R&S®FSH20-N
Spectrum Analyzer
Service Manual

MANUAL ISSUE

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Service Manual

ROHDE&SCHWARZ

The Service Manual describes the following R&S®FSH models:

- R&S FSH20-N (1314.2000.80)

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

Table of Contents

Documentation Overview

The user documentation for the R&S FSH is divided as follows:

Manual

The Manual contains information for manual operation of the R&S FSH and for maintenance (service) of the R&S FSH.

It covers the following topics:

- overview of all elements of the front and rear panels
- basic information on how to set up the R&S FSH
- information on how to operate the R&S FSH in a network
- instructions on how to perform measurements
- instructions on how to set up and operate the R&S FSH in its various operating modes
- instructions on how to perform measurements with the R&S FSH
- instructions on how to work with the available software options and applications

Service Manual

The Service Manual provides information on maintenance.

It covers the following topics:

- instructions on how to perform a performance test
- instructions on how to repair the R&S FSH including a spare parts list

Software Manual for remote control

The Software Manual contains information for remote operation of the R&S FSH.

It covers the following topics:

- information about the SCPI command structure and syntax
- information on how to set up a remote connection with the R&S FSH
- information about command processing
- information about the status reporting system
- description of supported remote commands

Conventions Used in the Documentation

The following conventions are used throughout the R&S FSH Service Manual:

Typographical conventions

Convention	Description
“Graphical user interface elements”	All names of graphical user interface elements both on the screen and on the front and rear panels, such as dialog boxes, softkeys, menus, options, buttons etc., are enclosed by quotation marks.
“KEYS”	Key names are written in capital letters and enclosed by quotation marks.
Input	Input to be entered by the user is displayed in italics.
`File names, commands, program code`	File names, commands, coding samples and screen output are distinguished by their font.
"Links"	Links that you can click are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by quotation marks.

Other conventions

- **Remote commands**: Remote commands may include abbreviations to simplify input. In the description of such commands, all parts that have to be entered are written in capital letters. Additional text in lower-case characters is for information only.

1 Performance Test

1.1 Test Instructions

- The rated specifications of the analyzer are tested after a warm-up time of at least 15 minutes. Only by adhering to this requirement can compliance with the guaranteed data be ensured.
- 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.
- Inputs for settings during measurements are shown as following:

[<KEY>] Press a key on the front panel, eg [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 RBW : 3 kHz].

1.2 Test Equipment

Item	Type of equipment	Recommended characteristics or features	Recommended model	R&S order no	Application
1	Signal generator	R&S FSH20: 10 MHz to 20 GHz Uncertainty of frequency: 0.1 ppm Phase noise at 500 MHz: < -100 dBc/Hz @ 10 kHz < -110 dBc/Hz @ 100 kHz < -130 dBc/Hz @ 1 MHz	R&S SMB100A w/ SMB-B120 w/ SMB-B1H or equivalent	1406.6000.02 1407.2209.02 1407.3070.02	Frequency response Frequency accuracy of reference oscillator
2	6-dB power splitter	R&S FSH20: 10 MHz to 20 GHz	Agilent 11667B or equivalent		Frequency response
3	Power meter		R&S NRX or equivalent	1424.7005.02	Frequency response
4	Power sensor	R&S FSH20: 10 MHz to 20 GHz RSS ≤ 0.8% Meter Noise ≤ 20 pW	R&S NRP33S or equivalent	1419.0064.02	Frequency response
5	N cable (Short)	Attenuation < 1 dB			Tracking generator output level
6	50 Ohm termination	9 kHz to 20 GHz Return loss ≤ -10 dB			Noise display

1.3 Performance Test R&S FSH

1.3.1 Checking the Reference Frequency Accuracy

Test equipment: Signal generator (see "Test Equipment", item 1)

Test setup: ► Connect the signal generator to the RF input of the R&S FSH.

Signal generator settings:
Frequency: 1 GHz
Level: -4 dBm

Determine the output power of the signal generator with the power meter. Adjust the output power of the generator until the power meter shows -10 dBm.

R&S FSH settings:
- [PRESET]
- [**FREQ** : **1 GHz**]
- [**SPAN** : **100 kHz**]
- [**BW** : MANUAL RBW : **300 kHz**]
- [**AMPT**: **0 dBm**]
- [**MARKER** : Marker Function: Frequency Count]

Measurement: ► Read out the frequency value (Count:) of the marker.

Nominal frequency: 1.0 GHz

Refer to "Performance Test Report" for tolerances.

Adjustment of the reference oscillator

The frequency of the reference oscillator can be adjusted by means of a service function (refer to "Adjustment").

1.3.2 Checking the Level Accuracy and the Frequency Response

Test equipment: Signal generator (see "Test Equipment", item 1)

Power meter (see "Test Equipment", item 3)

Power sensor (see "Test Equipment", item 4)

6-dB power splitter (see "Test Equipment", item 2)

1.3.2.1 Determining the Level Accuracy at 100 MHz

Test setup:

► Connect the power sensor (item 4) to the power meter and execute function 'ZERO' while there is no signal applied to the power sensor.

► Connect the RF output of the signal generator to the input of the divider.

► Connect output 1 of the divider to the power sensor / power meter.

► Connect output 2 of the divider to the RF input of the R&S FSH

Signal generator settings:

Frequency	100 MHz
Level	6 dBm

► Determine the output power of the signal generator with the power meter. Adjust the output power of the generator until the power meter shows 0 dBm.

R&S FSH settings:

- [**PRESET**]
- [**FREQ** : **100 MHz**]
- [**AMPT**: **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : MANUAL RBW : **10 kHz**]
- [**SWEEP** : Manual SWP Time : 5s]
- [**TRACE** : DETECTOR : RMS]

► Set the marker to the peak of the signal.

- [**MKR->** : Set to Peak]

Evaluation: The difference between the signal levels measured with the power meter and the level reading of the marker reflects the absolute level error of the R&S FSH. It can be calculated as:

$$\text{Level error}_{100\ \text{MHz}} = L - L_{\text{powermeter}}$$

1.3.2.2 Checking the Frequency Response

For the measurement of the frequency response, the value at 100 MHz for each reference level setting is used as the reference. For reference level and RF attenuator please refer to the settings which are indicated in the chapter “performance test report”!

Test setup:

► Connect the RF output of the signal generator to the input of the divider.

► Connect output 1 of the divider to the power sensor / power meter.

► Connect output 2 of the divider to the RF input of the SA..

Signal generator settings:

Frequency	$\{f_{in}\}$
Level	-4 dBm

Refer to "Performance Test Report" for values of Ref_Lev and f_{in}.

► Determine the output power of the signal generator with the power meter. Adjust the output power of the generator until the power meter shows:

-25 dBm ± 0.2 dB	for RF_Att = 5 dB (Preamp Off)
-15 dBm ± 0.2 dB	for RF_Att = 10 dB (Preamp Off)
- 5 dBm ± 0.2 dB	for RF_Att = 20 dB (Preamp Off)
0 dBm ± 0.2 dB	for RF_Att = 30 dB (Preamp Off)

R&S FSH settings:

- [**PRESET**]
- [**AMPT** : Ref_Lev]
- [**SPAN** : **100 kHz**]
- [**BW** : MANUAL RBW : **10 kHz**]
- [**SWEEP** : Manual SWP Time : 1s]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : $\{f_{in}\}$]

Reference measurement:

► Determine signal level $L_{powermeter}$.

► Set the marker to the peak of the signal.

- [**MKR->** : SET TO PEAK]

► The signal level L is displayed by the level reading of the marker.

$Ref_{100MHz} = L - L_{powermeter}$

Measurement

Signal generator settings: Frequency $\{f_{in}\}$

Refer to “Performance Test Report” for values of $\{f_{in}\}$.

Power meter settings: Determine the signal level $L_{powermeter}$. To achieve higher accuracy, compensating the frequency response of the power sensor is recommended.

R&S FSH settings: - [**FREQ** : $\{f_{in}\}$]

Refer to table under “Performance Test Report” for values of $\{f_{in}\}$.

► Set the marker to the peak of the signal.

- [**MKR->** : SET TO PEAK]

The signal level L is displayed by the level reading of the marker.

Evaluation: The frequency response can be calculated as:

► Frequency response = L - $L_{powermeter}$ - $Ref_{100\ MHz}$

1.3.3 Checking the Accuracy of the RF Attenuator

Test principle: The RF attenuator of the R&S FSH can be switched from 0 to 40 dB in 5 dB increments.

Test equipment: Signal generator (refer to "Test Equipment", item 1)

Frequency	100 MHz
Maximum level	≥ 6 dBm

Test setup:

► Connect the RF output of the signal generator to the input of the divider.

► Connect output 1 of the divider to the power sensor / power meter.

► Connect output 2 of the divider to the RF input of the R&S FSH.

Signal generator settings:

Frequency	100 MHz
Level	-14 dBm

Determine the output power of the signal generator with the power meter. Adjust the output power of the signal generator until the power meter shows -20 dBm ± 0.2 dB.

R&S FSH settings:

- [**PRESET**]
- [**FREQ** : **100 MHz**]
- [**SPAN** : **100 kHz**]
- [**BW** : MANUAL RBW : **10 kHz**]
- [**BW** : MANUAL VIDEO BW : **30 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**AMPT**: **-10 dBm**]
- [**AMPT**: RF Att Amp / Imp: RF attenuation Man: **0 dB**]

Reference measurement:

► Set the marker to the peak of the signal.

[**MKR->** : SET TO PEAK]

The signal level L is displayed by the level reading of the marker.

$$Ref_{(0\ dB)} = L - L_{powermeter}$$

Measurement

Signal generator settings

Frequency	100 MHz
Level	RF Att – 24 dB

Refer to "Performance Test Report" for values of {RF Att}.

► Determine the output power of the signal generator with the power meter. Adjust the output power of the generator until the power meter shows the level:

-20 dBm ± 0.2 dB	for RF_Att = 0 dB
-15 dBm ± 0.2 dB	for RF_Att = 5 dB
- 5 dBm ± 0.2 dB	for RF_Att = 10 dB
0 dBm ± 0.2 dB	for RF_Att = 20 dB
0 dBm ± 0.2 dB	for RF_Att = 30 dB

R&S FSH settings: - [**AMPT**: RF Att Amp / Imp: RF attenuation Man: **0 dB**]

- [**MKR->**: SET TO PEAK]

Evaluation: The signal level L is displayed by the level reading of the marker.

The difference between the level inaccuracy of the R&S FSH and Ref_{0dBm} (at 10 dB RF-Att) is the uncertainty of the RF attenuation:

$$RF\ Att_{accuracy} = (L - L_{powermeter}) - Ref_{(0\ dB)}$$

1.3.4 Checking the Accuracy of the IF Gain Setting

Test principle: The R&S FSH do not have any switchable IF gain. A change in reference level is only a graphical shift on the display. Therefore, no measurement is needed to verify the specified accuracy.

1.3.5 Checking the Display Linearity

Test equipment: Signal generator (refer to "Test Equipment", item 1)

Power meter (refer to "Test Equipment", item 3)

Power sensor (refer to "Test Equipment", item 4)

6-dB power splitter (refer to "Test Equipment", item 2)

Test setup:

- ► Connect the power sensor (item 4) to the power meter and execute function 'ZERO' when there is no signal applied to the power sensor.
- ► Connect the RF output of the signal generator to the input of the divider.
- ► Connect output 1 of the divider to the power sensor / power meter.
- ► Connect output 2 of the divider to the RF input of the R&S FSH.

1st Measurement

0 dB to 30 dB below reference level

Signal generator settings:

Frequency	100 MHz
Level	+ 6 dBm

- ► Determine the output power of the signal generator with the power meter. Adjust the output power of the generator until the power meter shows 0 dBm.

R&S FSH settings: - [**PRESET**]

- [**AMPT: 0 dBm**]
- [**AMPT**: RF Att Amp / Imp: RF attenuation Man: 20 dB]
- [**FREQ**: **100 MHz**]
- [**SPAN** : **10 kHz**]
- [**Manual RBW** : **1 kHz**]
- [**Manual VBW** : **3 kHz**]
- [**SWEEP**: Manual SWP Time : 1 s]
- [**TRACE** : DETECTOR : RMS]

Reference measurement:

► Set the marker to the peak of the signal.

- [**MKR->** : SET TO PEAK]

► The signal level L is displayed by the level reading of the marker.

$Ref_{(0dB)} = L - L_{powermeter}$

Signal generator settings:

Frequency	100 MHz
Level	Sig_Lev + 6 dB

Refer to "Performance Test Report" for values of {Sig_Lev}.

► Determine the output power of the signal generator with the power meter. Adjust the output power of the generator until the power meter shows the value of {Sig_Lev}.

Evaluation:

► The signal level L is displayed by the level reading of the marker.

The difference between the level inaccuracy of the R&S FSH and Ref_{0dBm} is the uncertainty of the display linearity:

$Linearity_{uncertainty} = (L - L_{powermeter}) – Ref_{(0dB)}$

2nd Measurement

30 dB to 50 dB below reference level

Because the sensitivity of the power meter is limited, the internal RF attenuator of the R&S FSH is used to increase the dynamic range of the input signal.

R&S FSH settings: - [**AMPT**: RF Att Amp / Imp: RF attenuation Man: 40 dB]

Signal generator settings:

Frequency	100 MHz
Level	- 4 dBm

► Determine the output power of the signal generator with the power meter. Adjust the output power of the generator until the power meter shows Sig_Lev ± 0.2 dB.

Reference measurement:

► Set the marker to the peak of the signal.

- [**MKR->** : SET TO PEAK]

The signal level L is displayed by the level reading of the marker.

With the result of the 1st linearity measurement, a new correction factor is to be calculated. “$Linearity_{uncertainty}$ (-30dB)” is the measured uncertainty of the R&S FSH linearity at 30 dB below reference level.

$$Ref_{(20dB)} = (L - L_{powermeter}) – Linearity_{uncertainty} (-30dB)$$

Signal generator settings:

Frequency	100 MHz
Level	Sig_Lev + 6 dB

Refer "Performance Test Report" for values of {Sig_Lev}.

► Determine the output power of the signal generator with the power meter. Adjust the output power of the generator until the power meter shows the value Sig_Lev ± 0.2 dB.

Evaluation:

The signal level L is displayed by the level reading of the marker.

The difference between the level inaccuracy of the R&S FSH and Ref_{20dBm} is the uncertainty of the display linearity:

$$Linearity_{uncertainty} = (L - L_{powermeter}) – Ref_{(20dB)}$$

1.3.6 Checking the Phase Noise

Test equipment: Signal generator (refer to "Test Equipment", item 1)

Frequency 500 MHz

Level -4 dBm

Phase noise at 500 MHz:
< -105 dBc (1Hz) @ 10 kHz
< -115 dBc (1Hz) @ 100 kHz
< -130 dBc (1Hz) @ 1 MHz

Test setup: ► Connect the RF output of the signal generator to the RF input of the R&S FSH.

