



ROHDE & SCHWARZ

Test and Measurement
Division

Service Manual

VSWR Bridge with Tracking Generator Bypass

R&S FSH-Z3

10 MHz to 6 GHz

1300.7756.02

Contents

1 Performance Test	1.1
Test Instructions	1.1
Measuring Equipment and Accessories	1.1
Performance Test	1.2
Checking the directivity	1.2
Checking the Return Loss of the TEST Port	1.3
Checking the Insertion Loss of the Tracking Generator Bypass	1.5
Checking the isolation between GEN OUTPUT port and TEST port	1.6
Performance Test Report	1.7
2 Adjustment	2.1
3 Spare Part Replacement	3.1
Overview of the spare parts	3.2
Opening the instrument	3.3
Closing the instrument	3.3
Replacing the Front/Rear covers	3.4
Replacing the wire tree	3.5
Replacing the coax cable assemblies	3.6
Troubleshooting	3.7
Overview of errors, causes, and possible corrective actions	3.7
Troubleshooting problems	3.7
4 Documents	4.1
Shipping of Instrument and Ordering of Spare Parts	4.1
Shipping of instrument	4.1
Shipping of a module	4.1
Ordering spare parts	4.2
Refurbished modules	4.2
Return of defective replaced modules	4.2
Spare Parts	4.3

1 Performance Test

Test Instructions

- Values specified in the following sections are not guaranteed. Only the technical specifications provided on the data sheet are binding.
- The values specified in the data sheet are the guaranteed limits.
- All non used ports are supposed to be terminated with a 50 Ohm load.
- Inputs for settings during measurements are shown as following:
 - [<KEY>] Press a key on the front panel, e.g. [SPAN].
 - [<SOFTKEY>] Press a softkey, e.g. [MARKER -> PEAK].
 - [<nn unit>] Enter a value and terminate by entering the unit, e.g. [12 kHz].
 Successive entries are separated by [:], e.g. [BW : MANUAL RES BW : 3 kHz].

Measuring Equipment and Accessories

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S order no.	Use
1	Spectrum Analyzer with TG output	Frequency: 10 MHz to 6 GHz	FSH-6	1145.5850.26	Directivity, ReturnLoss, InsertionLoss, Isolation
2	SWR Bridge	Directivity > 40 dB , RL testport > 20 dB	Agilent 86205A		ReturnLoss
3	Open Circuit Termination	10 MHz to 6 GHz N-type male	FSH-Z28 Combined Calibration Standard	1300.7804.02	Directivity ReturnLoss
4	Short Circuit Termination	10 MHz to 6 GHz N-type male	Part of item 3 (FSH-Z28)		Directivity ReturnLoss
5	50-Ω termination N-male	10 MHz to 6 GHz Return loss ≤ -35 dB	Part of item 3 (FSH-Z28)		Directivity ReturnLoss Isolation
6	Precision Adapter	N-male to N-male	Huber&Suhner: 32 N-50-0-51		ReturnLoss
7	50-Ω termination N-female (2x)	10 MHz to 6 GHz	Pasternack: PE6032		ReturnLoss
8	Adapter	N-male to N-male	Huber&Suhner: 32 N-50-0-1		ReturnLoss
9	Cable	Flexible cable RG213/U with N-male connector on both sides. L≈approx 30 cm	Pasternack: PE3496-12		ReturnLoss InsertionLoss Isolation

Performance Test

Checking the directivity

Test equipment:

- Spectrum Analyzer (refer to section "Measurement Equipment and Accessories", item 1)
- Open Circuit termination (refer to section "Measurement Equipment and Accessories", item 3)
- Short Circuit termination (refer to section "Measurement Equipment and Accessories", item 4)
- 50 Ohm termination (refer to section "Measurement Equipment and Accessories", item 5)

Test setup:

Connect the 7 pins connector of the FSH-Z3 to the Power Sensor connector of the FSH-6 and mount the FSH-Z3 on to the spectrum analyzer (item 1)

