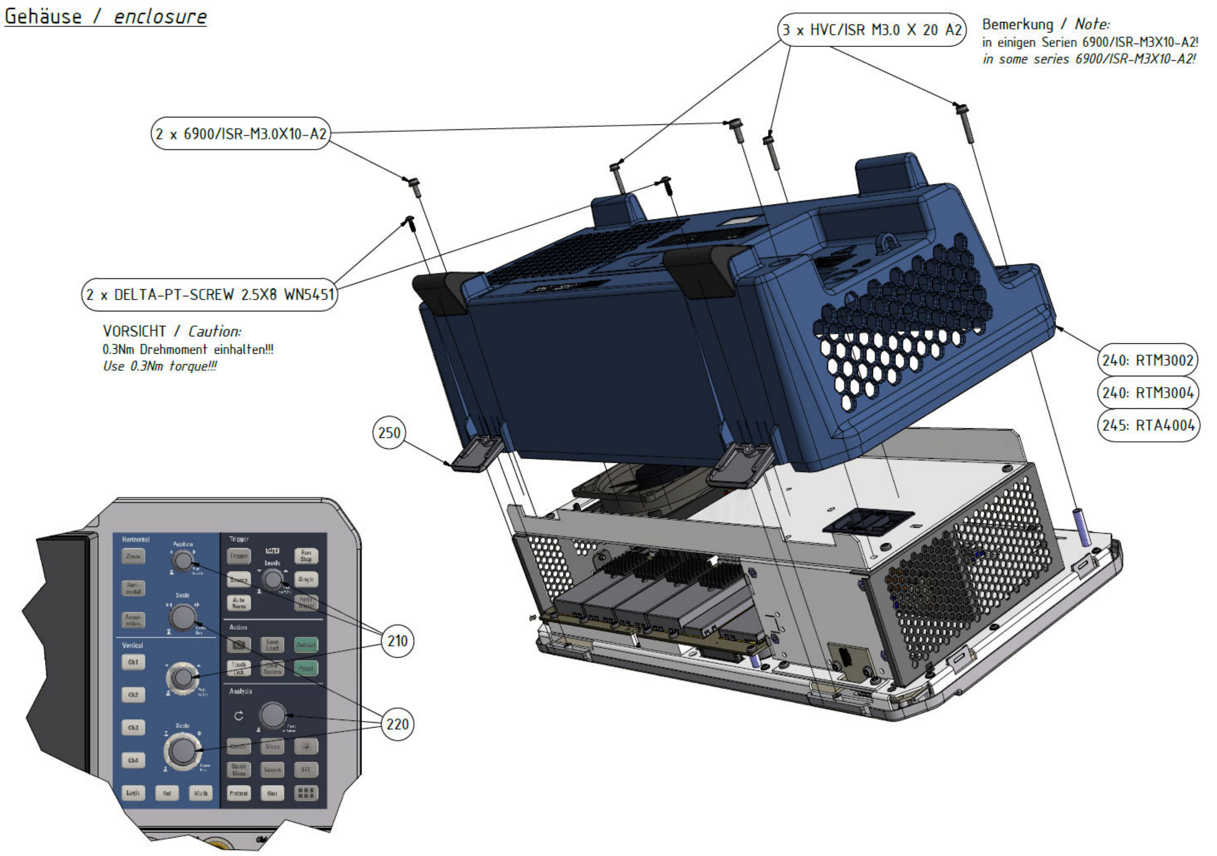
When shipping a module, observe the instructions provided in the "Procedure in Case of Service and Ordering of Spare Parts" chapter at the beginning of this document.