R&S FSH settings: Frequency 500 MHz

Level 0 dBm

- [**PRESET**]
- [**FREQ** : **500 MHz**]
- [**AMPT** : -1**0 dBm**]
- [**AMPT**: RF Att Amp / Imp: RF attenuation Man: **0dB**]
- [**SPAN** : 10 kHz]
- [**Manual RBW** : **1 kHz**]
- [**Manual RBW** : **1 kHz**]
- [**SWEEP**: Manual SWP Time : 500 ms]
- [**TRACE** : DETECTOR : SAMPLE]
- [**TRACE** : Trace Mode: Average 10]
- Marker to peak
- [**MKR->** : SET TO PEAK]
- Readout marker level L_{ref} and marker frequency f_{ref}

Measurement at several Offsets
- [**FREQ** : f_{ref} – {Offset}] with Offset ={30 kHz, 100 kHz, 1 MHz}
- [**MKR->**: SET TO f_{ref} – {Offset}]
- Readout marker level L_{Offset}

Evaluation: The phase noise will be calculated with:

$PN_{Offset} = (L_{Offset} - L_{ref} – 30dB)$ dBc (1 Hz)

1.3.7 Checking the Displayed Average Noise Floor

Test equipment: 50-Ω termination (refer to "Test Equipment", item 6)

Test setup: ► Terminate the RF input of the R&S FSH with 50 Ω

R&S FSH settings:
- [**PRESET**]
- [**SPAN** : Zero Span]
- [**BW**: Manual RBW : **1 kHz**]
- [**BW**: Manual VBW : **10 Hz**]
- [**SWEEP** : Manual SWP Time : 600ms]
- [**TRACE** : Trace Mode: Average 12]
- [**TRACE** : DETECTOR : SAMPLE]
- [**AMPT** : **-40 dBm**]
- [**FREQ** : {f_n}]

Refer to "Performance Test Report" for values of f_n.

Measurement: ► Read out the marker level.

Evaluation: The displayed average noise floor is displayed by the level reading of the marker.

1.3.8 Checking the Tracking Generator

Test equipment: N cable

Test setup: ► Connect both ports directly with the N cable.

R&S FSH settings:
- [**PRESET**]
- [**MODE:** Network Analyzer]
- [**AMPT**: RF Att Amp / Imp: RF attenuation Man: 10dB]
- [**AMPT** : TG Output Attenuation: {TG_Att}]
- [**MEAS** : Result Display: {Transmission Rev / Transmission Fwd}]
- [**MEAS** : Result Display: {Transmission Rev (Port 2 > 1)}] (R&S FSH23/30 only)
- [**MKR->**: Set to Peak]
- [**MKR->** : Set to Minimum]

► Determine whether the maximum and the minimum value are within the upper and lower functional limit.

Lower functional limit: -10 dB
Upper functional limit: 10 dB

► Perform the test with the following values of TG_Att:

10 dB, 11 dB, 12 dB, 16 dB, 18 dB

Note:

This test is a functional test only, which makes sure that the tracking generator is working properly. The test result is therefore not included in the performance test report.

1.4 Performance Test Report

ROHDE&SCHWARZ	Spectrum Analyzer R&S FSH	1314.2000.80
Model		
Order number		
Serial number:		
Date:		
Person responsible:		
Signature:		

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

Measurand	Specified min. value	Measured value	Specified max. value	Unit
Frequency accuracy (reference oscillator)				
Base unit	0.999998	_____	1.000002	GHz
Level accuracy at 100 MHz with Ref_Lev = 0 dBm	-0.3	_____	+0.3	dB
Frequency response (f_{resp}) with RF Att = 5 dB Ref_Lev = -20 dBm				
10 MHz	-2	_____	+2	dB
100 MHz	-	Reference	-	
500 MHz	-2	_____	+2	dB
1000 MHz	-2	_____	+2	dB
1500 MHz	-2	_____	+2	dB
2000 MHz	-2	_____	+2	dB
2500 MHz	-2	_____	+2	dB
3000 MHz	-2	_____	+2	dB
3500 MHz	-2	_____	+2	dB
4000 MHz	-2	_____	+2	dB
4500 MHz	-2	_____	+2	dB
5000 MHz	-2	_____	+2	dB

Measurand	Specified min. value	Measured value	Specified max. value	Unit
5500 MHz	-2	_____	+2	dB
6000 MHz	-2	_____	+2	dB
7000 MHz	-2	_____	+2	dB
7500 MHz	-2	_____	+2	dB
7990 MHz	-2	_____	+2	dB
8010 MHz	-2	_____	+2	dB
8500 MHz	-2	_____	+2	dB
9000 MHz	-2	_____	+2	dB
9500 MHz	-2	_____	+2	dB
10000 MHz	-2	_____	+2	dB
10500 MHz	-2	_____	+2	dB
11000 MHz	-2	_____	+2	dB
12500 MHz	-2	_____	+2	dB
13000 MHz	-2	_____	+2	dB
13590 MHz	-2	_____	+2	dB
13610 MHz	-2	_____	+2	dB
14000 MHz	-2	_____	+2	dB
14500 MHz	-2	_____	+2	dB
15000 MHz	-2	_____	+2	dB
15500 MHz	-2	_____	+2	dB
16000 MHz	-2	_____	+2	dB
16500 MHz	-2	_____	+2	dB
17000 MHz	-2	_____	+2	dB
17500 MHz	-2	_____	+2	dB
18000 MHz	-2	_____	+2	dB
18500 MHz	-2	_____	+2	dB
19000 MHz	-2	_____	+2	dB
19500 MHz	-2	_____	+2	dB
19900 MHz	-2	_____	+2	dB

Measurand	Specified min. value	Measured value	Specified max. value	Unit
Frequency response (f_{resp}) with RF Att = 10 dB Ref_Lev = -10 dBm				
10 MHz	-2	_____	+2	dB
100 MHz	-	Reference	-	
500 MHz	-2	_____	+2	dB
1000 MHz	-2	_____	+2	dB
1500 MHz	-2	_____	+2	dB
2000 MHz	-2	_____	+2	dB
2500 MHz	-2	_____	+2	dB
3000 MHz	-2	_____	+2	dB
3500 MHz	-2	_____	+2	dB
4000 MHz	-2	_____	+2	dB
4500 MHz	-2	_____	+2	dB
5000 MHz	-2	_____	+2	dB
5500 MHz	-2	_____	+2	dB
6000 MHz	-2	_____	+2	dB
7000 MHz	-2	_____	+2	dB
7500 MHz	-2	_____	+2	dB
7990 MHz	-2	_____	+2	dB
8010 MHz	-2	_____	+2	dB
8500 MHz	-2	_____	+2	dB
9000 MHz	-2	_____	+2	dB
9500 MHz	-2	_____	+2	dB
10000 MHz	-2	_____	+2	dB
10500 MHz	-2	_____	+2	dB
11000 MHz	-2	_____	+2	dB
12500 MHz	-2	_____	+2	dB
13000 MHz	-2	_____	+2	dB
13590 MHz	-2	_____	+2	dB

Measurand	Specified min. value	Measured value	Specified max. value	Unit
13610 MHz	-2	_____	+2	dB
14000 MHz	-2	_____	+2	dB
14500 MHz	-2	_____	+2	dB
15000 MHz	-2	_____	+2	dB
15500 MHz	-2	_____	+2	dB
16000 MHz	-2	_____	+2	dB
16500 MHz	-2	_____	+2	dB
17000 MHz	-2	_____	+2	dB
17500 MHz	-2	_____	+2	dB
18000 MHz	-2	_____	+2	dB
18500 MHz	-2	_____	+2	dB
19000 MHz	-2	_____	+2	dB
19500 MHz	-2	_____	+2	dB
19900 MHz	-2	_____	+2	dB
Frequency response (f_{resp}) with RF Att = 20 dB Ref_Lev = 0 dBm				
10 MHz	-2	_____	+2	dB
100 MHz	-	Reference	-	
500 MHz	-2	_____	+2	dB
1000 MHz	-2	_____	+2	dB
1500 MHz	-2	_____	+2	dB
2000 MHz	-2	_____	+2	dB
2500 MHz	-2	_____	+2	dB
3000 MHz	-2	_____	+2	dB
3500 MHz	-2	_____	+2	dB
4000 MHz	-2	_____	+2	dB
4500 MHz	-2	_____	+2	dB
5000 MHz	-2	_____	+2	dB
5500 MHz	-2	_____	+2	dB
6000 MHz	-2	_____	+2	dB

Measurand	Specified min. value	Measured value	Specified max. value	Unit
7000 MHz	-2	_____	+2	dB
7500 MHz	-2	_____	+2	dB
7990 MHz	-2	_____	+2	dB
8010 MHz	-2	_____	+2	dB
8500 MHz	-2	_____	+2	dB
9000 MHz	-2	_____	+2	dB
9500 MHz	-2	_____	+2	dB
10000 MHz	-2	_____	+2	dB
10500 MHz	-2	_____	+2	dB
11000 MHz	-2	_____	+2	dB
12500 MHz	-2	_____	+2	dB
13000 MHz	-2	_____	+2	dB
13590 MHz	-2	_____	+2	dB
13610 MHz	-2	_____	+2	dB
14000 MHz	-2	_____	+2	dB
14500 MHz	-2	_____	+2	dB
15000 MHz	-2	_____	+2	dB
15500 MHz	-2	_____	+2	dB
16000 MHz	-2	_____	+2	dB
16500 MHz	-2	_____	+2	dB
17000 MHz	-2	_____	+2	dB
17500 MHz	-2	_____	+2	dB
18000 MHz	-2	_____	+2	dB
18500 MHz	-2	_____	+2	dB
19000 MHz	-2	_____	+2	dB
19500 MHz	-2	_____	+2	dB
19900 MHz	-2	_____	+2	dB

Measurand	Specified min. value	Measured value	Specified max. value	Unit
Frequency response (f_{resp}) with RF Att = 30 dB Ref_Lev = +5 dBm				
10 MHz	-2	_____	+2	dB
100 MHz	-	Reference	-	
500 MHz	-2	_____	+2	dB
1000 MHz	-2	_____	+2	dB
1500 MHz	-2	_____	+2	dB
2000 MHz	-2	_____	+2	dB
2500 MHz	-2	_____	+2	dB
3000 MHz	-2	_____	+2	dB
3500 MHz	-2	_____	+2	dB
4000 MHz	-2	_____	+2	dB
4500 MHz	-2	_____	+2	dB
5000 MHz	-2	_____	+2	dB
5500 MHz	-2	_____	+2	dB
6000 MHz	-2	_____	+2	dB
7000 MHz	-2	_____	+2	dB
7500 MHz	-2	_____	+2	dB
7990 MHz	-2	_____	+2	dB
8010 MHz	-2	_____	+2	dB
8500 MHz	-2	_____	+2	dB
9000 MHz	-2	_____	+2	dB
9500 MHz	-2	_____	+2	dB
10000 MHz	-2	_____	+2	dB
10500 MHz	-2	_____	+2	dB
11000 MHz	-2	_____	+2	dB
12500 MHz	-2	_____	+2	dB
13000 MHz	-2	_____	+2	dB
13590 MHz	-2	_____	+2	dB

Measurand	Specified min. value	Measured value	Specified max. value	Unit
13610 MHz	-2	_____	+2	dB
14000 MHz	-2	_____	+2	dB
14500 MHz	-2	_____	+2	dB
15000 MHz	-2	_____	+2	dB
15500 MHz	-2	_____	+2	dB
16000 MHz	-2	_____	+2	dB
16500 MHz	-2	_____	+2	dB
17000 MHz	-2	_____	+2	dB
17500 MHz	-2	_____	+2	dB
18000 MHz	-2	_____	+2	dB
18500 MHz	-2	_____	+2	dB
19000 MHz	-2	_____	+2	dB
19500 MHz	-2	_____	+2	dB
19900 MHz	-2	_____	+2	dB

Measurand	Specified min. value	Measured value	Specified max. value	Unit
Attenuator accuracy				
RF_Att / Ref_Lev				
0 dB / -10 dBm	-	Ref	-	
5 dB / -5 dBm	-0.3	_____	+0.3	dB
10 dB / 0 dBm	-0.3	_____	+0.3	dB
20 dB / 10 dBm	-0.3	_____	+0.3	dB
30 dB / 15 dBm	-0.3	_____	+0.3	dB
Displayed average noise floor (f_{noise}) in 1 Hz bandwidth				
100 kHz	-	_____	-115	dBm (1 Hz)
1 MHz	-	_____	-115	dBm (1 Hz)
10.1 MHz	-	_____	-115	dBm (1 Hz)
499 MHz	-	_____	-115	dBm (1 Hz)
999 MHz	-	_____	-115	dBm (1 Hz)
1499 MHz	-	_____	-115	dBm (1 Hz)
1999 MHz	-	_____	-115	dBm (1 Hz)
2499 MHz	-	_____	-115	dBm (1 Hz)
2999 MHz	-	_____	-115	dBm (1 Hz)
3599 MHz	-	_____	-115	dBm (1 Hz)
3601 MHz	-	_____	-115	dBm (1 Hz)
3999 MHz	-	_____	-115	dBm (1 Hz)
4499 MHz	-	_____	-115	dBm (1 Hz)
4999 MHz	-	_____	-115	dBm (1 Hz)
5499 MHz	-	_____	-115	dBm (1 Hz)
5999 MHz	-	_____	-115	dBm (1 Hz)
6499 MHz	-	_____	-115	dBm (1 Hz)
6999 MHz	-	_____	-115	dBm (1 Hz)
7499 MHz	-	_____	-115	dBm (1 Hz)
7999 MHz	-	_____	-115	dBm (1 Hz)

Measurand	Specified min. value	Measured value	Specified max. value	Unit
8001 MHz	-	_____	-115	dBm (1 Hz)
8499 MHz	-	_____	-115	dBm (1 Hz)
8999 MHz	-	_____	-115	dBm (1 Hz)
9499 MHz	-	_____	-115	dBm (1 Hz)
9999 MHz	-	_____	-115	dBm (1 Hz)
10499 MHz	-	_____	-115	dBm (1 Hz)
10999 MHz	-	_____	-115	dBm (1 Hz)
11499 MHz	-	_____	-115	dBm (1 Hz)
11599 MHz	-	_____	-115	dBm (1 Hz)
11999 MHz	-	_____	-115	dBm (1 Hz)
12599 MHz	-	_____	-115	dBm (1 Hz)
12999 MHz	-	_____	-115	dBm (1 Hz)
13599 MHz	-	_____	-115	dBm (1 Hz)
13601 MHz	-	_____	-115	dBm (1 Hz)
13999 MHz	-	_____	-115	dBm (1 Hz)
14499 MHz	-	_____	-115	dBm (1 Hz)
14999 MHz	-	_____	-115	dBm (1 Hz)
15499 MHz	-	_____	-115	dBm (1 Hz)
15999 MHz	-	_____	-115	dBm (1 Hz)
16499 MHz	-	_____	-115	dBm (1 Hz)
16999 MHz	-	_____	-115	dBm (1 Hz)
17499 MHz	-	_____	-115	dBm (1 Hz)
17999 MHz	-	_____	-115	dBm (1 Hz)
18599 MHz	-	_____	-115	dBm (1 Hz)
18999 MHz	-	_____	-115	dBm (1 Hz)
19599 MHz	-	_____	-115	dBm (1 Hz)

Phase noise at 500 MHz				
Offset frequency				
30 kHz	-	_____	-95	dBc (1 Hz)
100 kHz	-	_____	-100	dBc (1 Hz)
1MHz	-	_____	-120	dBc (1 Hz)
Display linearity 0 to -30 dB Reference level: 0 dBm	-	Reference	-	
Sig_Lev 0 dBm				
-5 dBm	-0.2	_____	+0.2	dB
-10 dBm	-0.2	_____	+0.2	dB
-15 dBm	-0.2	_____	+0.2	dB
-20 dBm	-0.2	_____	+0.2	dB
-25 dBm	-0.2	_____	+0.2	dB
-30 dBm	-0.2	_____	+0.2	dB
Display linearity -30 to -50 dB Reference level: 20 dBm				
Sig_Lev				
-10 dBm	-	Reference	-	
-15 dBm	-0.2	_____	+0.2	dB
-20 dBm	-0.2	_____	+0.2	dB
-25 dBm	-0.2	_____	+0.2	dB
-30 dBm	-0.2	_____	+0.2	dB

2 Adjustment

2.1 Quick Verification

This chapter describes a quick verification of the basic functions of the instrument hardware. Verifying the functionality of the R&S FSH as described in this section is recommended before adjustment or performance test. Testing of the following items is recommended:

- On/Off functionality
- Connections of the power adapter and the AF output
- Display
- Level and noise

2.1.1 Measurement Equipment

The quick verification procedure requires a very limited amount of equipment.