Spectrum Analyzer settings:

- [**PRESET**]
- [**FREQ**]
- [START FREQ : **10 MHz**]
- [STOP FREQ : **3 GHz**]
- [**BW** : MANUAL RES BW : **100 kHz**]
- [**MEAS** : MEASURE : TRACKING GEN]
- [MEAS MODE : SCALAR]
- [REFLECT CAL]

Measurement:

- Connect the Open Circuit termination (item 3) to the TEST port of the FSH-Z3
- Press softkey [CONTINUE] on the Spectrum Analyzer.
- Replace the Open Circuit termination (item 3) on the TEST port of the FSH-Z3 with the Short Circuit termination (item 4).
- Press softkey [CONTINUE] on the Spectrum Analyzer.
- Replace the Short Circuit termination (item 3) on the TEST port of the FSH-Z3 with the 50 Ohm termination (item 5).
- The curve shows the directivity (limited by return loss of the used 50 Ohm termination, item 4).

Checking the Return Loss of the TEST Port

Test principle:	Measure the return loss of the TEST port of the FSH-Z3 using a Standing Wave Ratio Bridge
Test equipment:	<ul style="list-style-type: none">- Spectrum Analyzer (refer to section "Measurement Equipment and Accessories", item 1)- SWR bridge (refer to section "Measurement Equipment and Accessories", item 2)- Open circuit termination (refer to section "Measurement Equipment and Accessories", item 3)- Short circuit termination (refer to section "Measurement Equipment and Accessories", item 4)- 50 Ohm termination (refer to section "Measurement Equipment and Accessories", item 5)- Precision Adapter (refer to section "Measurement Equipment and Accessories", item 6)- Two 50 Ohm terminations N-female (refer to section "Measurement Equipment and Accessories", item 7)- Adapter (refer to section "Measurement Equipment and Accessories", item 8)- Cable (refer to section "Measurement Equipment and Accessories", item 9)
Test setup:	<ul style="list-style-type: none">➤ Connect GEN OUTPUT of the Spectrum Analyzer (item1) to RF input of SWR Bridge (item 2) using adapter (item 8)➤ Connect output of the SWR Bridge (item 2) to the RF input of the Spectrum Analyzer using cable (item 9).➤ Connect the Open Circuit termination (item 3) onto the TEST port of the SWR Bridge (item 2).➤ Connect the 7 pins connector of the FSH-Z3 to the Power Sensor connector of the FSH-6 (Only this connector of the FSH-Z3 is connected to set the switch in the right position)
Spectrum Analyzer settings:	<ul style="list-style-type: none">- [PRESET]- [FREQ]- [START FREQ : 10 MHz]- [STOP FREQ : 6 GHz]- [MEAS : MEASURE : TRACKING GEN]- [REFLECT CAL : CONTINUE]

Measurement:

- Replace the Open Circuit termination (item 3) on the TEST port of the SWR Bridge (item 2) with the Short Circuit termination (item 4).
- Press softkey [CONTINUE] on the Spectrum Analyzer.
- Replace the Short Circuit termination (item 3) on the TEST port of the SWR Bridge (item 2) with the 50 Ohm termination (item 5).
- Press softkey [CONTINUE] on the Spectrum Analyzer.
- Remove the 50 Ohm termination (item 5)
- Connect the two 50 Ohm terminations (item 7) to the ports GEN OUTPUT and RF INPUT of the FSH-Z3
- Connect TEST port of the FSH-Z3 with the TEST port of the SWR Bridge (item 2) using an precision adapter (item 6)
- The curve shows the return loss of the FSH-Z3.

