# R&S®FPC1000 / FPC1500
# Spectrum Analyzer
# Service Manual Level 1&2


1328.7238.02 – 03

ROHDE&SCHWARZ

Service Manual Level 1&2

The Service Manual Level 1&2 describes the following R&S®FPC models and options:

- R&S® FPC1000 (1328.6660.02)
- R&S® FPC1500 (1328.6660.03)


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

# Safety Instructions
# Instrucciones de seguridad
# Sicherheitshinweise
# Consignes de sécurité

**⚠ WARNING**

**Risk of injury and instrument damage**

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

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

**⚠ ADVERTENCIA**

**Riesgo de lesiones y daños en el instrumento**

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

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

**⚠ WARNUNG**

**Gefahr von Verletzungen und Schäden am Gerät**

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

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

**⚠ AVERTISSEMENT**

**Risque de blessures et d'endommagement de l'appareil**

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

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

# Customer Support

## Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz equipment, contact one of our Customer Support Centers. A team of highly qualified engineers provides telephone support and will work with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz equipment.

## Up-to-date information and upgrades

To keep your instrument up-to-date and to be informed about new application notes related to your instrument, please send an e-mail to the Customer Support Center stating your instrument and your wish. We will take care that you will get the right information.


**Europe, Africa, Middle East**

Phone +49 89 4129 12345
customersupport@rohde-schwarz.com

**North America**

Phone 1-888-TEST-RSA (1-888-837-8772)
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# Procedure for servicing and repairs

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

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

## Shipping the instrument or module

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

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

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

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

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

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

# Contents

# 1 Documentation Overview

This section provides an overview of the R&S FPC user documentation. You can find it on the product page at: www.rohde-schwarz.com/manual/fpc

**Getting started manual**

Introduces the R&S FPC and describes how to set up and start working with the product. A printed version is included in the delivery

**User manual**

The user manual contains the description of all instrument modes and functions. It also provides an introduction to remote control, a complete description of the remote control commands with programming examples, and information on maintenance, instrument interfaces and error messages

In addition to the R&S FPC user manual, there is a separate user manual for the R&S InstrumentView software package. This manual contains a description of all features of the R& S InstrumentView software package

The online version (html format) of the R&S FPC provides the complete contents for immediate display on the internet.

The user manual is also integrated into the firmware (.chm format). You can export the file to a memory stick ("Setup" > "User Preferences" > "Export Documentation". After the export, you can connect the memory stick to a PC and read the .chm file

**Service manual**

Describes the performance test for checking the rated specifications, module replacement and repair, firmware update, troubleshooting and fault elimination, and contains mechanical drawings and spare part lists

The service manual is available for registered users on the global Rohde&Schwarz information system (GLORIS, https://gloris.rohde-schwarz.com).

**Basic safety instructions**

Contains safety instructions, operating conditions and further important information. The printed document is included in the delivery

**Data sheet and brochure**

The data sheet contains the technical specifications of the R&S FPC. It also lists the options and their order numbers as well as optional accessories

The brochure provides an overview of the R&S FPC and shows its specific characteristics.

**Release notes and open source acknowledgment**

The release notes list new features, improvements and known issues of the current firmware version, and describe the firmware installation.

The open source acknowledgment document provides verbatim license texts of the used open source software. See www.rohde-schwarz.com/firmware/fpc.

The open source acknowledgement is also integrated into the firmware (.chm format). You can export the file to a memory stick ("Setup" > "User Preferences" > "Export Documentation". After the export, you can connect the memory stick to a PC and read the .chm file.

**Application notes, application cards, white papers, etc**

These documents contain information about possible applications and background information on various topics, see www.rohde-schwarz.com/appnotes

**Calibration certificates**

The calibration certificates of your device are available online. Visit the R&S FPC product page and select the item to download the calibration certificate. You will be forwarded to a Gloris page.

https://gloris.rohde-schwarz.com/calcert

Enter the device ID of your R&S FPC and download the certificate. You can find the device ID either in the "Setup" menu or on the label on the rear panel.

# 2 Conventions Used in the Documentation

The following conventions are used throughout the R&S FPC Service Manual Level 1&2 :

### 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.

# 3 Performance Test

This chapter provides information on executing performance tests. After an overview of the required equipment, the test procedure and the detailed test goals are described. At the end of this chapter, templates for test reports are supplied for your convenience. Fields in the report that the user must fill out before or during the test are indicated by a gray background.

## 3.1 Test Equipment

| Item | Type of equipment | Recommended characteristics or features | Recommended model | R&S order no. | Application |
|---|---|---|---|---|---|
| 1 | Signal generator | Frequency:<br>R&S FPC 10 MHz to 3 GHz<br><br>Uncertainty of frequency: 0.1 ppm<br>Phase noise at 500 MHz:<br>< -100 dBc (1Hz) @ 10 kHz<br>< -110 dBc (1Hz) @ 100 kHz<br>< -130 dBc (1Hz) @ 1 MHz | R&S SGS-B106+<br>SGS-B1 +<br>SGS-B26 | 1416.2308.02<br>1416.2408.02<br>1416.1353.02 | Frequency response<br>Frequency accuracy of reference oscillator |
| 2 | 6-dB divider (power splitter) | R&S FPC 10 MHz to 3 GHz | Weinschel 1870A | | Frequency response |
| 3 | Power meter | | R&S NRP | 1143.8500.02 | Frequency response |
| 4 | Power sensor | Frequency:<br>R&S FPC 10 MHz to 3 GHz<br>RSS ≤ 0.8%<br>Meter noise ≤ 20 pW | R&S NRP-Z211 | 1417.0409.02 | Frequency response |
| 5 | 50 Ohm termination | 10 MHz to 3 GHz<br>Return loss ≤ -10 dB | | | Noise display |
| 6 | Cal-Kit | | FSH-Z28 or equivalent | | S11 Port Cal |
| 7 | N(m) -N(m) low loss cable | DC- 3,0 GHz < 0,5 dB | | | TG Level<br>TG frequency response |

## 3.2 Performance Test R&S FPC

**Test Instructions**

To ensure that rated specifications are maintained, the following preparations must be made prior to checking the rated characteristics:

- Allow for a minimum warm-up time of 30 minutes at ambient temperature.
- Carry out all internal adjustments.
- The values are specified in the data sheet. Additional uncertainties introduced by the measurement equipment must be taken into account when checking the rated values.
- Unless specified otherwise, all measurements will be performed with external reference frequency.