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S order no.	Use
1	Signal generator	Frequency: 10 MHz to 3 GHz	R&S SMB100A		Level
2	N-cable	Attenuation: < 0.2 dB to 3 GHz			Tracking generator output level

2.1.2 Verifying on/off functionality

Test equipment	None
R&S FSH settings	Switch instrument ON.
Measurement	► Verify that the instrument switches ON.

2.1.3 Verifying Power and AF Connections

Test equipment	None
Accessories	AC power adapter
	Headphone
R&S FSH settings	Switch instrument ON.
	Connect the AC supply.
Reference measurement	► Verify in the display that the battery symbol changes to a power plug
R&S FSH settings	Connect the headphone. - [**Marker** : MARKER DEMOD : **AM**]
Reference measurement	► Verify that a noise signal is heard on the headphone.

2.1.4 Verifying the Display

Test equipment	None
R&S FSH settings	Switch instrument ON.
Reference measurement	► Check the display for disturbance.

2.1.5 Verifying the Level and Noise

Test principle	The RF attenuator of the R&S FSH can be switched from 0 to 30 dB by changing the reference level in the instrument.
Test equipment	Signal generator (refer to "Measurement Equipment", item 1). Frequency: 100 MHz Maximum level: ≥ 6 dBm
Test setup	Connect the RF output of the signal generator to the input of the R&S FSH.
Signal generator settings	- Frequency: 100 MHz - Level: -20 dBm
R&S FSH settings	- [**PRESET**] - [**FREQ** : **100 MHz**] - [**SPAN** : **10 kHz**] - [**BW** : RES BW MANUAL : **1 kHz**] - [**BW** : VIDEO BW MANUAL : **100 Hz**] - [**TRACE** : DETECTOR : RMS] - [**AMPT**: **0 dBm**]
Verification	► Read the level and verify that it shows -20 dBm +/-2 dB. ► Verify that the noise level in the display is < -60 dBm.
Check 30 dB attenuation	
Change signal generator setting	- Level: -30 dBm
Change R&S FSH setting	- [**AMPT** : **-10 dBm**]
Verification	► Read the level and verify that it shows -30 dBm +/-2 dB.
Check 10 dB attenuation	
Change signal generator setting	- Level: -10 dBm
Change R&S FSH setting	- [**AMPT** : **10 dBm**]
Verification	► Read the level and verify that it shows -10 dBm +/-2 dB.
Check 0 dB attenuation	
Change signal generator setting	- Level: 0 dBm
Change R&S FSH setting	- [**AMPT** : **20 dBm**]
Verification	► Read the level and verify that it shows 0 dBm +/-2 dB.

2.1.6 Verifying the Tracking Generator

Test principle	The generator output must be connected to the RF input and verified.
Test equipment	N cable
Test setup	Connect the generator output of the R&S FSH to the RF input.
R&S FSH settings	- [**PRESET**] - [**MODE** : Network Analyzer]
Verification	► Verify that the transmission shows 0 dB +/-5 dB. ► Following internal calibration, verify that the level shows 0 +/-1 dB.

2.2 Adjustment

NOTICE

Risk of erroneous measurement results

Exclusively qualified personnel must carry out adjustment since any change can considerably affect the instrument measurement accuracy.

2.2.1 Adjustment Instructions

- The adjustment of the analyzer must be performed after a warm-up time of at least 30 minutes. Only by adhering to this requirement can compliance with the guaranteed data be ensured.

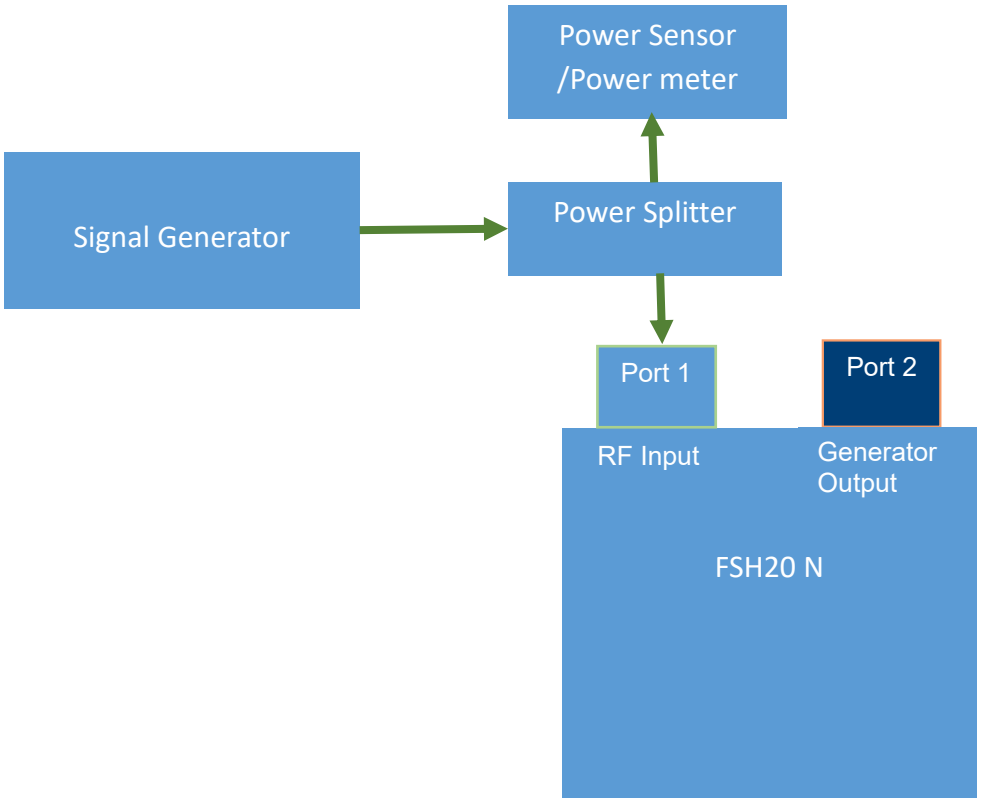
2.2.2 Measurement Equipment and Accessories

The equipment necessary to perform adjustment and re-alignment is described in chapter 1, "Measuring Equipment and Accessories".

2.3 Alignment

2.3.1 Reference oscillator alignment

Test Equipment	**Signal generator (refer to section "Measurement Equipment and Accessories")**
Test Setup	Connect the signal generator to the power splitter. Connect one arm of the power splitter to the power sensor/power meter and connect the other arm to the DUT RF input.



Signal Generator Settings	Frequency	1.0 GHz
	Level	-10 dBm at Power Meter reading at 1.0 GHz
DUT Settings	[PRESET] [FREQ: 1.0 GHz] [REF LVL: 0 dBm] [SPAN: ZERO] [ATT: 20 dB] [SWEEP: Single] [SWT: 200 msec] [DET: Auto Peak] [BW: MANUAL RBW: 300 kHz] [BW: VBW: 300 kHz] [MARKER: Marker Function: Frequency Count]	

Measurement : Use Telnet Software or “Orion Terminal”

Connect 172.17.75.1:5525 (TCP/IP Terminal)
[**bl 8121961**]
[**oti ohl1**]
[exit]
Connect 172.17.75.1:5555
[*OPC?]
[**DIAG:SERV:CAL:TCXO**] (automatically adjust the TCXO DAC Value)
Wait for TCXO Command to be complete
[*OPC?]

Connect 172.17.75.1:5600
[ch Get TCXO_DAC] (Read back the Adjusted TCXO DAC value)

3 Troubleshooting

3.1 Troubleshooting SD Card

Error: FSH cannot save data to SD card.

Put a workable SD card into FSH.

Press “photo button”.

Check whether screenshot is it saved into SD card. If not replace R&S Mainboard (Refer Table 3-1: List of spare parts and order numbers).

3.2 Troubleshooting Battery

Error: FSH cannot be charged.

Connect AC/DC Adaptor into FSH.

Check battery sign icon animation on the upper right edge of the display.
If it is not charging or charging is very slow (3.5 hours from empty to full with a properly working battery), replace the battery.

3.3 Troubleshooting the USB Type A interface

Error: Data can’t be transferred via USB Type A interfaces.

Connect memory sticks to FSH USB Type A interfaces.

Connect FSH to PC using a mini USB adaptor cable.
Transfer a file from the memory stick into the FSH and then transferred back.

- If no error message occurs, the test is successful. Otherwise, replace R&S Mainboard (Refer Table 3-2: List of spare parts and order numbers).

3.4 Troubleshooting start-up problems

Troubleshooting start-up problems

Error: FSH cannot be switched on.

Connect AC/DC adapter to FSH, press yellow power button
If FSH is on, the battery need to be troubleshoot, following 3.2 to be either recharged or replaced.
If FSH still cannot boot up properly, try firmware reset: In Instrument OFF state, Press PRESET+F6 and yellow power button.

If the instrument does not boot up after firmware reset, replace R&S Mainboard (Refer Table 3 1: List of spare parts and order numbers).

If the problem persists after R&S Mainboard exchange, please contact the R&S service center.

4 Repair

This chapter describes the design of the R&S FSH, simple measures for repair and troubleshooting, and, in particular, the replacement of modules.

4.1 Instrument Design and Function Description

The following figure shows a block diagram of the R&S FSH.

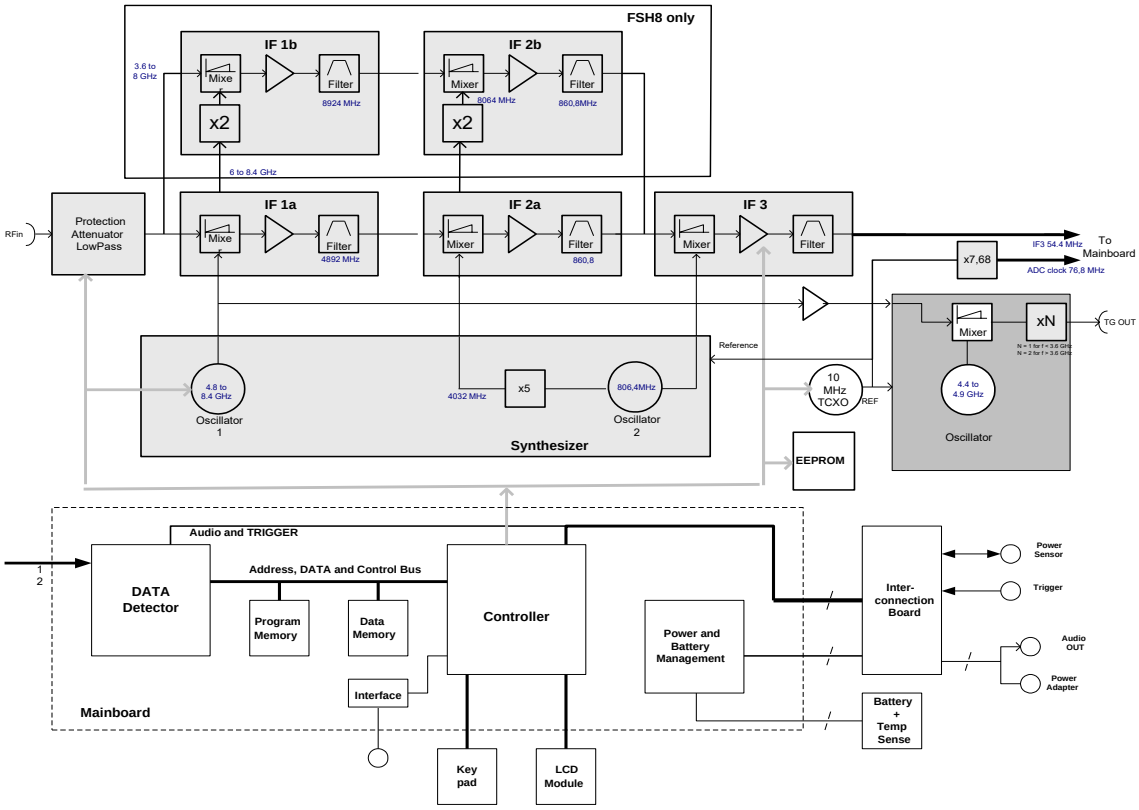


Figure 4-1: Block diagram of the R&S FSH

Description of the block diagram

The R&S FSH is a triple-conversion super-heterodyne receiver for the frequency range 9 kHz to 3.6 GHz, 8 GHz, 13 GHz or 20 GHz. After signals are received, they are processed by the RF/IF board and the mainboard. The RF/IF board contains the functions as described below.

4.1.1 Attenuator

The RF signal passes from the input connector RF INPUT to the programmable input attenuator, which can be switched from 0 dB to 40 dB in increments of 5 dB. The circuitry is protected from overvoltage.

4.1.2 RF to IF conversion

The RF/IF board converts the received frequencies to an IF of 21.4 MHz (serial number >=105000 54.4 MHz), which is digitized with a 14 bit ADC and a sample rate of 30 MHz (serial number >=105000 76.8 MHz), on the mainboard. The RF/IF board also includes the required local oscillators and associated frequency processing circuits. The unit is housed in silver-plated aluminum packaging.