Checking the Insertion Loss of the Tracking Generator Bypass

Test equipment:

- Spectrum Analyzer (refer to section "Measurement Equipment and Accessories", item 1)
- Cable (refer to section "Measurement Equipment and Accessories", item 9)

Test setup:

- Connect GEN OUTPUT to RF INPUT of the spect. Analyzer (item1) using cable (item 9)
- Connect the 7 pins connector of the FSH-Z3 to the Power Sensor connector of the FSH-6 (Only this connector of the FSH-Z3 is connected to set the switch in the right position)

Spectrum Analyzer settings:

- [**PRESET**]
- [**FREQ**]
- [START FREQ : **10 MHz**]
- [STOP FREQ : **6 GHz**]
- [**MEAS** : MEASURE : TRACKING GEN]
- [**AMPT** : REF : **+20 dBm**]
- [**MEAS** : MEAS MODE : SCALAR]
- [TRANSM CAL : CONTINUE]

Measurement:

- Remove cable (item 9)
- Connect the GEN OUTPUT port of the FSH-Z3 to the GEN OUTPUT port of the Spectrum Analyzer (item 1)
- Connect the other GEN OUTPUT port of the FSH-Z3 to the RF INPUT port of the Spectrum Analyzer (item 1) using cable (item 9)
- The curve shows the insertion loss of the Tracking Generator Bypass

Checking the isolation between GEN OUTPUT port and TEST port

Test equipment:

- Spectrum Analyzer (refer to section "Measurement Equipment and Accessories", item 1)
- 50 Ohm termination (refer to section "Measurement Equipment and Accessories", item 5)
- Cable (refer to section "Measurement Equipment and Accessories", item 9)

Test setup:

- Connect GEN OUTPUT to RF INPUT of the spect. Analyzer (item1) using cable (item 9)
- Connect the 7 pins connector of the FSH-Z3 to the Power Sensor connector of the FSH-6 (Only this connector of the FSH-Z3 is connected to set the switch in the right position)

Spectrum Analyzer settings:

- [**PRESET**]
- [**FREQ**]
- [START FREQ : **10 MHz**]
- [STOP FREQ : **6 GHz**]
- [**BW** : MANUAL RES BW : **100 kHz**]
- [**MEAS** : MEASURE : TRACKING GEN]
- [**AMPT** : REF : **-35 dB**]
- [**MEAS** : TRANSM CAL : CONTINUE]

Measurement:

- Remove cable (item 9)
- Connect 50 Ohm termination (item 5) to the GEN OUTPUT port of the Spectrum Analyzer (item 1)
- Press softkey [CONTINUE] on the Spectrum Analyzer.
- Remove 50 Ohm termination and Mount the FSH-Z3 on to the Spectrum Analyzer (item 1)
- The curve shows the isolation between GEN OUTPUT port and TEST port

Performance Test Report

Table 1-1 Performance Test Report

ROHDE & SCHWARZ	VSWR Bridge with Tracking Generator Bypass	Version 6-Apr-05
Model ():	FSH-Z3	
Order number:	1300.7756.02	
Serial number:		
Date:		

Characteristic Bridge Mode	Freq Range GHz	Min Value	Actual value	Unit	Measurement uncertainty
Directivity	0.01 .. 0.03	10	see page 1.2	dB	+0.5/-0.5
	0.03 .. 3	20	see page 1.2	dB	+0.5/-0.5
	3 .. 6	18	see page 1.2	dB	+0.5/-0.5
Test Port Match	0.01 .. 0.05	12	see page 1.4	dB	+1.6/-2.1
	0.05 .. 6	16	see page 1.4	dB	+1.6/-2.1

Characteristic Transmission Mode	Freq Range GHz	Max Value	Actual value	Unit	Measurement uncertainty
Insertion Loss *	0.01 .. 6	5	see page 1.5	dB	+0.5/-0.5
		Min Value			
Isolation **	0.01 .. 3	80	see page 1.6	dB	+0.5/-0.5
	3 .. 6	60	see page 1.6	dB	+1.0/-1.0

* Between Generator Input and Output Port.

** Between Generator Output Port and Test Port.

2 Adjustment

The R&S FSH-Z3 does not have any possibilities for adjustment.