### 3.2.1 Checking the Reference Frequency Accuracy

Test equipment:
- Signal generator
  (refer to section "Measurement Equipment and Accessories", item 1)

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

Signal generator settings:
- Frequency 1 GHz
- Level -10 dBm

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

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

Nominal frequency: 1.0 GHz

### 3.2.2 Checking the Level Accuracy and the Frequency Response

Test equipment:

- Signal generator
  (refer to section "Measurement Equipment and Accessories", item 1)
- Power meter
  (refer to section "Measurement Equipment and Accessories", item 3)
- Power sensor
  (refer to section "Measurement Equipment and Accessories", item 4)
- 6 dB power splitter
  (refer to section "Measurement Equipment and Accessories", item 2)

**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 FPC.

Signal generator settings:

- Frequency 100 MHz
- Level Power meter reading = 0 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 FPC settings:

- [ **PRESET** ]
- [ **FREQ** : **100 MHz** ]
- [ **AMPT** : **0 dBm** ]
- [ RF ATT: 20 dB ]
- [ **SPAN** : **100 kHz** ]
- [ **BW** : MANUAL RBW : **10 kHz** ]
- [ **BW** : MANUAL VBW : **30 kHz** ]
- [ **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 FPC. It can be calculated as:

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

### 3.2.3 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. The reference level influences the RF attenuation (RF attenuation = +10 dBm + reference level).

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 power meter reading = {Ref_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 –10 dBm ± 0.2 dB.

R&S FPC settings:
- [ **PRESET** ]
- [ **AMPT** : {Ref_Lev}*) ]
- [ **SPAN** : **100 kHz** ]
- [ **BW** : MANUAL RBW : **10 kHz** ]
- [ **BW** : MANUAL VBW : **30 kHz** ]
- [ SWEEP TIME: **1s** ]
- [ **TRACE** : DETECTOR : RMS ]
- [ **FREQ** : CENTER : {$f_{in}$} * ]

*) Refer to table under “Performance test report” for values of {Ref_Lev} and {$f_{in}$.}

The frequency response of the RF preamplifier must also be checked. To switch it on, enter:

- [ **AMPT**: Preamp On ]

To avoid overdriving the preamplifier, the output power of the signal generator must be reduced to –30 dBm at the RF input of the R&S FPC during this measurement.

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 table under “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 FPC 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 = $L - L_{powermeter} - Ref_{100\ MHz}$

### 3.2.4 Checking the Accuracy of the RF Attenuator

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

Test equipment:
- Signal generator
  (refer to section "Measurement Equipment and Accessories", 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 FPC.

Signal generator settings:
- Frequency 100 MHz
- Level Power meter reading = -30dBm

R&S FPC settings:
- [ **PRESET** ]
- [ **FREQ** : **100 MHz** ]
- [ **SPAN** : **100 kHz** ]
- [ **BW** : MANUAL RBW : **10 kHz** ]
- [ **BW** : MANUAL VIDEO BW : **30 kHz** ]
- [ **TRACE** : DETECTOR : RMS ]
- [ **SWEEP TIME: 5s** ]
- [ **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**

- Frequency 100 MHz
- Level Power meter reading 30dB below {RF Att}*.

*) Refer to table under “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: RF attenuation – 30 [dBm].

R&S FPC settings: - [ **AMPT** : RF Att Amp / Imp: RF attenuation Man: {RF Att}. ]

- [ **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 FPC and $Ref_{0dBm}$ (at 0 dB RF-Att) is the uncertainty of the RF attenuation:

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

### 3.2.5 Checking the Displayed Average Noise Floor

Test equipment: 50 Ω termination (refer to section "Measurement Equipment and Accessories", item 6)

Test setup: Terminate the RF input of the R&S FPC with 50 Ω .

R&S FPC settings:
- [ **PRESET** ]
- [ **SPAN** : Zero Span ]
- [ **BW**: Manual RBW : 1 kHz ]
- [ **BW**: Manual VBW : 10 Hz ]
- [ **SWEEP** : Manual SWP Time : 600 ms]
- [ **TRACE** : Trace Mode: Average 12]
- [ **TRACE** : DETECTOR: SAMPLE]
- [ **AMPT** : –30 dBm ]
- [ **FREQ** : {$f_n$} ]

Refer to table under “Performance test report“ for values of $f_n$.

R&S FPC settings for the measurement of the displayed average noise floor with preamplifier = ON :
- [ **PRESET** ]
- [ **SPAN** : Zero Span ]
- [ **BW** : Manual RBW : **1 kHz** ]
- [ **BW** : Manual VBW : **10 Hz** ]
- [ **SWEEP** : Manual SWP Time : **600 ms** ]
- [ **TRACE** : Trace Mode: Average 12]
- [ **TRACE** : DETECTOR: SAMPLE]
- [ **AMPT** : **–40 dBm** ]
- [ **AMPT** : PREAMP : ON]
- [ **FREQ** : {$f_n$} ]

Refer to table under “Performance test report” for values of $f_n$.

Measurement: Read out the marker level.

evaluation: The displayed average noise floor is the level reading of the marker subtract by the value of 10*log{RBW}

### 3.2.6 Checking the Phase Noise

Test equipment: Signal generator
(refer to section "Measurement Equipment and Accessories", item 1)

Frequency 500 MHz

Level ≥ 0 dBm

Test setup:

► Connect the RF output of the signal generator to the RF input of the R&S FPC.
► Set the DUT (Spectrum Analyzer) to the below settings:-

- [ **PRESET** ]

- [ **FREQ** : 500 MHz ]

- [ **AMPT** : REF LEVEL –10 dBm ]

- [ **AMPT**: RF Att Amp / Imp: RF attenuation Man: 0 dB ]
- [ **SPAN** : 10 kHz ]

- [ **RBW** : 3kHz ]

- [ **VBW** : 30kHz ]

- [ **DETECTOR** : RMS ]

- [ **SWEEPTIME** : 500ms ]

- [ **TRACE** : Trace Mode: Average 20]

► Set the Signal Generator Pout @ 500MHz that the input level of the instrument is -10dBm

At the DUT (Spectrum Analyzer), activate the [ MKR► : SET TO PEAK ] and store the value shown by the marker as {MaxPeak@500MHz(dBm)}. This value is used as reference for the phase noise measurement. Depending on the offset, refer to the table below for values of center frequency {CENTER}.