The input signal passes via the input attenuator and the lowpass filter to the first mixer. The lowpass filter provides suppression of the image frequency (image = LO+ IF) to keep the conversion unambiguous. In the 1st mixer the input signal is up-converted to an IF of 4881.4 MHz (8931.4 GHz in the frequency band above 3.6 GHz) by means of the first LO (4.88 GHz to 8.4 GHz). The mixer is followed by a low noise IF amplifier, which compensates for the loss due to mixing. The signal then passes a filter with a 3 dB bandwidth of approximately 400 MHz for filtering the first IF. The local oscillator frequency required for this conversion is also generated on the board. This signal is generated by three VCOs which are synchronized to the third LO3 at 810 MHz (806.4 MHz serial number >=105000), which in turn is synchronized to a Temperature Compensated 10-MHz Xtal Oscillator (TCXO). This TCXO is electrically adjustable to the predetermined frequency.

The signal from the 1st IF filter is converted to the 2nd IF of 831.4 MHz (860.8MHz serial number >=105000). The signal is routed to an 831.4 MHz (860.8MHz) filter with a 3-dB bandwidth of 20 MHz for further signal processing. The filter is followed by the 3rd mixer, which converts to 21.4 MHz (54.4MHz) and utilizes the 3rd IF filter that has a -3 dB bandwidth of approximately 2 MHz. For resolution bandwidths above 1 MHz this last IF filter is bypassed.

The frequency range above 3.6 GHz in the R&S FSH8 is converted via two additional mixers to a first IF of 8931.4 MHz and to the same 2nd IF as in the R&S FSH4 of 831.4 MHz (860.8MHz). As LO signals the oscillator signals of the R&S FSH4 are doubled.

Above 8GHz the incoming signal is down-converted to an IF1 of 3171.2MHz. A second mixer converts the IF1 to 860.8MHz.

4.1.3 Tracking Generator.

The LO1 frequency of the 1st mixer is routed via isolation amplifiers to the Tracking Generator mixer. The other input of the mixer is a fixed frequency of 4881.4 MHz generated with a VCO locked to the TCXO frequency. The resulting IF signal is routed to the generator output connector. In the 8 GHz models in the frequency range above 3.6 GHz the VCO in the tracking generator is set to half the IF1b frequency to app. 4.465 GHz. With the use of a frequency doubler the tracking signal is generated in between 3.6 GHz and 8 GHz. In this band a subharmonic about 10 dB below the wanted signal is visible on the tracking generator output. Due to the selectivity in the receiver part this subharmonic has no disadvantage for the user.

4.1.4 RF/IF control

The microcontroller available on the mainboard controls the RF/IF setting by programming registers via an internal serial bus.

For calibration purposes the level correction values are stored in an EEPROM. This EEPROM also contains module-specific information.

The temperature of the module is continuously measured, and the measured levels will be compensated for drift if the temperature change is too great.

4.1.5 Mainboard

The mainboard is a combination of the power supply and the functions controlled by a dedicated processor. It also contains the analog to digital converter and the ASIC for the digital filtering of the IF signal.

4.1.6 Power and battery management

The ON/OFF key is de-bounced with the real-time clock in the controller. The ON/OFF function is completely software controlled. This implies that the controller must be operational in order for the instrument to be switched ON. The ADC-clock (30 MHz) is derived from the RF/IF board, thus requiring that this board be present.

If the instrument is in the OFF state and the power supply is connected, the µP will control the charging function of the battery depending on the battery condition. To prevent damage to the battery, the charging stops if the battery temperature reaches ≤ 0°C or > 45°C.

This power supply and battery management arrangement uses a dedicated IC. The instrument can be switched ON only if the battery is in operating condition. Thus, if the battery is completely empty, the instrument cannot be switched ON until the charging current has re-loaded the battery, which takes several minutes.

4.1.7 Processing of measured data, detectors

The measured data is processed in a dedicated ASIC (UDC: universal down converter) to reduce the sample rate of the input signal to a value that can be handled by the processor.

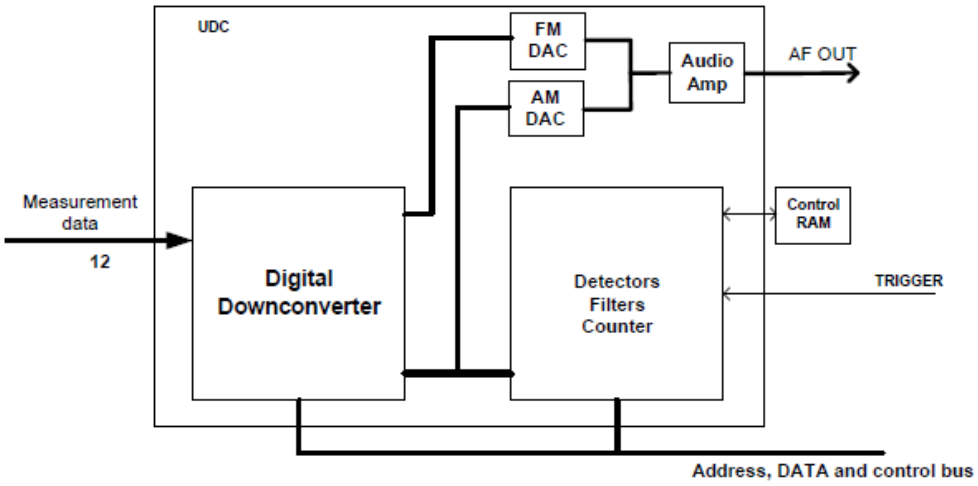


Figure 4-2: Measured data processing

The UDC converts the digital IF signal to I/Q base band and filters the base band signals using low pass filters with programmable bandwidth. In addition it delivers the AM or FM demodulated audio signal. The ASIC also detects the envelope of the filtered and combined base band signal and calculates its logarithm. It contains also the video filter and the different detectors. In addition it is responsible for the sweep control of the R&S FSH.

4.1.8 Resolution bandwidths (RBW)

The resolution bandwidths are implemented in the R&S FSH through digital processing in the UDC ASIC (Digital Down Converter). The RBW can be selected from within the range 100 Hz to 3 MHz in 1-3-10 unit increments. The UDC first mixes its input IF to the baseband using a NCO (Numeric Controlled Oscillator) and then filters the resulting IQ signals via a combination of HDF (High Decimation Filter) and a FIR filter (Finite Impulse Response) stages. At the end of the UDC processing chain, the IQ signal is split into magnitude and phase.

For AF demodulation the amplitude information is used. In the case of FM the phase information is used and fed to the headphone connector. In the analyzer mode the signal at the position of the marker can be demodulated. In this case the R&S FSH stops the sweep for a selectable period of time and demodulates the input signal. The volume can be adjusted.

4.1.9 Video bandwidths (VBW)

The video filters can be adjusted between 10 Hz and 3 MHz in increments of 1-3-10 units. They are designed as digital single pole lowpass filters for the video signals. Software can couple the VBW to the RBW, or the VBW can be set independently.

4.1.10 Detectors

The R&S FSH uses a detector for the positive peak and the negative peak value. In the "sample" mode the measured value is routed directly to the display. In the "RMS" mode the detector determines the RMS value of the input signal for one specific point in the display during the measured time.

4.1.11 Keypad control

Keypad control is a dedicated function of the controller. For the implementation of the rotary knob, an encoder is used that is detected with a dedicated CPLD (Complex Programmable Logic Device). This "One Time Programmable" CPLD is programmed during production.

4.1.12 Power sensor

The power sensor uses the display of the R&S FSH. Communication is achieved with a separate UART from the controller.

4.2 Module Replacement

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

The words "left" and "right" in the manual always refer to the front view of the instrument.

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

4.2.1 Overview of the Modules

Table 4-1: List of spare parts and order numbers

Reference	Description	R&S Order Number
Housing parts		
1.	FSH Label Front	1321.2918.00
2.	Front Rotary Assy	1318.6422.00
3.	Holster Bottom Assy	1321.2530.00
4.	Holster Top Assy with TG and BG	1321.2560.00
5.	Side Flap and Connector Cap Set	1316.6416.00
6.	Outer housing plastics	1318.6400.00
7.	Cushion Speaker	1318.5055.00
Battery module		
8.	Battery and Power Connector Board	4079.9905.02
9.	Subassy Compartment Battery	1318.4913.00
10.	Speaker 40X40 8Ohm	3587.8325.00
FSH-FE (RF/IF Module) for R&S FSH20		
11.	FSH20 Frontend Tested	1314.3793.20

Connectors & Cabling		
12.	N Connector 50 Ohm	3588.8441.00
13.	Assy Bracket Connector	4080.0672.00
14.	Internal Cabling set	1318.6439.00
Mainboard Spectrum Analyzer Tested (instruments with serial number ≥ 115 000)		
15.	Mainboard Shield	1309.7294.00
16.	Mainboard Tested	4096.3499.03
Front module		
17.	Subassy Case Front	1318.4907.00
18.	Main Rotary Board	4080.0008.02
19.	FSH Assy LCD Bracket	1318.5203.00
20.	Switch Foil	4080.0250.00
21.	Lens	1318.4613.00
22	Seal Lens	4080.0414.00
23.	Rubber Keypad FSH	1318.4642.00
24.	Flex PCB2	1314.3893.00
25.	Nut Spec Galaxy	4080.0508.00
26.	TFT 6.5” VGA (LCD)	5702.6056.00
Accessories		
27.	HA-Z201 Power Supply Power adaptor set, PN: 1318.4971.00 comes with it.	1309.6100.00
28.	HA-Z204 LI-Ion Battery	1309.6130.00

4.2.2 Equivalence for Different R&S FSH Part Numbers

- Part number 1314.2000.30 is equivalent to 1314.2000.80

4.2.3 Opening the Instrument

- ► Switch the instrument off.
- ► Disconnect the power plug.
- ► Remove the Battery Pack (leave Cover Battery open).
- ► Loosen two (2) screws (S1) and remove the Holster Bottom (P1).
- ► Loosen two (2) screws (S2) and remove the Holster Top (M3).

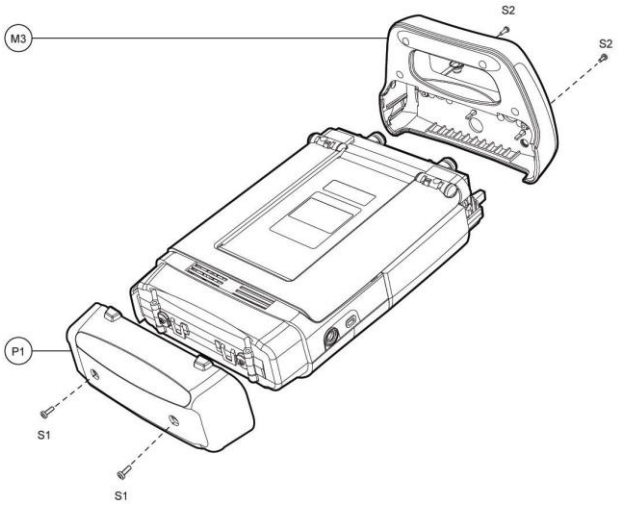


Figure 4-3: Removing Holster Bottom and Holster Top

- ► Loosen the two (2) screws (S3) of Stand Up (P2).
- ► Remove Stand Up Hinges (2X) (M4/M5).
- ► Remove Stand Up (P2).

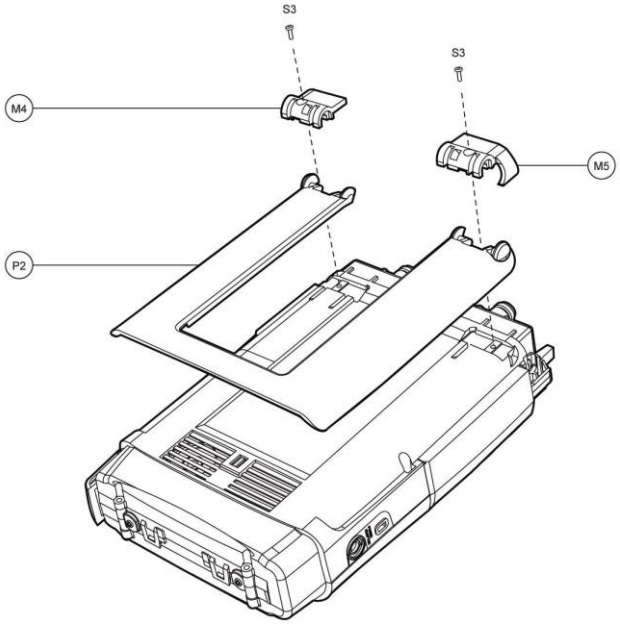


Figure 4-4: Removing Stand Up

- ► Remove the two (2) screws (S4) of Rear Case.
- ► Remove the two (2) screws (S5) of Rear Case.
- ► Remove Rear Case (M6).
- ► Remove Rubber Cover Connector Left (P3).
- ► Remove the two Rubber Cover Connector Right (P4) (P5).
- ► Remove Cover Battery (P6).

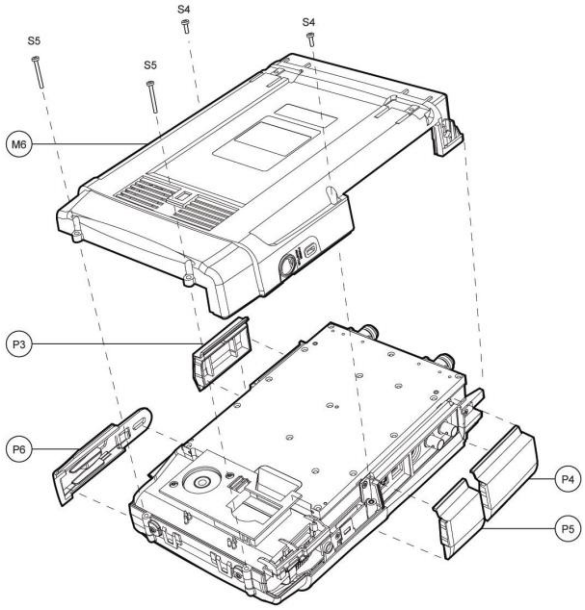


Figure 4-5: Removing Rear Case, Connector Cover, and Cover Battery

- ► Remove the five (5) screws S6 from the sides (see fig 3-6).
- ► Remove Cover Connector Left (P7).
- ► Remove Stand Up Hinge Lock (P8).
- ► Remove Plate of Kensington lock (P9).

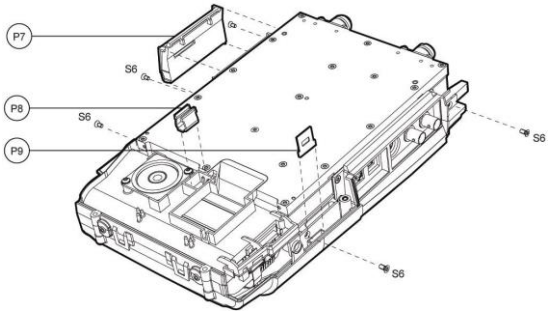


Figure 4-6: Replacing the Cover Connector Left- Right, Stand Up Lock Spring and Plate Kensington.