3 Spare Part Replacement

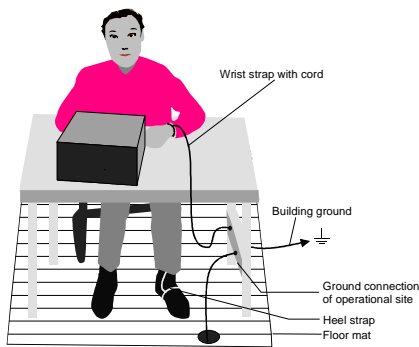
This section describes the service concept and contains the spare parts list and the basic documents for the R&S FSH-Z3 instrument.

Note: The numbers indicated in brackets refer to items in the mechanical exploded drawings.

Note: The words “left” and “right” in the manual always refer to the front view of the instrument.



Caution!



- Please pay close attention to the safety instructions in the front section of this manual.
- Safeguard the replacement site against electrostatic discharge to prevent damage to electronic components.
- The following two methods of ESD protection can be used together or separately:
 - Wrist strap with cord to ground connection
 - Conductive floor mat and heel strap combination

Overview of the spare parts

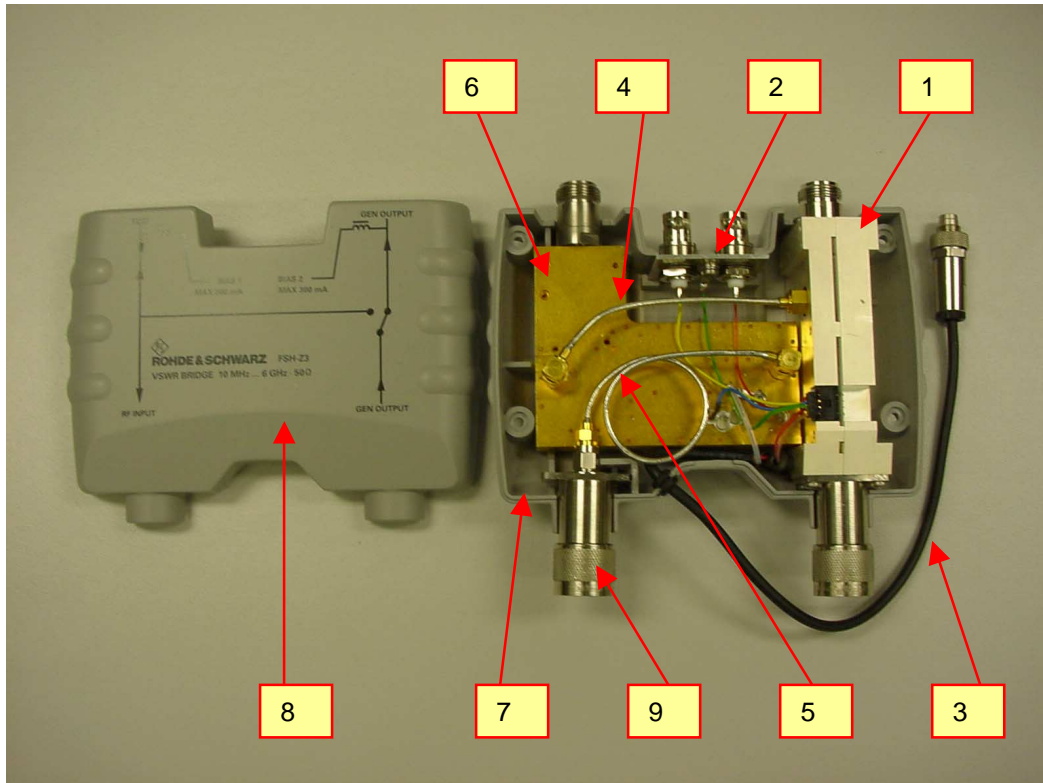


Fig. 3-1 Overview of spareparts

Table 3-1 List of spare parts and order numbers

Reference	Part	R&S Order Number
1	TG SWITCH MODULE	1300.7904.00
2 + 3	MOUNTING PLATE ASSY FSH-Z3 and WIRE TREE FSH-Z3	1300.7910.00
4	COAX CABLE ASSY A FSH-Z3	1300.7927.00
5	COAX CABLE ASSY B FSH-Z3	1300.7933.00
6	RM BRIDGE UNIT FSH-Z3	1145.3593.03
7 + 8	Z3 COVERS	1300.7956.00
9	ADAPTER N TO SMA	1157.3541.00