Item	Designation	Part no.	Used in RTM3000	Used in RTA4000	Recomen-ded Spare Part
110	ED FRONTCONTROLLER FC-2A40	5810.2111.40	x	x	x
120	SF SCHALTMATTE 2CH-WFSML	5810.2186.00	x		
121	SF SCHALTMATTE 4CH-WFSML	5810.2170.00	x		
122	SF SCHALTMATTE RTA	5810.3130.00		x	
130	DF FLEX-STRIP 10P R=0.5 L=350	3584.4270.00	x	x	
140	DF FLEXSTRIP 16P R= 0.5 L=270	5705.6286.00	x	x	
150	ED PROBE DETECT PD-3A40	5810.2757.40	x	x	
210	MM KNOPF 12 WFL	1329.6487.00	x	x	x
220	MM KNOPF 16 WFL	1329.6493.00	x	x	x
230	ZM FRONTRAHMEN-BG FÜR DEN RTM3002	5810.3060.00	x	x	
235	ZM FRONTRAHMEN-BG FÜR DEN RTM3004	5810.3076.00	x		
237	ZM FRONTRAHMEN-BG FÜR DEN RTA4004	1335.8165.00		x	
240	ZM GEHAEUSE-BG FÜR DEN RTM3000	5810.3030.00	x		
245	ZM GEHAEUSE-BG FÜR DEN RTA4004	1335.8171.00		x	
250	MM KLAPPFUSS RTS/WFLX	5810.1380.00	x	x	

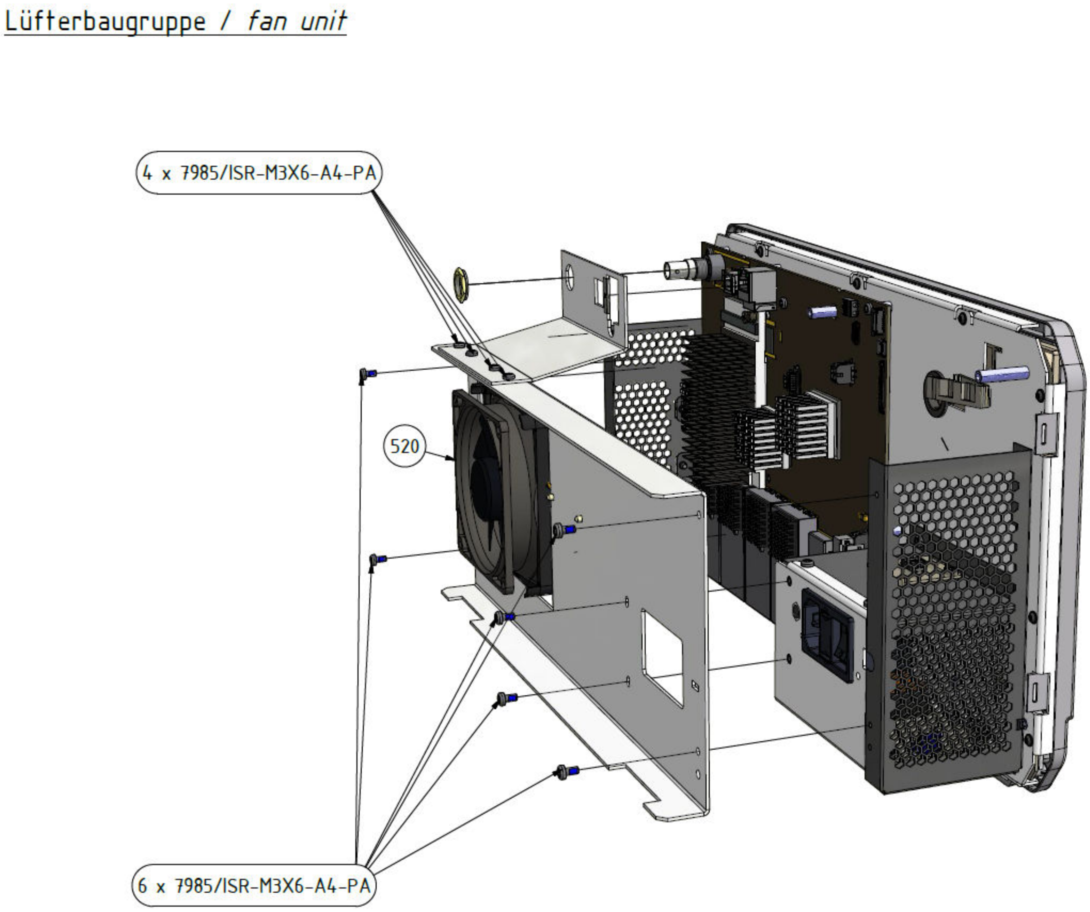