- ► Remove Battery Module (M8).
- ► Disconnect Flat Cable (X1) between Battery Module (M8) and Internal Module (M7).

► Disconnect Cable Adaptation 6P (X2) between Battery Module (M8) and Internal Module (M7).

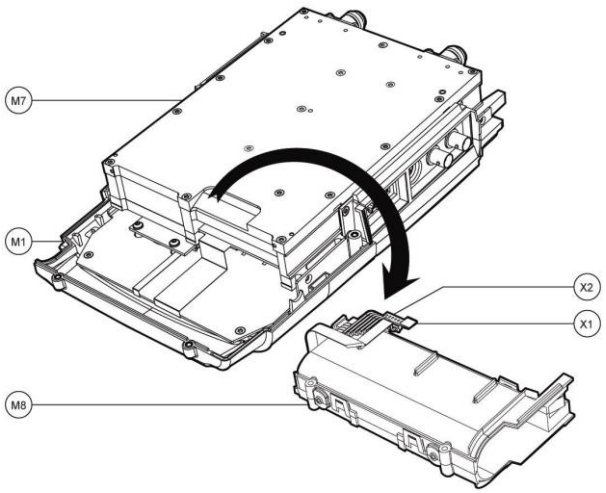


Figure 4-7: Remove Battery Module (Subassy Compartment Battery)

► Disconnect Flex Cable (X3) from Internal Module (M7).

► Disconnect Audio Cable (X4) from Internal Module (M7).

► Disconnect Flex PCB2 Cable (X5) from Internal Module (M7).

► Rotate module counter clockwise.

► Remove Cover Side Left (P10).

► Disconnect Switch Foil (X6) from LCD (P11).

► Disconnect the two (2) LCD Cables (X7).

► Disconnect Switch Foil (X6) from Internal Module (M7).

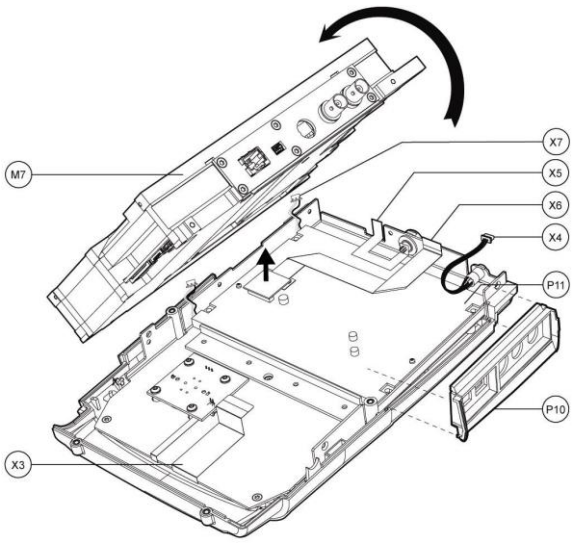


Figure 4-8: Remove Internal Module and Cover Side Left

4.2.4 Closing the Instrument

► Follow the steps of "Opening the Instrument" in reversed order

► Perform the quick verification test.

4.2.5 Spare Part Replacement for Housing Parts

4.2.5.1 Spare Part FSH Label Front, PN: 1321.2918.00

The spare part contains the following part:

- FSH Label Front 20 (P1) PN: 1321.2918.00

Procedure

► Replace FSH Label Front (P1) in the Subassy Case Front (M1).

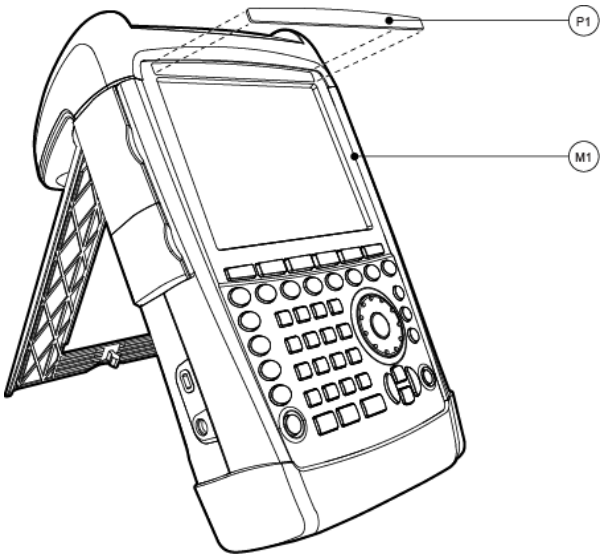


Figure 4-9: Replacing the Label Front

4.2.5.2 Spare Part Front Rotary Assy, PN: 1318.6422.00

The spare part contains the following parts:

- Knob Rotary (P1) PN: 1318.4620.00
- Button Push (P2) PN: 1318.4636.00
- Cushion Rotary (P3) PN: 4080.0737.00
- Rotary Clamping Bush (P4) PN: 4096.2305.00

Procedure

► Assemble the parts of the Rotary Assembly (M2).

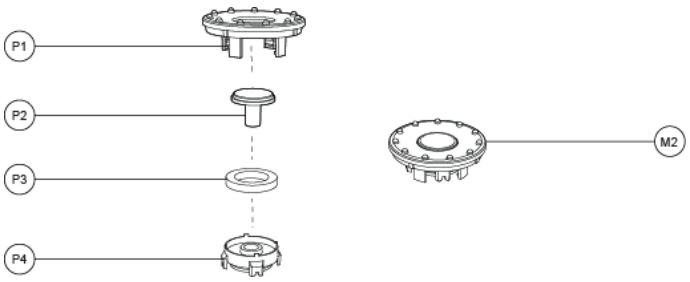


Figure 4-10: Assemble the Rotary Assembly

► Replace Rotary Assembly (M2), the instrument does not need to be opened.

Figure 4-11: Replace Rotary Assembly in the Subassy Case Front.

► Close the instrument.

► Perform a quick verification test.

4.2.5.3 Spare Part Holster Bottom Assy, PN: 1321.2530.00

The spare part contains the following parts:

- Holster Bottom (P1) PN: 1318.4794.00
- Screw 2x M3 X 6 A4 PA (S1) PN: 1148.2630.00

Procedure

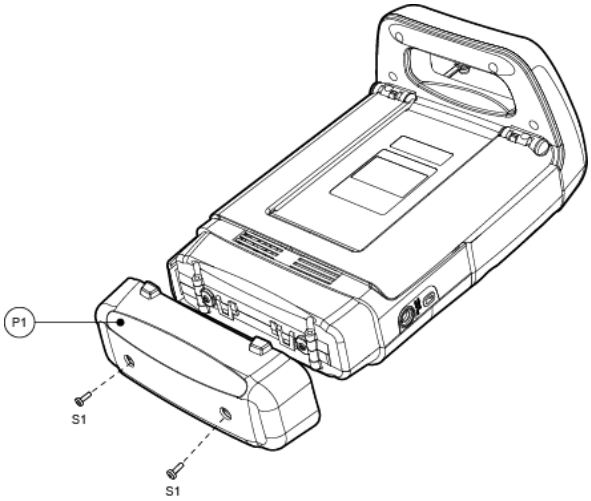


Figure 4-12: Replacing the Holster Bottom

► Open the Cover Battery.

► Remove two (2) screws (S1).

► Replace the Holster Bottom (P1) and fasten the screws (S1).

► Close the instrument.

► Perform a quick verification test.

4.2.5.4 Spare Part Holster Top with TG and BG Assy, PN: 1321.2560.00

The spare part contains the following parts:

- Holster Top with TG and BG (P1) PN: 1318.4813.00
- Holster Cover Top (P2) PN: 1318.4788.00
- Screw 4x Delta PT Screw 3.0 X 12 (S1) PN: 3588.1153.00
- Screw 2x 7985/ISR M3 X 10 A4 PA (S2) PN: 1148.2623.00

Procedure

► Mount the Holster Cover Top (P2) on the Holster Top (P1).

► Fasten four (4) screws (S1).

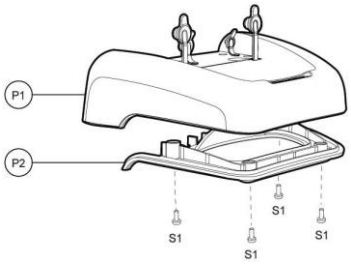


Figure 4-13: Assembling the Holster Top

► Loosen the two (2) screws (S2) of Holster Top (M3).

► Replace the Holster Top (M3).

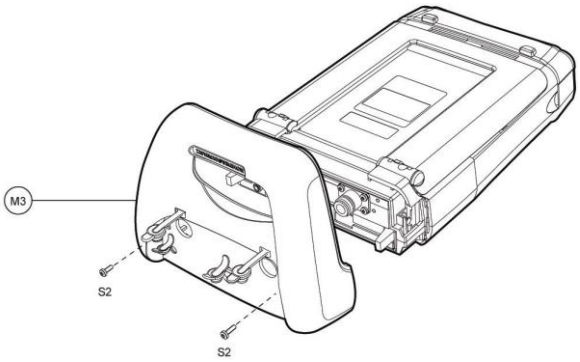


Figure 4-14: Replacing the Holster Top

► Fasten the two (2) screws (S2).

► Close the instrument.

► Perform a quick verification test.

4.2.6 Replacing Stand Up

The following parts are described in this section:

• Stand Up Hinge Right (P1)	PN: 1318.4742.00
• Stand Up Hinge Left	PN: 1318.4736.00
• Stand Up Hinge Spring 2x (P2)	PN: 1318.4759.00
• Stand Up (P3)	PN: 1318.4720.00
• Screw 2x 7985/ISR M3 X 10 A4 PA (S4)	PN: 1148.2623.00 (not included)
• Washer 2x	PN: 0082.4670.00 (not included)

These items are part of spare part Outer Housing Plastics, PN: 1318.6400.00.

Procedure

► Remove the Holster Bottom and Holster Top, follow the steps described in:

- "Spare Part Holster Bottom Assy, PN: 1321.2530.00"
- "Spare Part Holster Top with TG and BG Assy, PN: 1321.2560.00"

► Mount the Stand Up Hinge Spring (P2) into the Stand Up Hinge Right (P1).

► Mount the Stand Up Hinge Spring (P2) into the Stand Up Hinge Left.

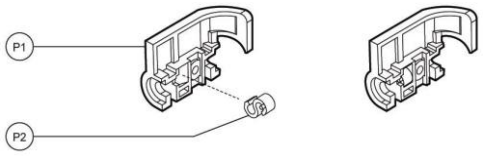


Figure 4-15: Mounting the Stand Up Hinge Spring into the Stand Up Hinge

► Remove two (2) screws (S1) of Stand Up (P3).

► Remove the two (2) Stand Up Hinge Left (M4) right (M5).

► Replace the Stand Up (P3).

► Replace the Stand Up Hinge Left (M4) and Right (M5).

► Fasten two (2) screws (S1) of Stand Up (P3).

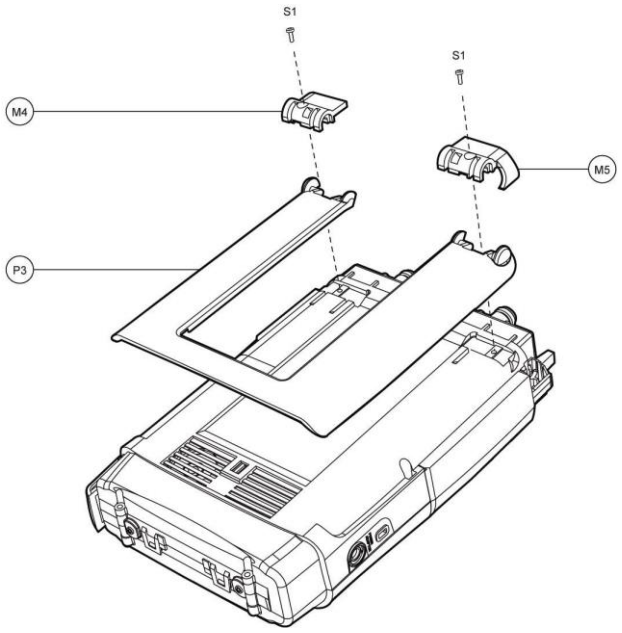


Figure 4-16: Replacing the Stand Up

► Close the instrument.

► Perform the quick verification test.

4.2.6.1 Spare Part Side Flap and Connector Cap Set, PN: 1318.6416.00

The spare part contains the following parts:

- Cover Connector Right PN: 1318.4694.00
- Cover Connector Left Up PN: 1318.4671.00
- Cover Connector Left Lo PN: 1318.4688.00
- Cover Battery PN: 1318.4707.00
- Label Connector 04-08-14-18 PN: 1318.5032.00
- Label Connector 24-28 PN: 1318.5049.00
- Combi Screw M3X10A 2x (S1) PN: 1206.2110.00 (not included)
- Screw M3X30 A4 2x (S2) PN: 2100.6777.00 (not included)
- Washer 2x (together with S2) PN: 0082.4670.00 (not included)

Procedure

► Open the instrument, follow the steps described in:

- "Spare Part Holster Bottom Assy, PN: 1321.2530.00"
- "Spare Part Holster Top with TG and BG Assy, PN: 1321.2560.00"

► Replacing Stand Up.

► Remove two (2) screws (S1) of the Rear Case (M6).

► Remove two (2) screws (S2) of the Rear Case (M6).

► Remove Rear Case (M6).

► Replace Cover Connector Right (P1).

► Replace Cover Connector Left Up (P2) and Left Lo (P3).

► Replace Cover Battery (P4).

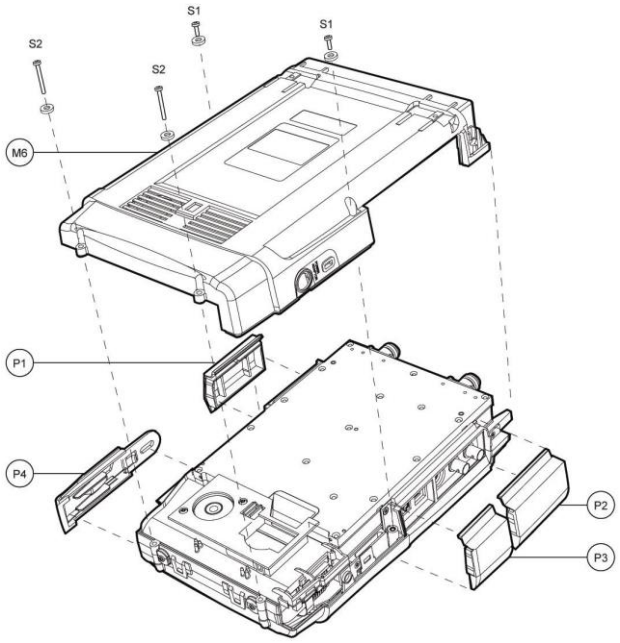


Figure 4-17: Replacing the Cover Connector Left-Right and Cover Battery

► Close the instrument.