Note: The references can be found in Fig. 3-1

Opening the instrument

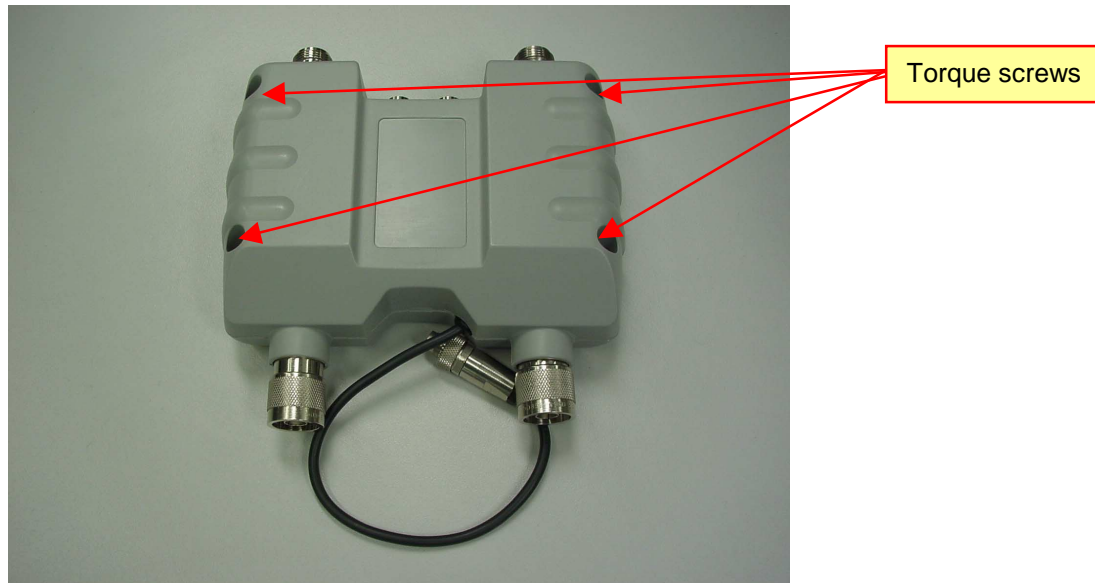


Fig. 3-2 Opening the instrument

- Loosen the four screws, see Fig 3-2.
- Turn the instrument so that the bottom with type plate touches the table.
- Remove the top cover.

Closing the instrument

- Place the top cover.
- Turn the instrument so that the top cover touches the table.
- Fasten the four screws.

Replacing the Front/Rear covers

Housing parts:

- 07: Rear cover
- 08: Front cover

Notes: When replacing the rear cover, the existing type plate must be placed on the new rear cover, or the old series number must be written on the new type plate.

- Open the instrument as described earlier.
- Replace the specific cover.
- Close the instrument as described earlier.