Item	Designation	Part no.	Used in RTM3000	Used in RTA4000	Recomen-ded Spare Part
320	NJ EPP-200-12 PS 200W 12V 4X2	3626.9268.00	x	x	
380	SS SCHMELZS. 3.15A T IEC60127/V	0099.6729.00	x	x	
395	FN POWER INLETS WITH FUSEHOLDER AND SW	5705.5521.00	x	x	x
410	ED COMPLEXBOARD CB-3A20	5810.2392.20	x		x
411	COMPLEXBOARD CB-3A20 US-VERSION	5810.3401.00	x		x
420	ED COMPLEXBOARD CB-3A40	5810.2392.40	x		x
421	COMPLEXBOARD CB-3A40 US-VERSION	5810.3418.00	x		x
425	ED COMPLEXBOARD CB-3A50	5810.2392.50		x	x
426	COMPLEXBOARD CB-3A50 US-VERSION	5810.3424.00		x	x
430	EB CR2032 BATT(P) LI-MNO2 3.0/0.23	0858.2049.00	x	x	x
510	MZ CHASSIS-BGR. RTS GENIETET	5810.1173.02	x	x	
520	EV DC-LÜFTER 92X92X25 12V KONFEK.	5810.1344.00	x	x	x
530	ND TOUCH 10.1 INCH CAPACITIVE USB	5810.1121.00	x	x	
550	DG DISPLAYKABEL	1323.1431.00	x	x	
560	DG TOUCH KABEL MICRO-USB RTS / WFLX	5810.2034.00	x	x	
599	DZ KABELHALTER 1X5.8 SW	2600.5517.00	x	x	