► Perform the quick verification test.

4.2.6.2 Spare Part Outer Housing Plastics, PN: 1318.6400.00

The spare part contains the following parts:

- Case Front PN: 1318.4607.00
- Rear Case PN: 1318.4713.00
- Holster Bottom PN: 1318.4794.00
- Holster Cover Top PN: 1318.4788.00
- Cover Side Left PN: 1318.4659.00
- Cover Side Right PN: 1318.4665.00
- Cover Battery PN: 1318.4707.00
- Plate Kensington PN: 4080.0750.00
- Stand Up PN: 1318.4720.00
- Stand Up Hinge Right PN: 1318.4742.00
- Stand Up Hinge Left PN: 1318.4736.00
- Cover Connector Right PN: 1318.4694.00
- Cover Connector Left Up PN: 1318.4671.00
- Cover Connector Left Lo PN: 1318.4688.00
- Stand Up Hinge Spring (2x) PN: 1318.4759.00
- Stand Up Lock Spring PN: 1318.4765.00
- Label Connector 04-08-14-18 PN: 1318.5032.00
- Label Connector 24-28 PN: 1318.5049.00
- Cushion Speaker PN: 1318.5055.00 (not included)

Procedure

► Open the instrument, follow the steps described in:

- "Opening the Instrument"

► Replace Cushion Speaker (P1) in Rear Case (M6).

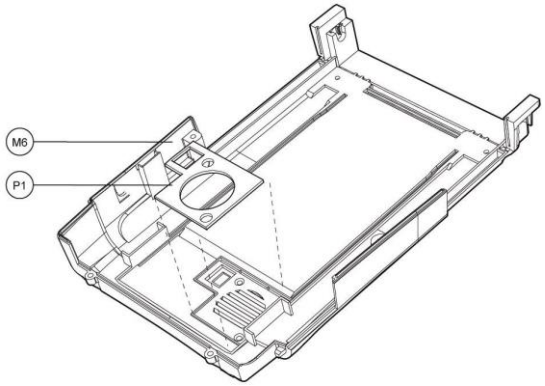


Figure 4-18: Replace Cushion Speaker in Rear Case

► Close the instrument.

► Perform a quick verification test.

4.2.7 Spare Part Replacement for Battery Module

4.2.7.1 Remove Battery Module (Subassy Compartment Battery)

Procedure

► Open the instrument, follow the steps described in:

- "Spare Part Holster Bottom Assy, PN: 1321.2530.00"
- "Spare Part Holster Top with TG and BG Assy, PN: 1321.2560.00"
- "Replacing Stand Up"

► Remove Battery Module (M8) by rotating in clock-wise direction.

► Disconnect Flat Cable (X1) from Internal Module (M7).

► Disconnect Cable Adaptation 6P (X2) from Internal Module (M7).

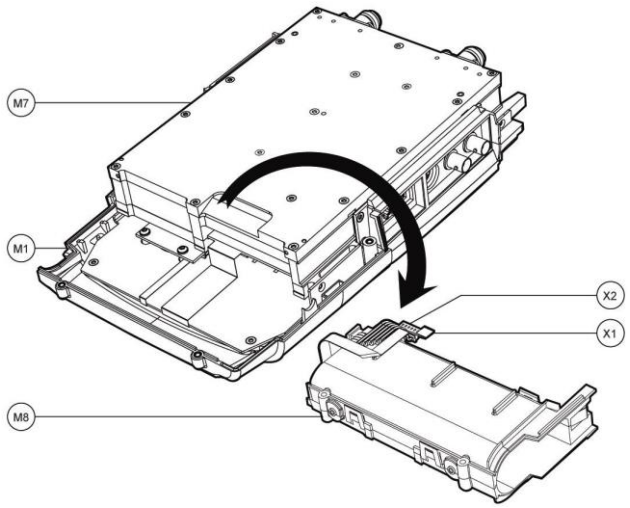


Figure 4-19: Remove Battery Module (Subassy Compartment Battery)

4.2.7.2 Spare Part Battery and Power Connector Board, PN: 4079.9905.02

The spare part contains the following part:

- Battery and Power Connector Board (P1) PN: 4079.9905.02
- Screws 3x PT PAN TX K25 x 8 (S1) PN: 3587.9209.00 (not included)

Procedure

► Disconnect Flat Cable (X1) from Battery and Power Connector Board.

► Disconnect Cable Adaptation 6P (X2) from Battery and Power Connector Board.

► Disconnect Audio Cable (X3) from Battery and Power Connector Board.

► Loosen the three (3) screws (S1).

► Replace Battery and Power Connector Board (P1).

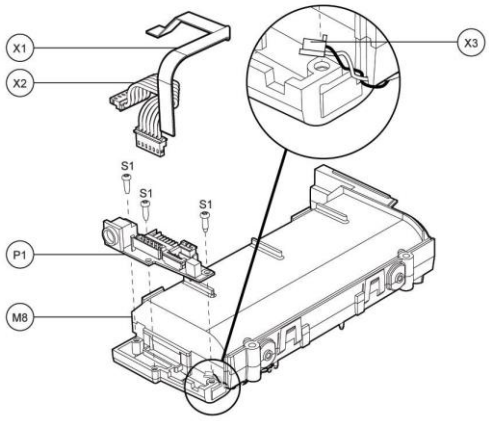


Figure 4-20: Replace Battery and Power Connector Board

- ► Connect Flat Cable (X1) to Battery and Power Connector Board.
- ► Connect Cable Adaptation 6P (X2) to Battery and Power Connector Board.
- ► Connect Audio Cable (X3) to Battery and Power Connector Board.
- ► Connect Cable Adaptation 6P (X2) to Internal Module.
- ► Connect Flat Cable (X1) to Internal Module.
- ► Place Battery Module (M8) by rotating in anti-clock-wise direction.
- ► Close the instrument.
- ► Perform a quick verification test.

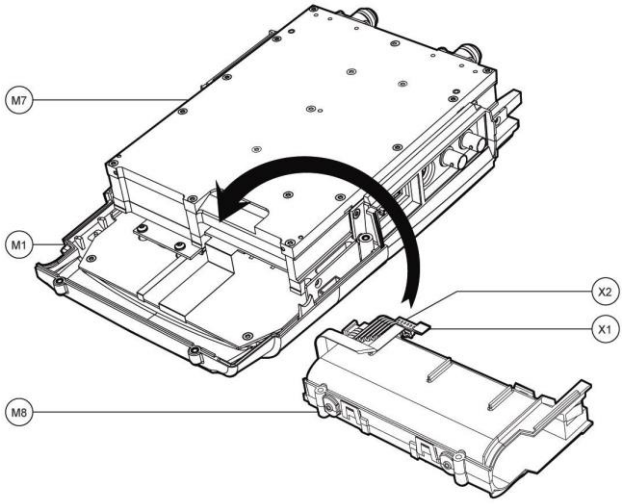


Figure 4-21: Place Battery Module (Subassy Compartment Battery)

4.2.8 Spare Part Replacement for Frontend Tested and Mainboard Tested

4.2.8.1 Remove Internal Module

Procedure

► Open the instrument, follow the steps described in:

- "Opening the Instrument"

► Remove Internal Module (M7).

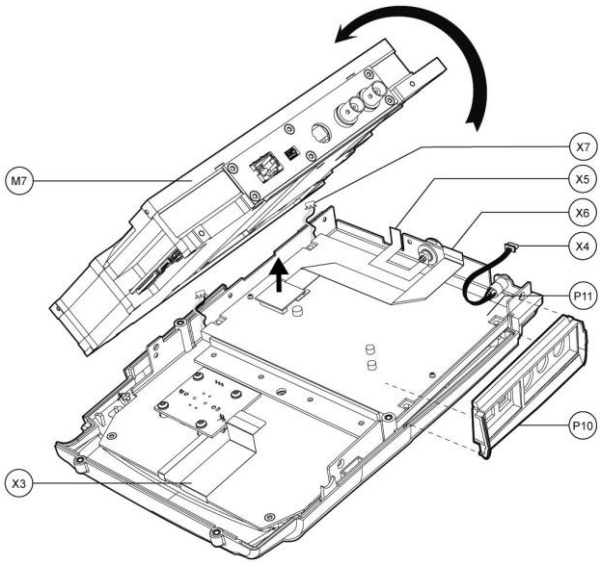


Figure 4-22: Replace Internal Module

► Close the instrument.

► Perform a quick verification test.

4.2.8.2 Spare Part Mainboard Shielding, PN: 1309.7294.00

The spare part contains the following part:

- Mainboard Shielding
- Screws M3X16 A4 13x PN: 1300.0868.00 (not included)
- Screws M3X6 A4 6x PN: 1148.2781.00 (not included)

Procedure

► Open the instrument, follow the steps described in:

- "Spare Part Replacement for Frontend Tested and Mainboard Tested"

► Loosen the three (3) screws (S1) at the top of the Bracket Connector (M9).

► Loosen the thirteen (13) screws (S2).

► Replace Mainboard Shielding (P1).

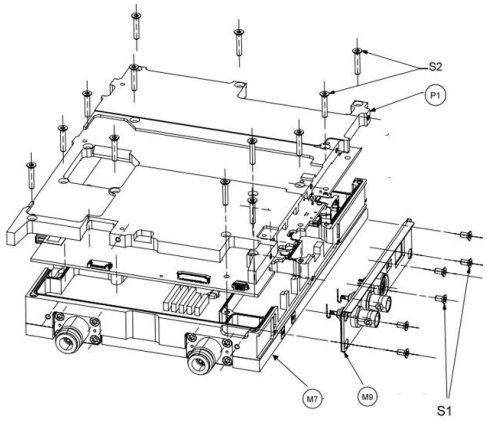


Figure 4-23: Remove Mainboard Shielding

► Close the instrument.

► Perform a quick verification test.

4.2.8.3 Spare Part Mainboard Tested, PN: 4096.3499.03

The following spare part (assembled):

- Mainboard Tested (P2) PN: 4096.3499.03

Procedure

► Open the instrument, follow the steps described in:

- "Spare Part Mainboard Shielding, PN: 1309.7294.00"

► Loosen the three (3) screws (S1) at the bottom of the Bracket Connector (M9).

► Remove the Mainboard (P2) from the Frontend Tested (M7).

The Bracket Connector (M9) is attached to the Mainboard with a soldering connection.

Mainboard programming

After replacement of Mainboard, the necessary device data must be programmed and enabled the device key by R&S authorized service center.

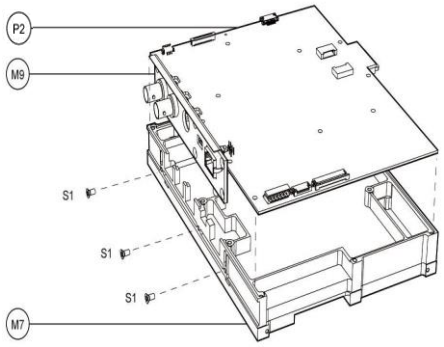


Figure 4-24: Remove the Mainboard with Bracket Connector

► Disconnect the two (2) BNC 50 Ohm Receptacles from the Mainboard PCB (P1) by soldering.

► Disconnect the Coax cable, Cable Flat 26P and 12P from the Mainboard PCB (P1).

► Remove the Bracket Connector (M9) from the Mainboard PCB (P1).

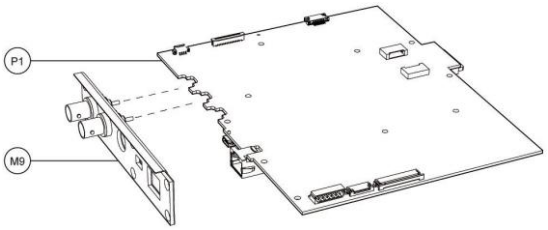


Figure 4-25: Assemble the Bracket Connector to the Mainboard PCB

- ► Replace the Mainboard (P1) and place to Bracket Connector.
- ► Fasten the three (3) screws (S1) at the bottom of the Bracket Connector (M9).

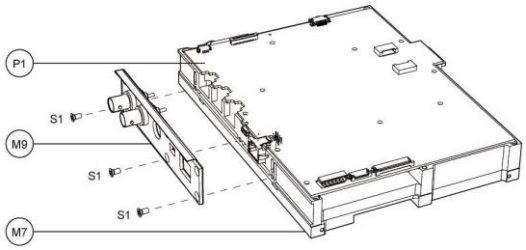


Figure 4-26: Place the Mainboard and the Bracket Connector

- ► Connect the two (2) BNC 50 Ohm Receptacles to the Mainboard PCB (P1) by soldering.
- ► Connect the Coax Cable, Cable Flat 26P and 12P to the Mainboard PCB (P1).
- ► Place Mainboard Shielding (P2).
- ► Fasten the three (3) screws (S1) at the top of the Bracket Connector (M9).

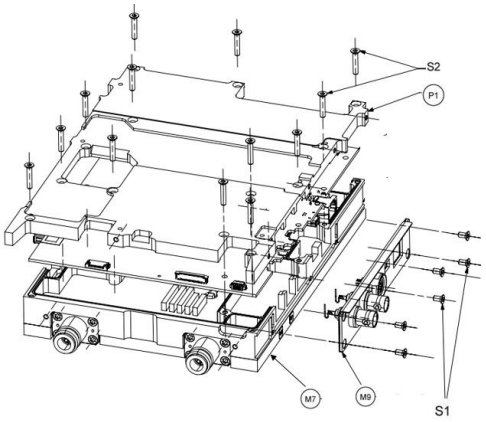


Figure 4-27: Place the Mainboard Shielding.

- ► Close the instrument.
- ► Perform a quick verification test.

4.2.8.4 Spare Part 4080.0672.00 Assy Bracket Connector

4080.0672.00 contains the following parts (assembled):

- Bracket Module Connector PN: 4080.0689.00
- BRACKET CONNECTOR 2 PN: 4080.0372.00
- BNC Recep-F-Solder Cup (2x) PN: 4079.9140.00
- Spacer BNC (2x) PN: 4080.0566.00
- Flex PCB1 PN: 4080.0120.00
- Nut Spec Galaxy PN: 4080.0120.00
- Wire 0.00005 K PN: 0025.0091.00

Procedure

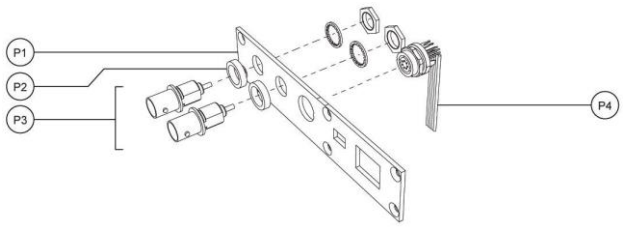


Figure 4-28: Parts of the Assy CONNECTOR BRACKET

► Open the instrument, follow the steps described in:

- "Spare Part Mainboard Tested, PN: 4096.3499.03"

► Replace the Bracket Connector (M9).