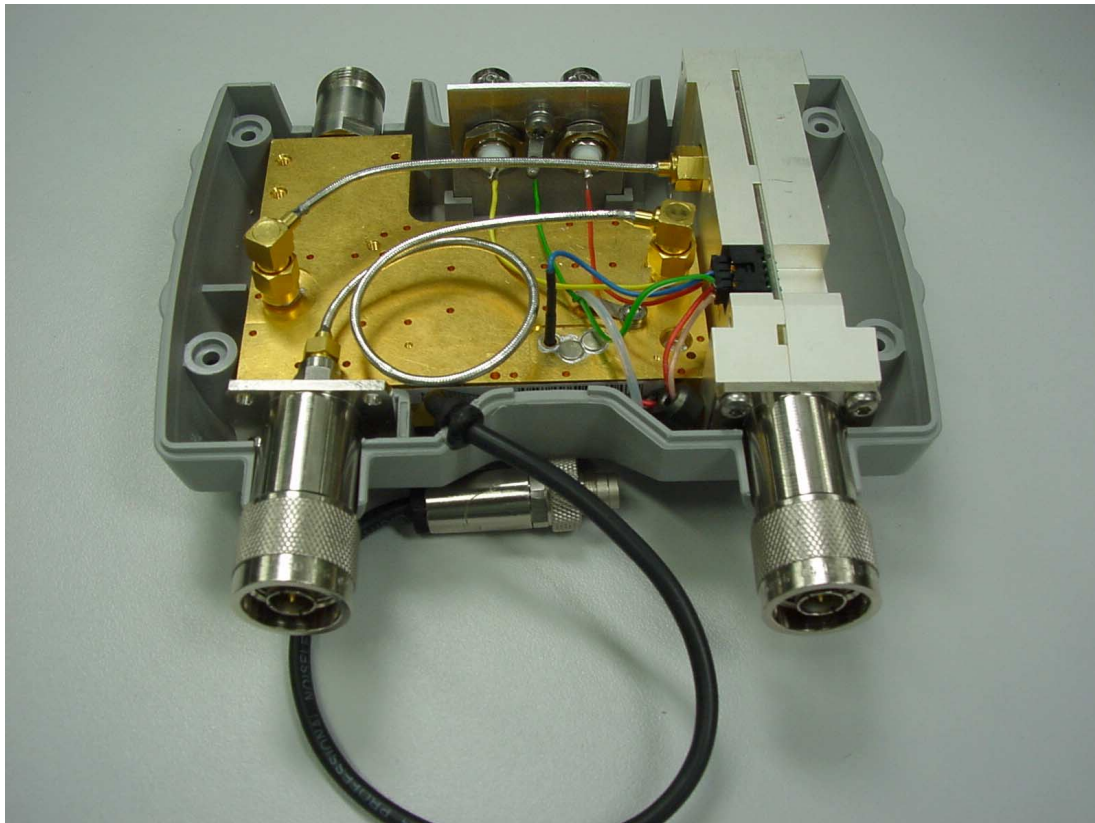


Fig. 3-3 Location of the power cable assembly and the coax cable assemblies in the rear cover.

Replacing the wire tree

(See table Table 3-1 List of spare parts and order numbers for references)

- Open the instrument as described earlier.
- Remove the defective power cable assembly.
 - Loosen screw 1 (see Fig 3-4)
 - Remove the connector from TG Switch unit (see Fig 3-4)