6.2 Mechanical Drawings

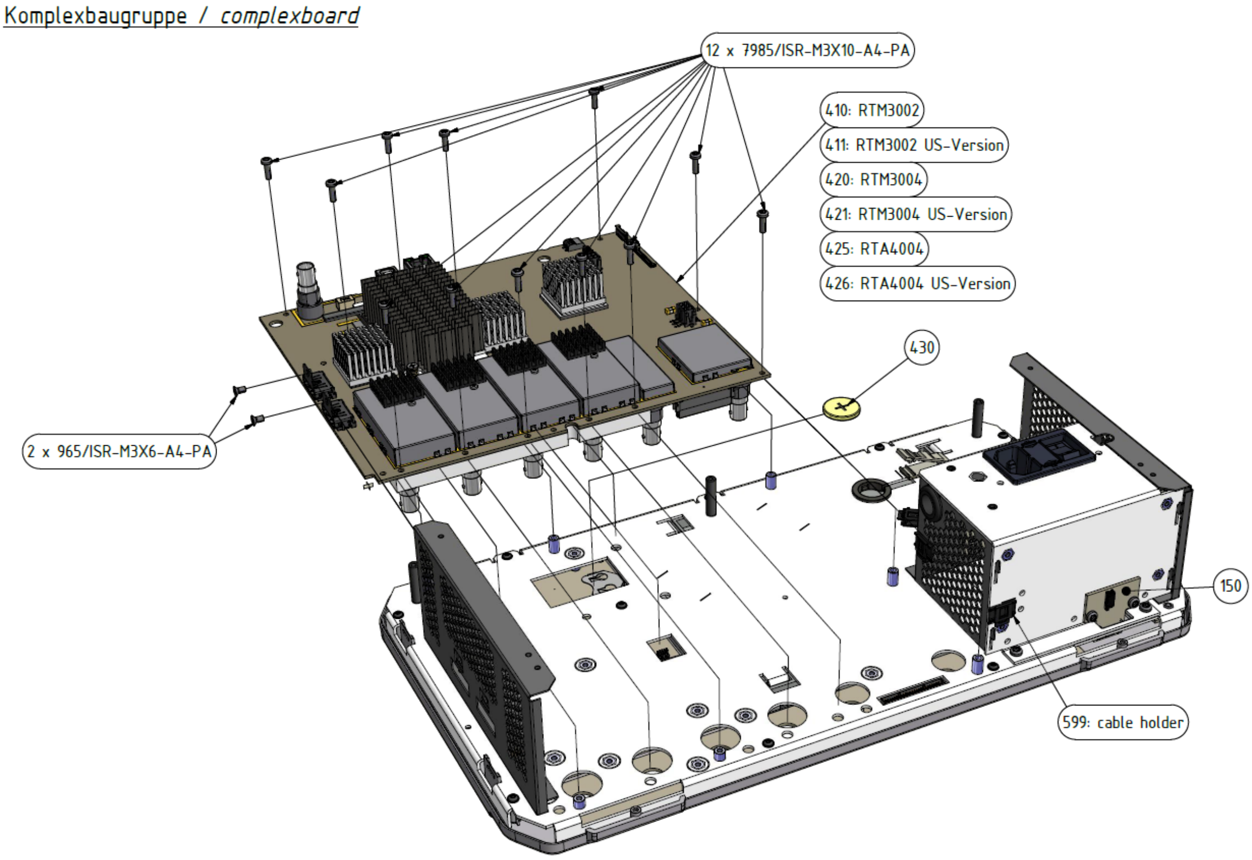
Housing



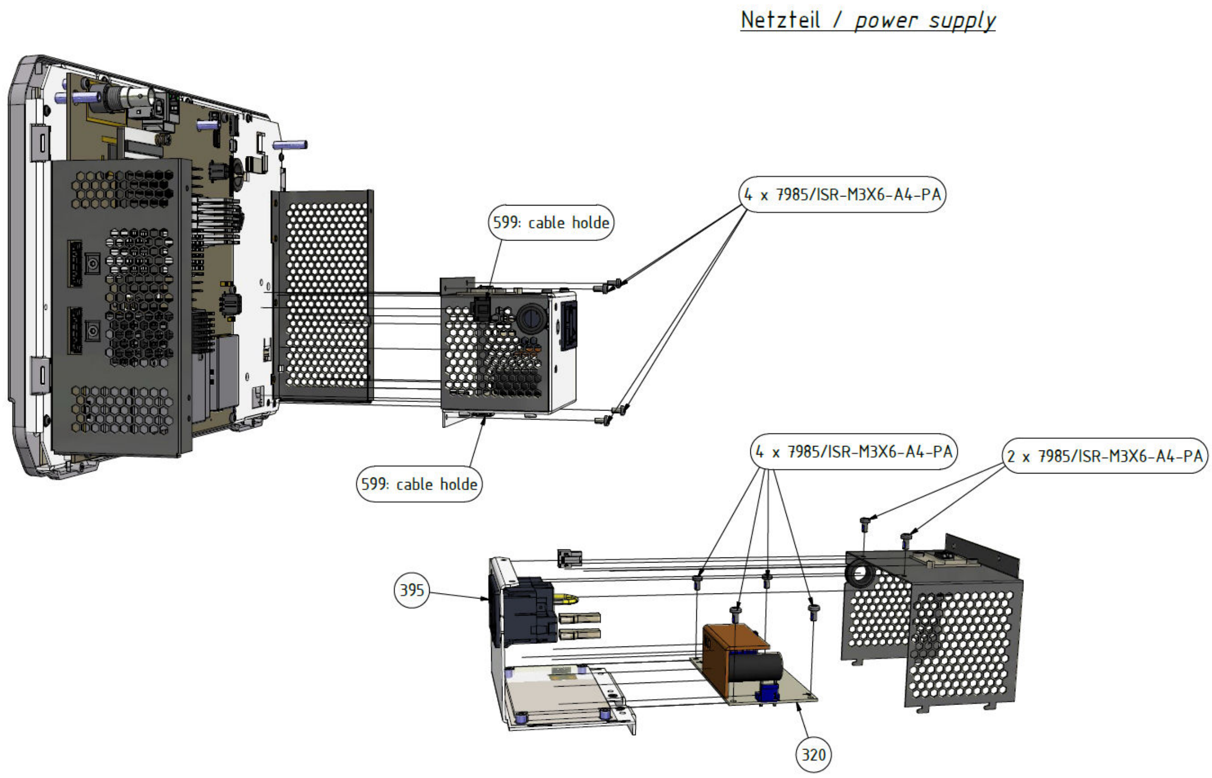
Fan unit


Lüfterbaugruppe / fan unit