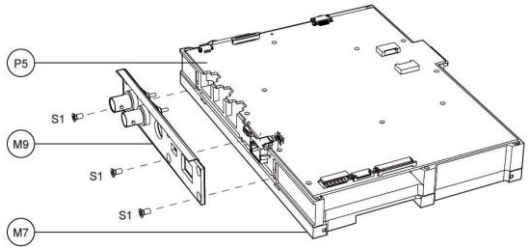


Figure 4-29: Replace the Bracket Connector

► Close the instrument.

► Perform a quick verification test.

4.2.8.5 Spare Part Frontend Tested, PN: 1314.3793.20 and N Type Panel Receptacle, PN: 3588.8441.00

The spare part Frontend Tested contains the following parts (assembled):

- FSH20 Frontend PN: 1309.7020.20
- FSH20 RF Shielding PN: 1309.7271.00
- Cable Flat 26P PN: 4080.0820.00
- Cable Flat 12P PN: 4080.0837.00
- Coax Cable 100mm PN: 1314.3935.00
- FSH20 Combi Shielding PN: 1309.7288.00
- Cable SMP- SMP PN: 1309.7313.00
- Tape Copper Conductive 25X30mm PN: 1318.5103.00
- 7985/ISR 1x M2 X 6 A4 PA PN: 1148.2700.00
- 7985/ISR 4x M3 X 8 A4 PA PN: 1148.2875.00
- 965/ISR 19x M3 X 12 A4 PA PN: 1148.3336.00
- Barcode Label PN: 0071.7714.00
- Label Ref PN: 1314.3870.00
- Label IF PN: 1314.3887.00

The N Type Panel Receptacle contains the following part:

- N-Type Panel Receptacle PN: 3588.8441.00

Procedure

► Open the instrument, follow the steps described in:

- “Spare Part Replacement for Frontend Tested and Mainboard”
- "Spare Part Mainboard Tested, PN: 4096.3499.03"

► Loosen the three (3) screws (S1) at the bottom of the Bracket Connector (M9).

The Bracket Connector (M9) is attached to the Mainboard with a soldering connection.

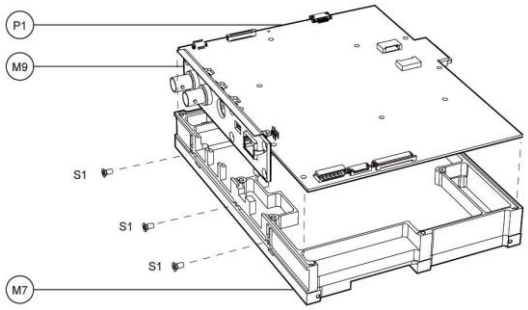


Figure 4-30: Lift the Mainboard with Bracket Connector

- ► Rotate the Mainboard (M10) 180 degrees clockwise from the Internal Module (M7).
- ► Disconnect Cable Flat 26P (X1).
- ► Disconnect Cable Flat 12P (X3).
- ► Disconnect two (2) Coax Cable (X2) by soldering.

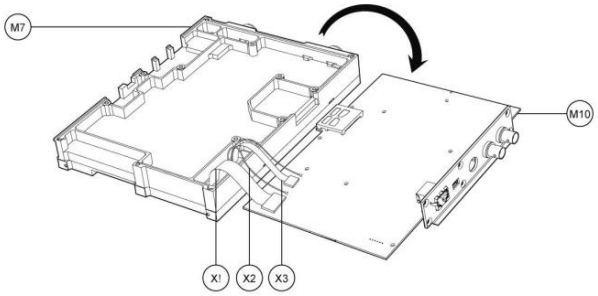


Figure 4-31: Remove Flat Cable 26P, Flat Cable 12P and Coax Cable.

- ► Disconnect Mini SMP cable (1).

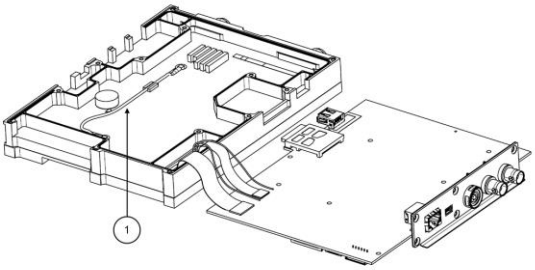


Figure 4-32: R&S FSH20 view

- ► Replace the Frontend tested if it is found defective. Otherwise, proceed to next step to replace the N Connector (P5).
- ► Turn over Frontend (M7).
- ► Loosen the nineteen (19) screws (S2) at the rear of the Frontend (M7).
- ► Screw (S2) is M3 X 12 A4, PN: 1148.3336.00.

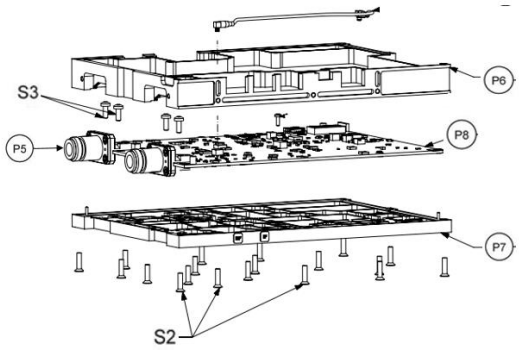


Figure 4-33: Remove the screws at the rear of Frontend Tested

- ► Turn over Frontend (M7).
- ► Loosen the two (2) screws (S3) that fix the N Connector (P5).
- ► Remove the Combi Shield (P6).

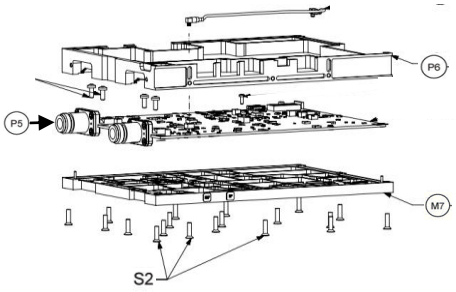


Figure 4-34: Remove the Combi Shield

- ► Loosen the two (2) screws (S4) that fix the N Connector (P5).
- ► Loosen the two (2) N Connector (P5) by soldering.
- ► Place the new N Connector (P5).
- ► Fasten the two (2) screws (S4) that fix the N Connector (P5) to the RF Shield (P7).
- ► Connect the N Connector (P5) to the Frontend PCBA (P8) by soldering.

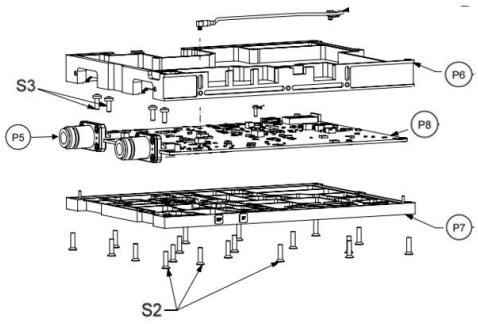


Figure 4-35: Replace N Connector

- ► Close the instrument.
- ► Perform a quick verification test.

4.2.9 Spare Part Replacement for Subassy Case Front

4.2.9.1 Spare Part Subassy Case Front, PN: 1318.4907.00

The spare part contains the following parts (assembled):

- Main Rotary Board PN: 4080.0008.02
- Case Front PN: 1318.4607.00
- Seal Len PN: 4080.0414.00
- Lens PN: 1318.4613.00
- Frame Lens Support PN: 4096.2034.00
- Rubber Keypad PN: 1318.4642.00
- Switch Foil PN: 4080.0250.00
- Assy LCD Bracket PN: 1318.5203.00
- Cable Audio PN: 4080.0843.00
- Flex PCB2 PN: 1314.3893.00
- Nut Spec Galaxy PN: 4080.0508.00
- TFT 6.5” VGA LVDS PN: 5702.6056.00
- Cable LCD Interface PN: 4080.0872.00
- Cable LED Backlight PN: 4080.0866.00
- 965/ISR M3 X 6 A4 PA (6x) PN: 1148.2781.00
- Delta PT Screw 3.0 X 8 (4x) PN: 3588.1076.00
- Screw PT CSK T X K25 X 6 (5x) PN: 3587.9180.00
- Button Push PN: 1318.4636.00
- Rotary Clamping Bush PN: 4096.2305.00
- Cushion Rotary PN: 4080.0737.00
- Knob Rotary PN: 1318.4620.00
- Sheet Bearing Rotary PN: 4080.0743.00
- Foam Silicon D1.6 S30A 170L PN: 4096.2434.00
- Foam Silicon D1.6 S30A 240L PN: 4096.2440.00
- FSH Label Important Note PN: 1318.4988.00
- 965/ISR M2 X 10 A4 (2x) PN: 4060.5485.00
- Screw M2 X 3 Socket HD A4 (2x) PN: 3587.9950.00
- Washer ISO7093 2.2 A2 (2x) PN: 3588.0011.00
- Cushion LCD (4x) PN: 4080.0795.00
- Spacer Bar LCD PN: 4080.0366.00
- EMI Gasket 4X4X120 PN: 1318.5090.00
- Conductive Foam3X1X104.5 (2x) PN: 4080.0272.00
- Conductive Foam 3X1X144 PN: 4080.0289.00

Procedure

► Open the instrument, follow the steps described in:

- "Opening the Instrument"

► Remove Internal Module (M7)

► Replace Subassy Case Front (M1).

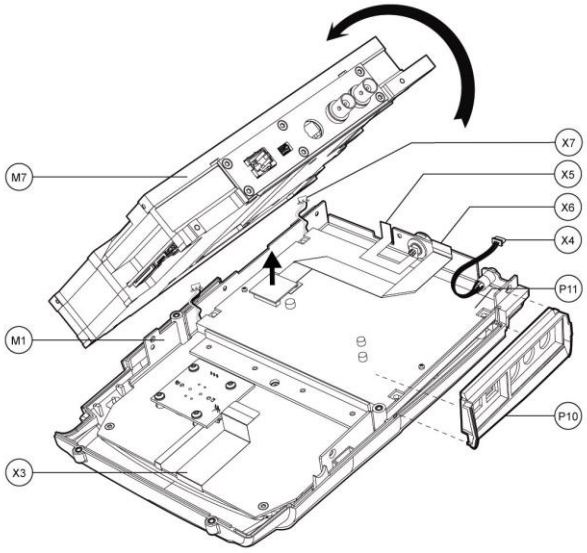


Figure 4-36: Remove Internal Module to replace Subassy Case Front

► Close the instrument.

► Perform a quick verification test

4.2.9.2 Spare Part Main Rotary Board, PN: 4080.0008.02

The spare part contains the following part:

- Main Rotary Board PN: 4080.0008.02
- Delta PT Screws 3.0X8 4x (S1) PN: 3588.1076.00 (not included)

Procedure

► Open the instrument, follow the steps described in:

- "Opening the Instrument"

► Turn the Subassy Case Front (M1) around.

Figure 4-37: Remove Front Rotary out of the Subassy Case Front

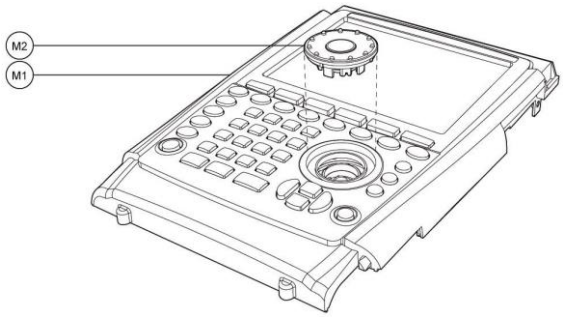


Figure 4-38: Remove Front Rotary out of the Subassy Case Front

► Remove Front Rotary (M2) from Subassy Case Front (M1).

► Turn the Subassy Case Front (M1) around.

► Loosen the four (4) screws (S1) of the Main Rotary Board.

► Remove Main Rotary Board (P1).

► Disconnect Flex Cable to Main Rotary Board (X1).

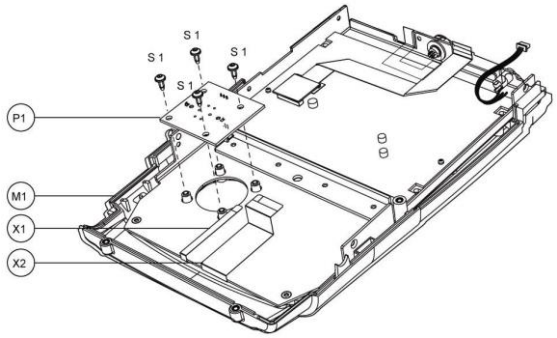


Figure 4-39: Remove Main Rotary Board from Subassy Case Front

- ► Replace Main Rotary Board (P1).
- ► Connect Flex Cable (X1) to Main Rotary Board (P1).
- ► Fasten the four (4) screws (S1).
- ► Close the instrument.
- ► Perform a quick verification test.

4.2.9.3 Spare Part Assy LCD Bracket, PN: 1318.5203.00

The spare part contains the following parts (assembled):

• LCD Bracket L	PN: 1318.5226.00
• LCD Base Bracket	PN: 1318.5210.00
• Screws M2X3 2x (S1)	PN: 3587.9950.00 (not included)
• Washer 2x	PN: 3588.0011.00 (not included)
• Screws 2x M2X10 (S1)	PN: 4060.5485.00 (not included)
• Screws PT CSK TXK25X6 5x (S2)	PN: 3587.9180.00 (not included)
• Screws M3 X 6 A4 6x (S3)	PN: 1148.2781.00 (not included)

Procedure

- ► Open the instrument, follow the steps described in:
  - "Spare Part Replacement for Subassy Case Front"
  - "Spare Part Front Rotary Assy, PN: 1318.6422.00"
- ► Loosen the two (2) screws (S1) and washers on the left and two (2) screws on the right of LCD (P1)
- ► Remove LCD (P1).

Replace LCD

If LCD (P1) is found defects, follow the procedure as per “4.2.9.3”..

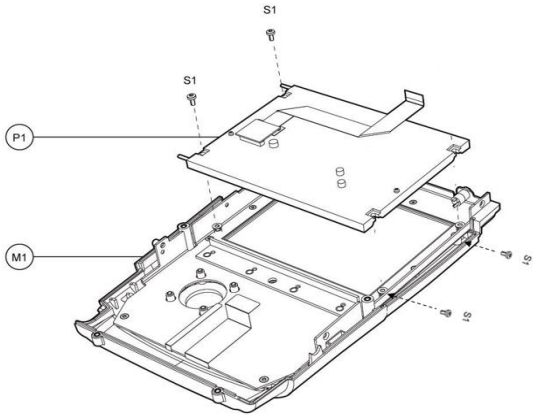


Figure 4-40: Remove LCD

- ► Loosen the five (5) screws (S2) of the Assy LCD Bracket.
- ► Loosen the six (6) screws (S3) of the Assy LCD Bracket.
- ► Remove Assy LCD Bracket (P2) and replace with a new LCD Bracket.