- [ **SPAN** : 0 Hz ]

- [ **FREQ** : {CENTER} MHz ]

► Set marker mode to noise measurement

- [**MARKER**: Marker Function: Marker Mode Noise ]

► Read out the display value and calculate the phasenoise result as described below.

Evaluation: The phase noise result is displayed in the marker field by the reading the peak marker and applied the following formula.

Phase noise result(dBc/Hz) = MaxPeakNoiseMarker Result (dBm/Hz) - MaxPeak@500MHz(dBm)

IE:

Phase noise at 500MHz $_{\text{offset of 30 kHz}}$ = MaxPeakNoiseMarker Result $_{\text{500.03MHz}}$ - MaxPeak@500MHz

Phase noise at 500MHz $_{\text{offset of 100 kHz}}$ = MaxPeakNoiseMarker Result $_{\text{500.10MHz}}$ - MaxPeak@500MHz

Phase noise at 500MHz $_{\text{offset of 1 MHz}}$ = MaxPeakNoiseMarker Result $_{\text{501.00MHz}}$ - MaxPeak@500MHz

| Phase noise measurement settings | |
|---|---|
| Offset | Center Frequency {CENTER} |
| 30 kHz | 500.03 MHz |
| 100 kHz | 500.10 MHz |
| 1 MHz | 501.00 MHz |

### 3.2.7 Checking the Display Linearity

Test equipment:
- - Signal generator
  (refer to section "Measurement Equipment and Accessories", item 1)
- - Power meter
  (refer to section "Measurement Equipment and Accessories", item 3)
- - Power sensor
  (refer to section "Measurement Equipment and Accessories", item 4)
- - 6 dB power splitter
  (refer to section "Measurement Equipment and Accessories", item 2)

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 FPC.

**1st measurement** 0 to 30 dB below reference level

Signal generator settings:
- - Frequency 100 MHz
- - Level Power meter reading = 0dBm

R&S FPC settings:
- - [ **PRESET** ]
- - [ **AMPT: 0 dBm** ]
- - [ **AMPT**: RF Att Amp / Imp: RF attenuation Man: 10 dB ]
- - [ **FREQ**: **100 MHz** ]
- - [ **SPAN** : **10 kHz** ]
- - [ **AMPT** : Manual RBW : 1 kHz ]
- - [ **AMPT** : 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 Power meter reading = {Sig_Lev}

Refer to table under “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 FPC 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 FPC is used to increase the dynamic range of the input signal.

R&S FPC settings: - [ **AMPT**: RF Att Amp / Imp: RF Attenuation Man: 30 dB ]

- [ **SWEEP**: SWEEP TIME MANUAL : 5s ]

Signal generator settings:
- Frequency 100 MHz
- Level power meter reading = -10dBm

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. “$Linearity_{uncertainty}$ (–30 dB)” is the measured uncertainty of the R&S FPC linearity at 30 dB below reference level.

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

Signal generator settings:
- Frequency 100 MHz
- Level Power meter reading = {Sig_Lev}

Refer to table under “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 FPC and $Ref_{20dBm}$ is the uncertainty of the display linearity:

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

### 3.2.8 Functional Test of Tracking Generator (R&S FPC1500 only)

For the functional test of the tracking generator (R&S FPC1500 only) the analyzer part must be verified according to performance test in advance.

**Absolute error at 100MHz:**

| | |
|---|---|
| Test equipment: | Low loss cable |
| Test setup: | Connect RF input to RF output with a low loss cable |
| R&S FPC1500 settings | Set level of RF out: -10dBm |
| | Set center frequency to 100MHz |
| | Set RBW = 10kHz |
| | Set Span = 0Hz |
| | Switch on RF output |
| Measurement | TG Level must be within +-1dB |

**Frequency response:**

| | |
|---|---|
| Test equipment: | Low loss cable |
| Test setup: | Connect RF input to RF output with a low loss cable |
| R&S FPC1500 settings | Set level of RF out: -10dBm |
| | Set center frequency to 100MHz (20MHz, 500MHz, 1000MHz, 1500MHz, 2000MHz, 2500MHz, 3000MHz) |
| | Set RBW = 10kHz |
| | Set Span = 0Hz |
| | Switch on RF output |
| Measurement | TG Level must be within + 3dB and -3,5dBm compared to the measurement reference value at 100MHz |

**Checking the Corrected Test Port Match (S11)**

The functionality of S11 can only be tested if the VNA Option R&S FPC-K42 is activated

Test equipment: CAL-Kit (refer to item in Chapter 3.2, "Test Equipment", on page 8)

Test setup: Connect the 50 ohm precision load to the RF Out / Reflection port of the R&S FPC1500

R&S FPC1500 settings

1. [ PRESET ]
2. [ CAL : Full 1-Port]
3. Connect Open to the RF Out / Reflection port and press “continue”
4. Connect Short to the RF Out / Reflection port and press “continue”
5. Connect Load to the RF Out / Reflection port and press “continue”

Measurement

- ► Connect the Load to the RF Out / Reflection port
- ► Set marker to fmarker to 100MHz (20MHz, 500MHz, 1000MHz, 1500MHz, 2000MHz, 2500MHz, 3000MHz)
- ► [ MARKER : {fmarker} ]
- ► Read out the marker level
- ► Repeat the measurement at all frequencies listed
- ► Refer to Chapter .3, "Performance Test Report", on page 20 for test frequency's

Evaluation The marker Level must be < -39 dBm

## 3.3 Performance Test Report for R&S FPC

| ROHDE&SCHWARZ | Spectrum Analyzer<br>R&S FPC | 1322.6660.02 |
|---|---|---|
| Serial number:<br><br>Date:<br><br>Person responsible:<br><br>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<br><br>Basic unit | 0.999998 | _____ | 1.000002 | GHz |
| Level accuracy<br>at 100 MHz with<br>Ref_Lev = –5 dBm<br><br>Frequency response ($f_{resp}$)<br>with RF Att = 5 dB<br>Ref_Lev = –10 dBm | –0.3 | _____ | +0.3 | dB |
| 10 MHz | –1 | _____ | +1 | dB |
| 100 MHz | - | Reference | - | |
| 500 MHz | –1 | _____ | +1 | dB |
| 1000 MHz | –1 | _____ | +1 | dB |
| For instruments with option FPC-B2 or FPC-B3: | | | | |
| 1500 MHz | –1 | _____ | +1 | dB |
| 2000 MHz | –1 | _____ | +1 | dB |
| For instruments with option FPC-B3: | | | | |
| 2500 MHz | –1 | _____ | +1 | dB |
| 2999 MHz | –1 | _____ | +1 | dB |