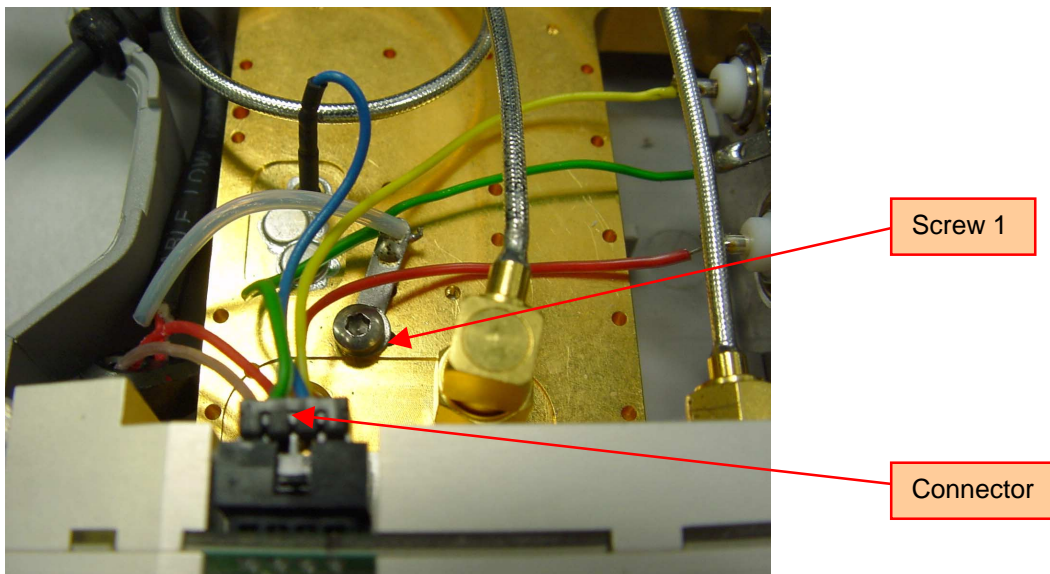


Fig. 3-4 Replacing the wire tree

- Solder the green, red and yellow wires as indicated in Fig 3-5

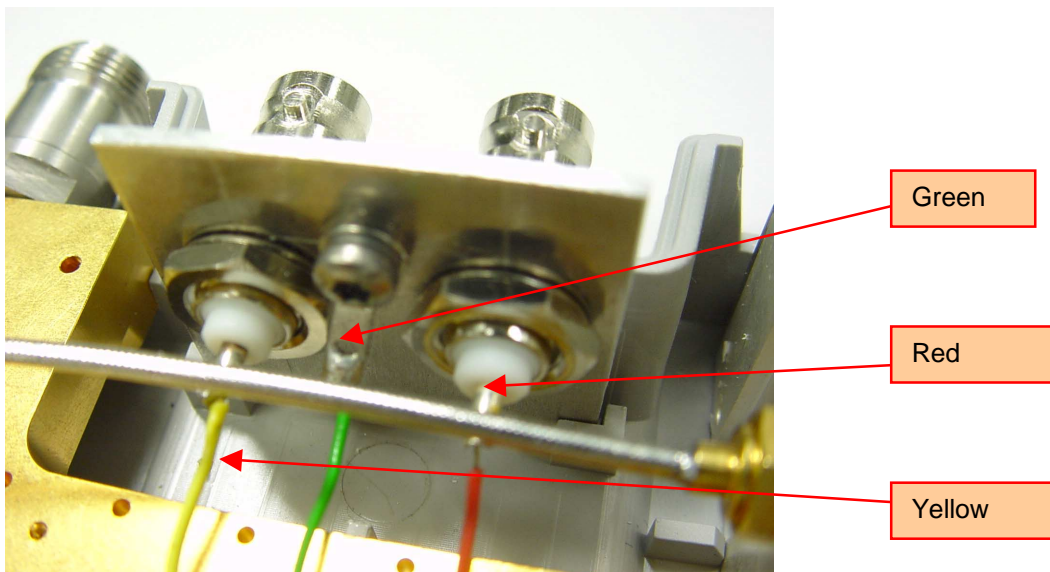


Fig. 3-5 Solder the wires to the pins

- Close the instrument as described earlier.

Replacing the coax cable assemblies

(See table Table 3-1 List of spare parts and order numbers for references)

- Open the instrument as described earlier.
-



Fig. 3-6 Connect the coax assy A (item 04) to the N-SMA connector (item 09) using a torque wrench

- Bend the coax assy A as shown in Fig. 3-3
- Connect coax assy B (item 05) as in Fig. 3-3 using a torque wrench
- Close the instrument as described earlier.

Troubleshooting

Malfunctions can have simple causes but can also be due to faulty components or modules.

These troubleshooting instructions can be used to locate causes of error down to spare parts level and to return the instrument to operability by replacing parts.

Note: When problems occur, first check whether any connections (cables, plug-in connections of boards, etc) are damaged or incorrectly connected.

Overview of errors, causes, and possible corrective actions

This section lists various errors and the suggested corrective action.