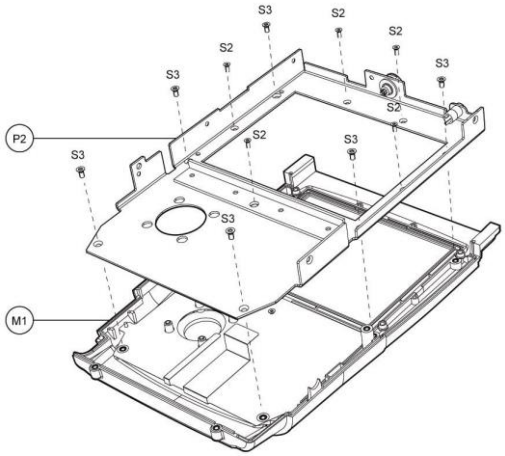


Figure 4-41: Replace Assy LCD Bracket

- ► Fasten screws (S1, S2 and S3) and install the LCD (P1).
- ► Close the instrument.
- ► Perform a quick verification test.

4.2.9.4 Spare Part Switch Foil, PN: 4080.0250.00 and Rubber Keypad, PN: 1318.4642.00

The following spare parts:

- Switch Foil PN: 4080.0250.00
- Rubber Keypad PN: 1318.4642.00

Procedure

► Open the instrument, follow the steps described in:

- "Spare Part Replacement for Subassy Case Front"
- "Spare Part Main Rotary Board, PN: 4080.0008.02"
- “Spare Part Assy LCD Bracket, PN: 1318.5203.00”

► Remove Switch Foil (P1) or Rubber Keypad (P2)

► Replace Switch Foil (P1) or Rubber Keypad (P2).

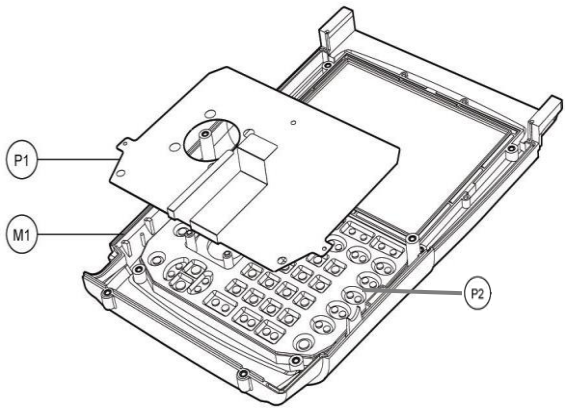


Figure 4-42: Replace Switch Foil and Rubber Keypad

► Close the instrument.

► Perform a quick verification test.

4.2.9.5 Spare Part Lens, PN: 1318.4613.00

The spare part contains the following part:

- Lens PN: 1318.4613.00

Seal Lens
Seal Lens, PN: 4080.0414.00 has to be ordered separately.

Procedure

► Open the instrument, follow the steps described in:

- "Spare Part Assy LCD Bracket, PN: 1318.5203.00"

► Remove Frame Lens Support (P1).

► Remove Lens (P2).

Lens
Lens (P2) is glued to the Front Case with an adhesive Seal Lens (P3).

► Remove the Seal Lens (P3) in the Front Case.

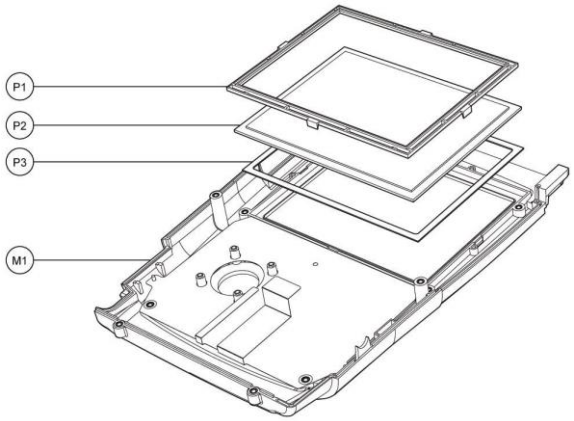


Figure 4-43: Remove Lens Support Frame and the Lens from the Front Case

► Place a new Seal Lens (P3) in the Front Case (M1).

► Place the Lens (P2).

► Place the Frame Lens Support (P1).

► Close the instrument.

► Perform a quick verification test.

4.2.10 Spare Part Replacement for Cables

4.2.10.1 Spare Part Internal Cabling Set, PN: 1318.6439.00

1318.6439.00 contains the following parts:

- Cable Adaptation 6P w/Ferrite PN: 1318.5255.00
- Cable Audio PN: 4080.0843.00
- Cable LCD Interface PN: 4080.0872.00
- Cable LED Backlight PN: 4080.0866.00
- Cable Flat 26P PN: 4080.0820.00
- Cable Flat 12P PN: 4080.0837.00
- Flex PCB2 PN: 1314.3893.00
- Flat Flexible Cable P1.0 L120 8P PN: 3587.9067.00
- Coax Cable 100mm PN: 1314.3935.00

Replace Flat Flexible Cable and Cable Adaptation 6P

► Open the instrument, follow the steps described in:

- "Spare Part Replacement for Subassy Case Front"

► Replace Flat Flexible Cable (P1).

► Replace Cable Adaptation 6P (P2).

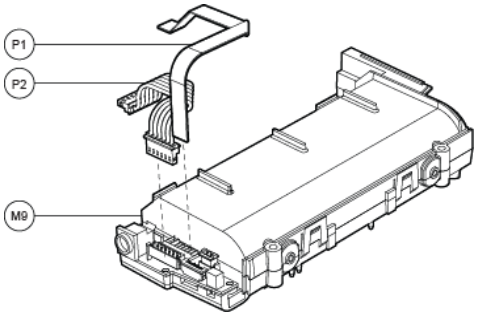


Figure 4-44: Replace Flat Flexible Cable and Cable Adaptation 6P

Replace Cable Audio, Flex PCB2, LCD Interface and LED Backlight

► Open the instrument, follow the steps described in:

- "Opening the Instrument"

► Replace Cable Audio(X1).

► Replace Flex PCB2 (X2).

► Replace Cable LCD Interface (X3).

► Replace Cable LED Backlight (X4).

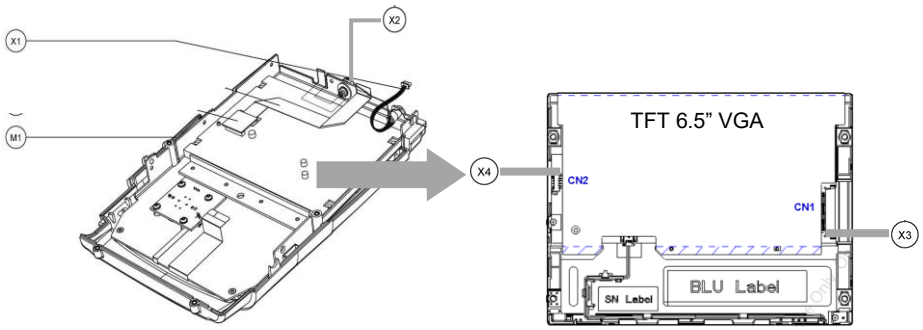


Figure 4-45: Replace Cable Audio, Flex PCB2, LCD Interface and LED Backlight

Replace Cable Flat 26P, Cable Flat 12P AND Coax Cable

► Open the instrument, follow the steps described in:

- "Spare Part Mainboard Tested, PN: 4096.3499.03"

► Remove the Mainboard (M9) from the Internal Module (M7) by rotating 180 degrees clockwise.

► Replace Cable Flat 26P (X1).

► Replace Cable Flat 12P (X3).

► Replace two (2) Coax Cable (X2).

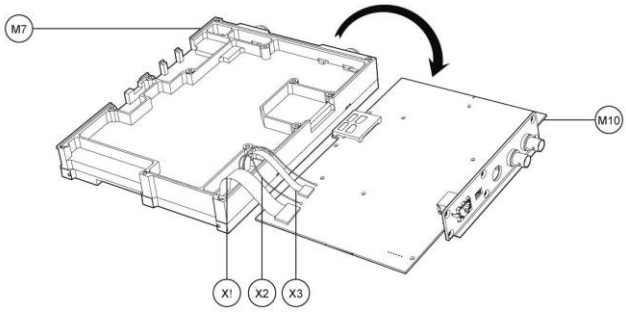


Figure 4-46: Replace Cable Flat 26P, Cable Flat 12P and Coax Cable

4.2.11 Accessories Spare Parts

4.2.11.1 Spare Part HA-Z201 Power Supply, PN: 1309.6100.00

1309.6100.00 contains the following parts:

- Power Adapter (M11)
- Adapter Set (P1) PN: 1318.4971.00

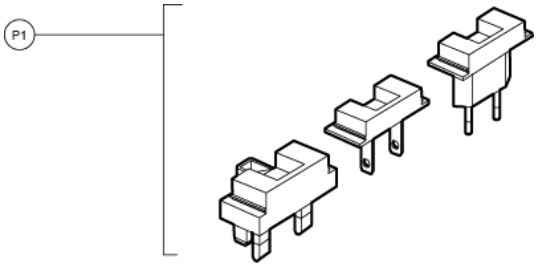


Figure 4-47: Adapter Set

► Slide the relevant adapter from the Adapter Set (P1) on the Power Adapter (M11).

► Connect the Power Adapter to the Device (M12).

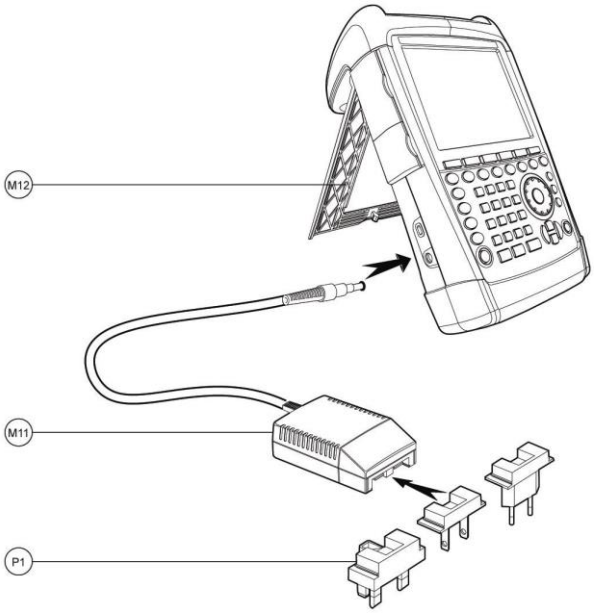


Figure 4-48: Connect Adapter Set to Power Adapter.

5 Firmware Updates / Installing Options

This chapter provides information on software updates and how to install options on the R&S FSH. Additional manuals supplied along with software/firmware updates or with options obtained later can be recorded here.

5.1 Installing New R&S FSH Firmware

A new firmware version can be installed via the R&S website. You can download the newest software version. In order to install the firmware, it must first be copied onto an SD Card, e.g. R&S HA-Z231, order no 1309.6217.00, or USB stick

USB stick requirements

If you are using an USB stick to update the firmware, make sure that it is formatted in FAT32 format. The maximum supported capacity of USB sticks is 32 GB.

For preparation of the SD card, the following steps must be processed:

1. Download the firmware update package from the R&S website into an empty folder on your PC.

   The update package comes as a self-extracting .ZIP file, e.g. "FSH4V1.00.EXE" for version 1.00.

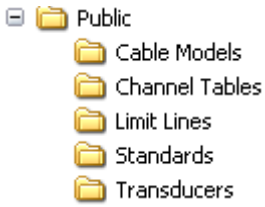
2. Start the .EXE-file. The installer allows you to select the folder for the extracted files. After you have entered the desired folder, press the START button.

Overwriting files

The installer will create a number of subdirectories for standards, limit lines, cable models etc. and copy the predefined configuration files into them. In case that files already exist, it will prompt you for confirmation to overwrite the files.

3. Copy all the files and subfolders into the root directory of the SD card.

   In the sequence, the folder structure should be as follows:

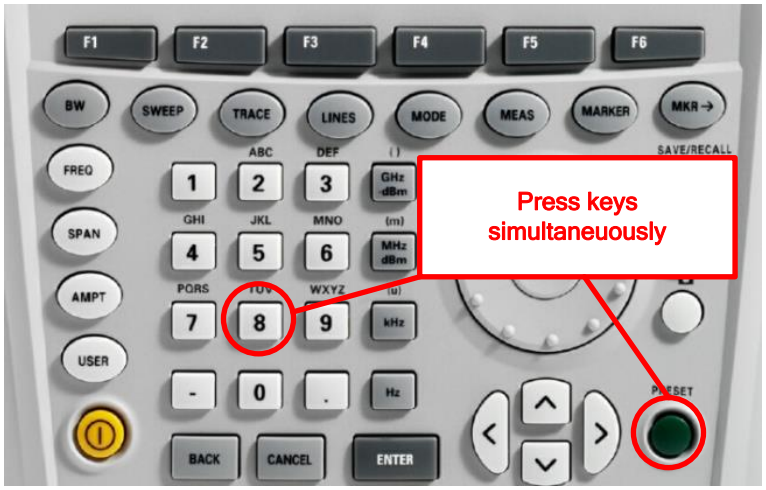


The root directory of the SD card should now contain the following files:

The SD card is now ready for use.

In order to perform the firmware update on the instrument itself the following steps must be processed:

1. Switch the instrument OFF.
2. Insert the SD card into the SD card slot on the right side of the instrument.
3. Connect the instrument to the AC mains via its power adapter.
4. Press the keys PRESET and 8 simultaneously and switch the instrument ON.



5. Keep PRESET and 8 pressed for at least 5 seconds after the startup screen has appeared on the screen

6. Release the keys PRESET and 8.

   The R&S FSH will continue its boot process and after a couple of seconds the following information will appear on the screen:

Instrument Firmware Update

Searching for Storage card … OK

Searching for updater _*.bin … Found updater _SA__....bin

Checking updater _SA_....bin: … OK

Update instrument to software version …

Press [ENTER] to update the firmware.

Press [CANCEL] to abort firmware updating.

---

7. Press ENTER to start the firmware update process.

   The instrument will perform the firmware update. This will take about 5 minutes.

   The progress of the update will be displayed in a sequence of messages on the screen.

NOTICE

Risk of data corruption

Do not switch the instrument off during the update process in order to avoid data corruption of the internal flash memory!

8. As soon as the firmware update is completed, the R&S FSH will display the following message at the bottom of the screen:

Firmware updating is successfully completed.

Please switch off the instrument.

Switch the instrument off and on again. The R&S FSH will boot with the new firmware version.

5.2 Installing Options

Installation of options is described in the operating manual, chapter "Enabling Options".

6 Documents

Spare Parts

The R&S order numbers necessary for ordering replacement parts and modules can be found in the spare part list provided in chapter 3, Table 3-1: "List of spare parts and order numbers".

For general information about spare parts for our products please refer to the sheet "Procedure in Case of Service and Ordering of Spare Parts" at the beginning of this manual.

NOTICE

Module replacement

When replacing a module, 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.

Index