| | | | | |
|---|---|---|---|---|
| Frequency response ($f_{resp}$) with RF Att = 10 dB Ref_Lev = –10 dBm | | | | |
| 10 MHz | –1 | _____ | +1 | dB |
| 100 MHz | - | Reference | - | |
| 500 MHz | –1 | _____ | +1 | dB |
| 1000 MHz | –1 | _____ | +1 | dB |
| For instruments with option FPC-B2 or FPC-B3: | | | | |
| 1500 MHz | –1 | _____ | +1 | dB |
| 2000 MHz | –1 | _____ | +1 | dB |
| For instruments with option FPC-B3: | | | | |
| 2500 MHz | –1 | _____ | +1 | dB |
| 2999 MHz | –1 | _____ | +1 | dB |
| Frequency response ($f_{resp}$) with RF Att = 20 dB Ref_Lev = –10 dBm | | | | |
| 10 MHz | –1 | _____ | +1 | dB |
| 100 MHz | - | Reference | - | |
| 500 MHz | –1 | _____ | +1 | dB |
| 1000 MHz | –1 | _____ | +1 | dB |
| For instruments with option FPC-B2 or FPC-B3: | | | | |
| 1500 MHz | –1 | _____ | +1 | dB |
| 2000 MHz | –1 | _____ | +1 | dB |
| For instruments with option FPC-B3: | | | | |
| 2500 MHz | –1 | _____ | +1 | dB |
| 2999 MHz | –1 | _____ | +1 | dB |
| Frequency response ($f_{resp}$) with RF Att = 30 dB Ref_Lev = –10 dBm | | | | |
| 10 MHz | –1 | _____ | +1 | dB |
| 100 MHz | - | Reference | - | |
| 500 MHz | –1 | _____ | +1 | dB |
| 1000 MHz | –1 | _____ | +1 | dB |

| | | | | |
|---|---|---|---|---|
| For instruments with option FPC-B2 or FPC-B3: | | | | |
| 1500 MHz | –1 | _____ | +1 | dB |
| 2000 MHz | –1 | _____ | +1 | dB |
| For instruments with option FPC-B3: | | | | |
| 2500 MHz | –1 | _____ | +1 | dB |
| 2999 MHz | –1 | _____ | +1 | dB |
| Instruments with option FPC-B22 installed: | | | | |
| Frequency response ($f_{resp}$) with PreAmp = ON RF Att = 0 dB Ref_Lev = –30 dBm | | | | |
| 10 MHz | –1 | _____ | +1 | dB |
| 100 MHz | - | Reference | - | |
| 500 MHz | –1 | _____ | +1 | dB |
| 1000 MHz | –1 | _____ | +1 | dB |
| For instruments with option FPC-B2 or FPC-B3: | | | | |
| 1500 MHz | –1 | _____ | +1 | dB |
| 2000 MHz | –1 | _____ | +1 | dB |
| For instruments with option FPC-B2 or FPC-B3: | | | | |
| 2500 MHz | –1 | _____ | +1 | dB |
| 2999 MHz | –1 | _____ | +1 | dB |
| 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 / 20 dBm | –0.3 | _____ | +0.3 | dB |

| | | | | |
|---|---|---|---|---|
| Displayed average noise floor ($f_{noise}$) in 1 Hz bandwidth | | | | |
| 1 MHz | - | _____ | –127 | dBm (1 Hz) |
| 10.1 MHz | - | _____ | –142 | dBm (1 Hz) |
| 499 MHz | - | _____ | –142 | dBm (1 Hz) |
| 999 MHz | - | _____ | –142 | dBm (1 Hz) |
| For instruments with option FPC-B2 or FPC-B3: | | | | |
| 1499 MHz | - | _____ | –142 | dBm (1 Hz) |
| 1999 MHz | - | _____ | –142 | dBm (1 Hz) |
| For instruments with option FPC-B3: | | | | |
| 2499 MHz | - | _____ | –138 | dBm (1 Hz) |
| 2999 MHz | - | _____ | –138 | dBm (1 Hz) |
| Instruments with option FPC-B22 installed: | | | | |
| Displayed average Noise floor ($f_{noise}$) in 1 Hz bandwidth, PreAmp = ON | | | | |
| 1 MHz | - | _____ | –147 | dBm (1 Hz) |
| 10.1 MHz | - | _____ | –158 | dBm (1 Hz) |
| 499 MHz | - | _____ | –158 | dBm (1 Hz) |
| 999 MHz | - | _____ | –158 | dBm (1 Hz) |
| For instruments with option FPC-B2 or FPC-B3: | | | | |
| 1499 MHz | - | _____ | –158 | dBm (1 Hz) |
| 1999 MHz | - | _____ | –158 | dBm (1 Hz) |

| | | | | |
|---|---|---|---|---|
| For instruments with option FPC-B3: | | | | |
| 2499 MHz | - | _____ | –155 | dBm (1 Hz) |
| 2999 MHz | - | _____ | –155 | dBm (1 Hz) |
| Phase noise at 500 MHz | | | | |
| Offset frequency: | | | | |
| 30 kHz | - | _____ | –88 | dBc (1 Hz) |
| 100 kHz | - | _____ | –98 | dBc (1 Hz) |
| 1MHz | - | _____ | –120 | dBc (1 Hz) |
| **Display linearity 0 dB to –30 dB**<br>**Reference level: 0 dBm** | | | | |
| **Sig_Lev:** | | | | |
| 0 dBm | - | Reference | - | |
| –5 dBm | –0.3 | _____ | +0.3 | dB |
| –10 dBm | –0.3 | _____ | +0.3 | dB |
| –15 dBm | –0.3 | _____ | +0.3 | dB |
| –20 dBm | –0.3 | _____ | +0.3 | dB |
| –25 dBm | –0.3 | _____ | +0.3 | dB |
| –30 dBm | –0.3 | _____ | +0.3 | dB |
| **Display linearity –30 dB to –50 dB**<br>**Reference level: 20 dBm** | | | | |
| **Sig_Lev:** | | | | |
| –10 dBm | - | Reference | - | |
| –15 dBm | –0.3 | _____ | +0.3 | dB |
| –20 dBm | –0.3 | _____ | +0.3 | dB |
| –25 dBm | –0.3 | _____ | +0.3 | dB |
| –30 dBm | –0.3 | _____ | +0.3 | dB |