Troubleshooting problems

- **Error: Directivity of R&S FSH-Z3 shows a resonance bump at frequencies higher than 2 GHz.**

Troubleshooting procedure	Possible cause of error and further steps
Check the N connector of the TEST Port	The N connector of the TEST Port is soiled. <i>Clean or replace this female N connector.</i>

- **Error:**

Troubleshooting procedure	Possible cause of error and further steps
Check ↓	Cause of error. <i>Repair Action.</i>
Next Check	<i>Repair Action.</i>

4 Documents

This chapter provides information on how to order spare parts, and it also contains the spare parts list.

Shipping of Instrument and Ordering of Spare Parts

Please contact your Rohde & Schwarz support center or our spare parts express service if you need to request service, repair your equipment, or order spare parts and modules.

The list of Rohde & Schwarz representatives and the address of our spare parts express service are provided in the front section of this service manual.

You will need to provide the following information in order for us to respond to your inquiries quickly and accurately and to determine whether the warranty for your instrument is still valid:

- Instrument model
- Serial number
- Detailed error description in case of repair
- Contact partner for checkbacks

Shipping of instrument

When shipping the instrument, be sure to provide sufficient mechanical and anti-static protection:

- Repack the instrument as it was originally packed. The antistatic packing foil prevents unintentional electrostatic charging from occurring.
- If you do not use the original packaging, include sufficient padding to prevent the instrument from slipping inside the package. Wrap antistatic packing foil around the instrument to protect it from electrostatic charging.

Shipping of a module

When shipping a module, be sure to provide sufficient mechanical and antistatic protection:

- Ship the module in a sturdy, padded box.
- Wrap the board in antistatic foil.
If the packaging is antistatic but not conductive, additional conductive packaging is required. The additional packaging is not required if the enclosed packaging is conductive.

Ordering spare parts

To deliver replacement parts promptly and correctly, we need the following information:

- R&S order number (refer to the spare part lists in this chapter)
- Designation
- Number of units
- Instrument type for the replacement part
- Contact person for possible questions

The R&S order number to be used when ordering replacement parts and modules as well as power cables can be found further below.

Refurbished modules

- Refurbished modules are an economical alternative to original modules. It should be kept in mind that refurbished modules are not new, but repaired and fully tested parts. They may have signs of use but they are electrically and mechanically equivalent to new modules.
- To find out which refurbished modules are available, please contact your Rohde & Schwarz representative (or the central service division at Rohde & Schwarz in Munich).

Return of defective replaced modules

- Defective modules of the replacement program that can be repaired may be returned within 3 **months** after delivery of the replaced module. A repurchasing value is credited.
- Excluded are parts that cannot be repaired, e.g. PCBs that are burned, broken or damaged by repair attempts, incomplete modules, or parts that have endured heavy mechanical damage.
- Defective parts must be sent back with an **accompanying document of returned items** containing the following information:
 - R&S order number, serial number and designation of the removed part
 - **Precise** description of the error
 - R&S order number, serial number and designation of the instrument the part was removed from
 - Date of part removal
 - Name of the technician who exchanged the part
- A **document of returned items** is provided along with each replacement module.

Spare Parts

The R&S order numbers necessary for ordering replacement parts and modules can be found in the spare part lists provided below.



Important Note!

When replacing a module, please pay careful attention to the safety instructions and the repair instructions provided in chapter 3 and at the beginning of this service manual.

When shipping a module, be sure to provide sufficient mechanical and antistatic protection.

List of R&S FSH-Z3 spare parts

The following table lists available spare parts together with their R&S order numbers.

Table 4-1 List of spare parts and order numbers

Reference	Part	R&S Order Number
1	TG SWITCH MODULE	1300.7904.00
2 + 3	MOUNTING PLATE ASSY FSH-Z3 and WIRE TREE FSH-Z3	1300.7910.00
4	COAX CABLE ASSY A FSH-Z3	1300.7927.00
5	COAX CABLE ASSY B FSH-Z3	1300.7933.00
6	RM BRIDGE UNIT FSH-Z3	1145.3593.03
7 + 8	Z3 COVERS	1300.7956.00
9	ADAPTER N TO SMA	1157.3541.00

Note: The references can be found in the drawing in Chapter 3.