4 x 7985/ISR-M3X6-A4-PA
520
6 x 7985/ISR-M3X6-A4-PA

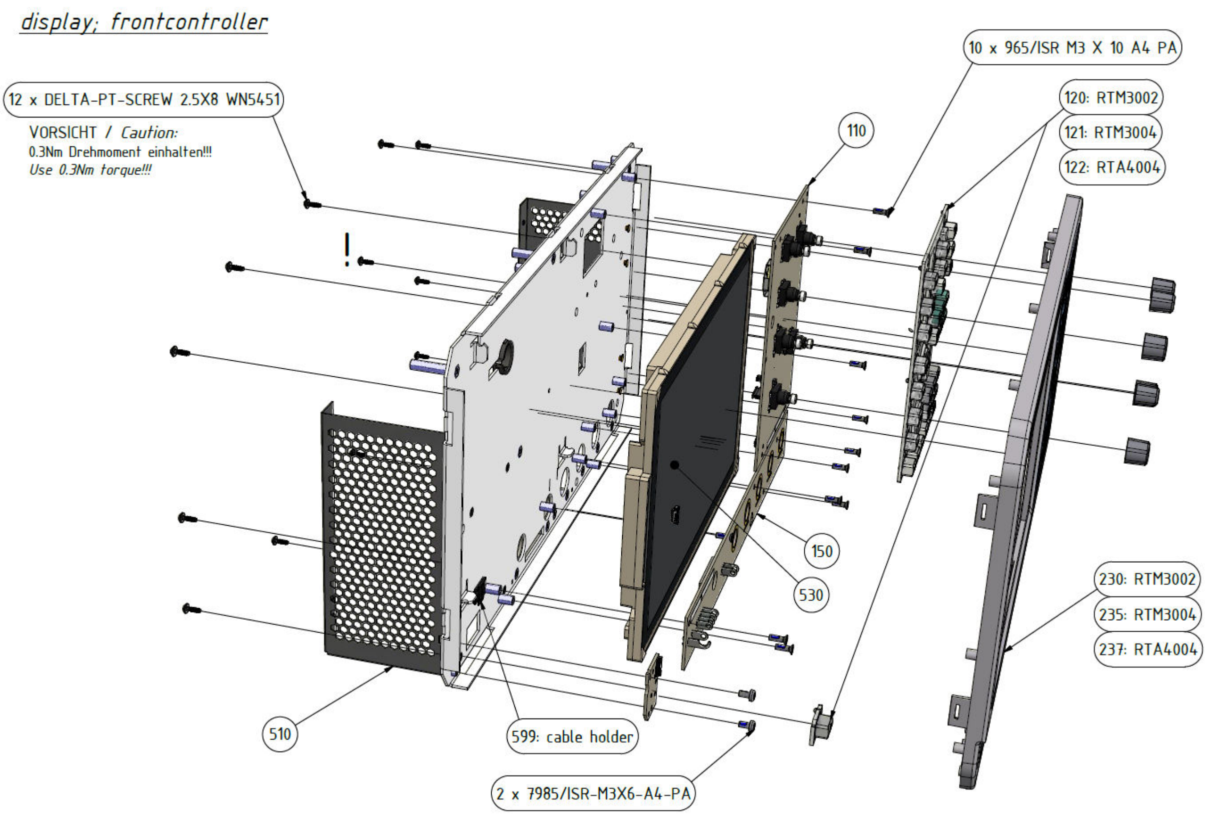
Complexboard



Power supply



Frontcontroller



6.3 Block Diagram