| | | | | |
|---|---|---|---|---|
| **Tracking Genarator** | | | | |
| **Reference Level** | | **Pass / Fail** | | |
| 100MHz | | | | **dB** |
| **TG Frequency response** | | **Pass / Fail** | | |
| 100 MHz | | Reference | | **dB** |
| 20MHz | | | | **dB** |
| 500MHz | | | | **dB** |
| 1000MHz | | | | **dB** |
| 1500MHz | | | | **dB** |
| 200MHz | | | | **dB** |
| 2500MHz | | | | **dB** |
| 3000MHz | | | | **dB** |
| **Checking the Corrected Test Port Match** | | **Pass / Fail** | | |
| 100 MHz (reference) | | | | dB |
| 20MHz | | | | dB |
| 500MHz | | | | dB |
| 1000MHz | | | | dB |
| 1500MHz | | | | dB |
| 200MHz | | | | dB |
| 2500MHz | | | | dB |
| 3000MHz | | | | dB |

# 4 Adjustment

The R&S FPC supports the following adjustments:

- Adjustment of the reference oscillator that determines the frequency accuracy of the R&S FPC.
- Adjustment of the level accuracy of the R&S FPC at different attenuator settings. Adjustment allows you to maintain and restore the data integrity of the instrument.
- Adjustment of tracking generator frequency response

All adjustments have to be performed at an ambient temperature between +20°C and +30°C after the instrument has properly warmed up. Verification of the R&S FPC functionality is recommended before you start performing adjustments.

**NOTICE**

**Adjustment is only possible in R&S service centers**

Only qualified personnel should carry out the re-alignment, because any change substantially influences the measurement accuracy of the instrument. For this reason, this chapter only contains general preconditions and does not explicitly describe the adjustment procedure.

Any device programming and adjustment procedure is done with a Rohde&Schwarz software solution called R&S PVS.

## 4.1 Measuring Equipment

The table below contains the necessary equipment for the adjustment procedure. For details on the equipment refer to the section 3.1

| Type of equipment | Adjusting the frequency accuracy | Frequency response correction |
|---|---|---|
| Signal Generator | X | X |
| Power Splitter | | X |
| Power Sensor | | X |

## 4.2 Adjusting the Frequency Accuracy

Adjusting the frequency accuracy is possible with a defined test system controlled by the R&S PVS software.

This software provides the control of the equipment and the R&S FPC. To run the adjustment in the R&S PVS system, the corresponding test plan has to be started.

**Preconditions for alignment**

- Adjustment of the R&S FPC is only possible with the R&S PVS system.
- Adjustment of the R&S FPC must be performed after a warm-up time of at least 30 minutes. Compliance with the guaranteed data can only be ensured after that warm-up time.

## 4.3 Frequency Response Correction for Spectrum Analyzer and Generator

Adjusting the frequency response is possible with a defined test system controlled by the R&S PVS software.

This software provides the control of the equipment and the R&S FPC. To run the adjustment in the R&S PVS system, the corresponding test plan has to be started.

**Preconditions for frequency correction**

- Adjustment of the R&S FPC is only possible with the R&S PVS system.
- Adjustment of the R&S FPC must be performed after a warm-up time of at least 30 minutes. Compliance with the guaranteed data can only be ensured after that warm-up time.

## 4.4 Restoring Instrument Identity

**Device Recovery**

Programming of the device data has to be carried out after replacement of the base unit.

# 5 Repair

The following chapter describes how to repair the R&S FPC.

Numbers in parenthesis refer to the elements indicated in the images.

## 5.1 Functional Description

### 5.1.1 Block Diagram

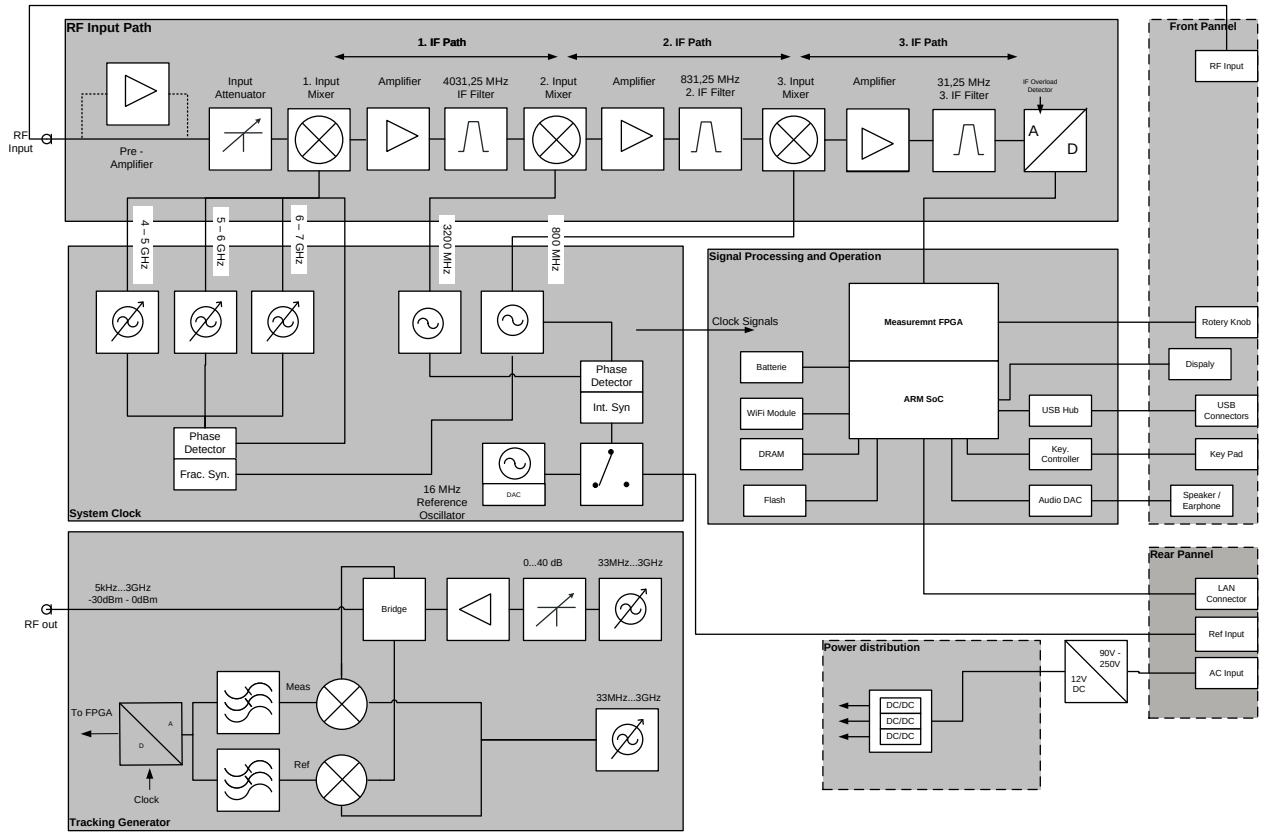



**Figure 5-1: R&S FPC block diagram**

### 5.1.2 Mainboard

The R&S FPC mainboard integrates the RF signal chain as well as the digital backend of the instrument. The digital part also includes the hardware for the interfaces and the front keys.

**RF input path**

The R&S FPC spectrum analyzer front-end is designed with a 3 mixing-conversion stages super-heterodyne architecture. The R&S FPC supports an input frequency range of 5 kHz to 3 GHz, depending on the installed options.

The first stage mixer is an up-converter. The input frequency from 5 kHz to 3 GHz is up-converted to a 1st IF (intermediate frequency) of 4031.25 MHz by LO1 (local oscillator). This has a frequency range 4031.35 MHz to 7031.25 MHz. This 1st IF will be down-converted to a 2nd IF (intermediate frequency) of 831.25 MHz by LO2. The frequency here is 3200 MHz. The 2nd IF will then be fed to the 3rd mixer and down-converted to 31.25 MHz by the LO3 with a frequency of 800 MHz.

After this down-conversion, a 14-bit A/D converter processes the third IF. An overload detector monitors the input level of the A/D converter. In case of too high input signal, the analyzer displays the IF OVL message.

**Signal processing and operation**

The R&S FPC uses an on-board dual-core processor operating at a core clock frequency of 533 MHz. The processor is equipped with an integrated FPGA supporting all instrument functionality as well as addressing all interfaces and memory chips.

**Audio output**

The serial audio output from the FPGA is converted to analog audio signals. The analog audio signals are then connected to the headphone jack and speaker.

The key click sounds are generated when the external keypad is pressed.

**Tracking generator and independent source generator functions**

The generator output of the R&S FPC can either used in tracking generator mode. The generator is coupled to the sweep frequency of the spectrum analyzer to perform transmission measurements. A frequency offset can be set.

Second, the generator can be used as independent signal source where the generation is coupled to the center frequency of the spectrum analyzer.

The level of the generator output can be set via step attenuator from 0 dB to - 30dB.

The generator stage is additionally equipped with a bridge for performing vector measurements. In case the network mode is activated, the maximum output power is limited to -10 dBm.

### 5.1.3 Front Unit

The front unit of the R&S FPC consists of the display, the key mat and the front board.

### 5.1.4 Power Supply

The R&S FPC is powered by a 12 V, 25 W internal power supply unit. This 12 V are converted to the board supply voltages by switching regulators or linear regulators all located on the mainboard of the R&S FPC.

## 5.2 Trouble Shooting / Failure Isolation

### 5.2.1 Structured Failure Locations

This section provides information about a structured troubleshooting during the boot process, until the R&S FPC reaches its operational status.

To locate any power up boot / operational problem, the chart below supports you in finding the source of problem.

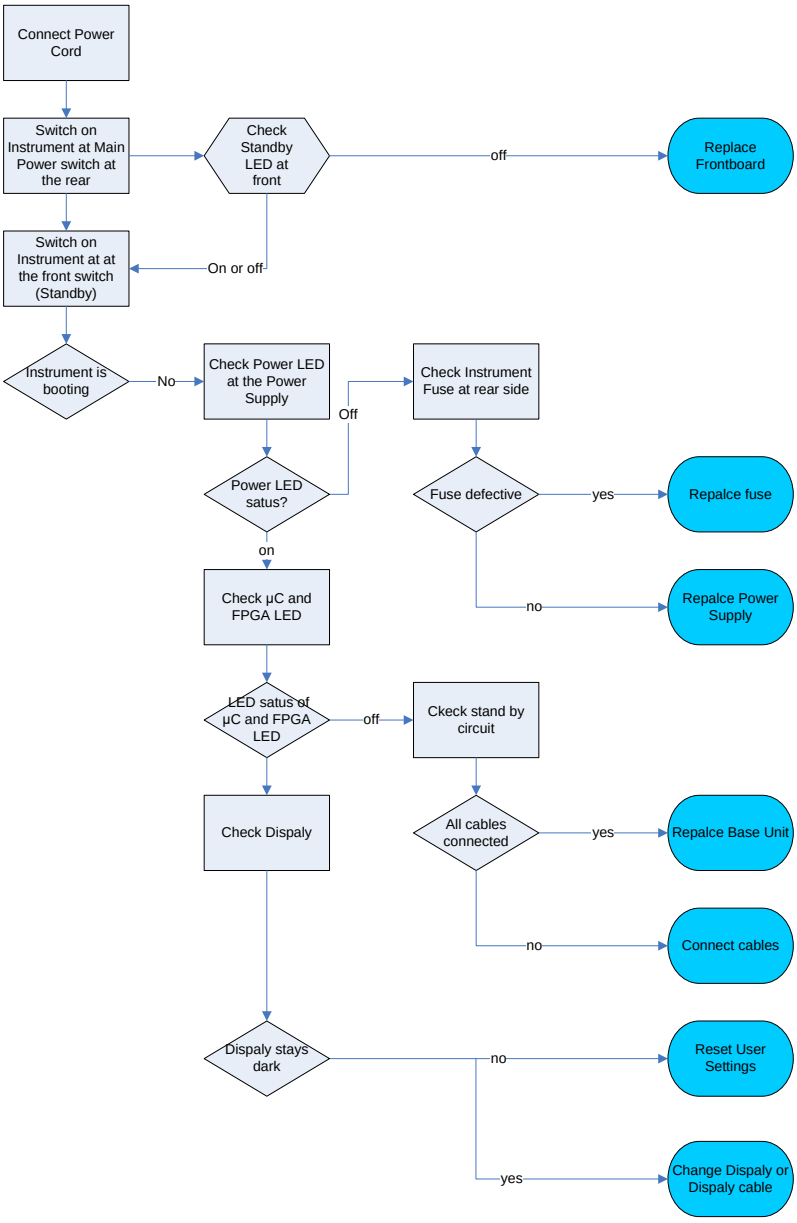



**Figure 5-2: Failure location chart**

### 5.2.1.1 Checking the Power Supply

**CAUTION**

**Shock hazard**

Be careful not to touch any parts inside the R&S FPC while it is connected to the mains.

Not doing so can result in physical harm (shock hazard).

**Checking the power LED at the power supply**

6. Remove rear cover.
7. Connect instrument to the mains via an isolation transformer.
8. Check if the power supply LED is active.

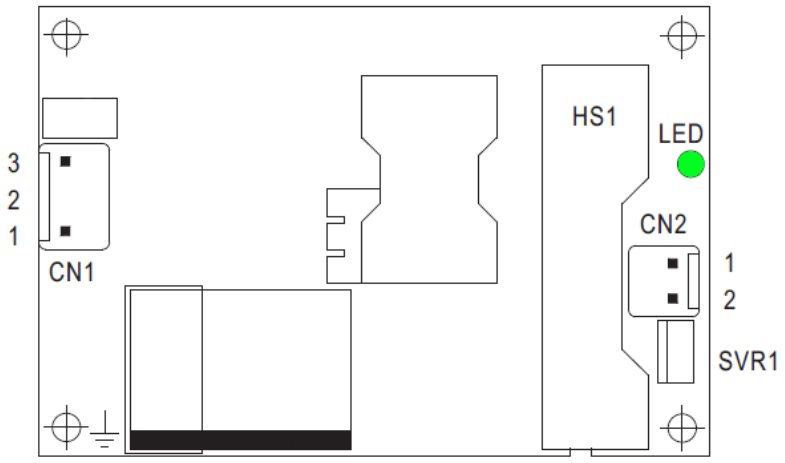



**Figure 5-3: Power supply top view**

9. Disconnect the instrument from the mains.
10. If the LED is not illuminated, check the main fuse at the rear side and replace it if necessary.
11. If the main fuse is ok, and the LED on the power supply is not illuminated, replace the power supply.

### 5.2.1.2 Checking the µController and FPGA operation

The successful finished boot process of the µController and FPGA are monitored via two LED's.

- In stand-by mode, the µController LED P2900 is illuminated.
- After a successful boot process, the "done LED" P1700 near the FPGA indicates the operational status.

► If the µController LED stays dark and the power supply is working correctly, check the secondary cabling of the power supply. If there is no fault, replace the base unit.

► If the FPGA LED stays dark after switching on the instrument via the front power button, check the illumination of the power on button. If it stays yellow, check the cabling to the front panel board. If there is no fault, the fault can be in a defective key mat, a defective front board, or a defective motherboard. If the illumination of the power button is changing to green after pressing it, replace base unit.

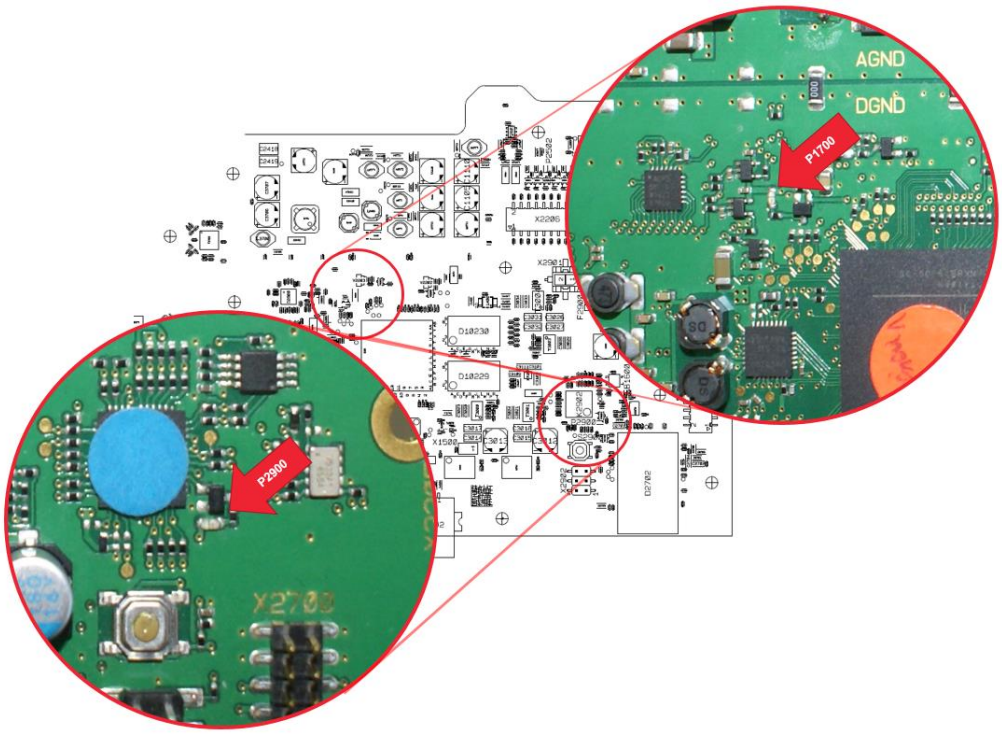



**Figure 5-4: Location of FPGA and µController LED**

### 5.2.2 Instrument Stop Frequency cannot be Reached

If the desired stop frequency cannot be reached, check if the corresponding frequency extension option (R&S FPC-B2 and/or R&S FPC -B3) is installed.

**Checking installed options**

1. Press the "Setup" key.
2. Press the "Installed Options" softkey and read out the installed options.
3. **Note:** To install new options, refer to the user manual.

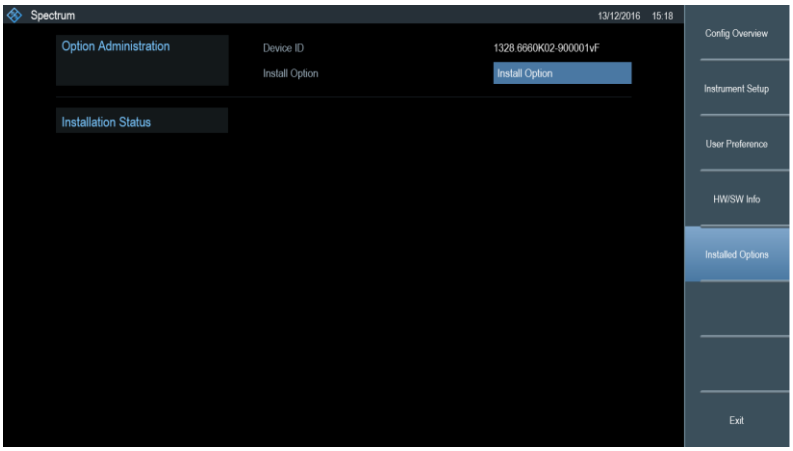



**Figure 5-5: Options menu**

### 5.2.3 Instrument Shows IF Overload

The instrument monitors the power on the 3rd IF. In case the IF overload message is displayed, the ADC is receiving too much input power from the 3rd IF.

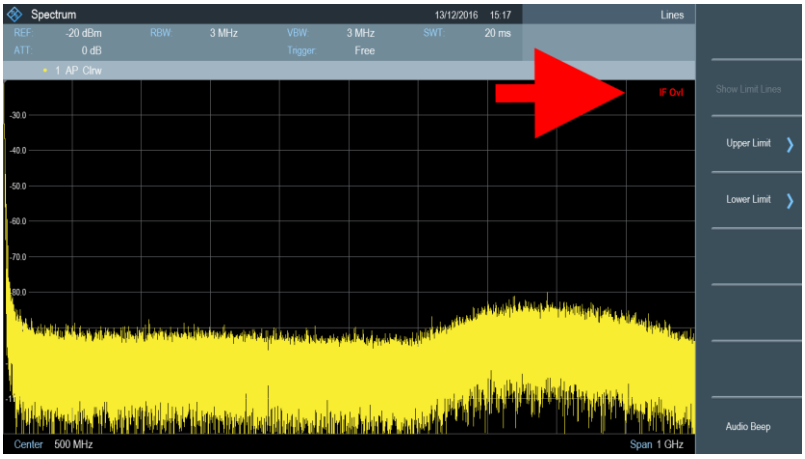



**Figure 5-6: IF Overload message**

In case the IF overload is still indicated, even if no input signal is applied, the analyzer input may be defective.

► Replace the base unit. Refer to section 5.3.4.

### 5.2.4 Instrument Displays Wrong Level Measurement

#### 5.2.4.1 Frequency Response Indicates too High Deviation

A wrong level indication of the instrument may have one of the following reasons.

- Aging effects of the used components.
- Defective components in the RF section.

You can correct the aging effects with the frequency correction tool included in the R&S PVS software. There, you can run the frequency response correction to align the levels at each frequency point.

If, after the frequency correction, the level offset or noise indication is still too high, you have to replace the base unit.

#### 5.2.4.2 Noise Floor too High

If the displayed average noise floor (DANL) is not within the limits, this may have the following reasons.

- The LO feedthrough overdrives the amplifiers. In that case, replace the base unit.
- The level correction is not ok. In that case, repeat level correction with the R&S PVS software.
- The internal Wi-Fi Module is activate (transmitting at 2.4 GHz). In that case, turn off Wi-Fi in the "Setup" menu.

### 5.2.5 Tracking Generator output (R&S FPC1500 only)

The signal source settings control the signal output on the corresponding RF connector on the front panel of the R&S FPC. You can use the signal source for transmission measurements, for example. The generated signal is a simple sine wave signal that you can feed into the DUT.

The frequency and level of the generated signal is variable.

For testing and test setup of Tracking Generator refer to the performance test.

#### 5.2.5.1 Tracking Generator Frequency

The output frequency depends on the mode you have selected. In case the expected signal does not appear, check first the TG settings by

1. Press the "Meas" key.

2. Select the "Source" menu item to open the signal source menu.

3. Check one of the signal source modes (refer to table below)

| Signal Source Mode | Frequency Setting |
|---|---|
| **Off** | Turns off the signal source. No signal is output on the RF connector. |
| **CW** | Opens an input field that allows you to define the output frequency. The output signal is a continuous wave signal whose frequency remains the same throughout the measurement. |
| **CW Coupled** | The output signal is a continuous wave signal whose frequency is coupled to the center frequency. When you change the center frequency, the R&S FPC adjusts the output signal accordingly. |
| **Tracking Generator** | The output signal is a continuous wave signal whose frequency is coupled to the measurement frequency.<br>For time domain measurements (span = 0), use either mode "CW" or "CW Coupled".<br>For frequency domain measurements (span > 0), the R&S FPC automatically adjusts the frequency of the generated signal to the current measurement frequency. The number of frequency changes thus depends on the number of measurement points. |

#### 5.2.5.2 Tracking Generator Level

The Generator output level can be variated between 0dBm  -30dBm in 1 dB StepsPress the "Meas" key.

2. Select the "Source" menu item to open the signal source menu.

3. Select the "Level" menu item.

The R&S FPC opens an input field to define the level of the output signal.

### 5.2.6 Error Message during Boot Process

If the R&S FPC displays an error message during the boot process or the boot process does not finish successfully, the formatting of the user memory may help.

**NOTICE**

**Data loss**

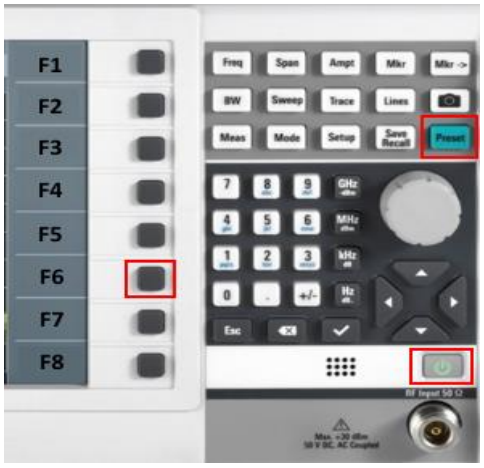
Formatting the user memory resets all user settings and deletes all user data.

#### 5.2.6.1 Formatting of User Memory

In some cases, it may become necessary to reset the instrument by formatting the user memory. This procedure deletes all user data and settings and restarts the Analyzer in the factory-preset mode.

Perform the factory reset as follows.

1. Press "Preset" and "F6" simultaneously.
2. Turn on the instrument.
3. Keep holding the "Preset" and "F6" keys until a grey screen becomes visible (about 30 s).
4. The process of resetting the device can take up to 5 minutes. Afterwards the instrument will reboot with default parameters.



## 5.3 Replacing Parts

### 5.3.1 Disassembling / Assembling the Device

#### 5.3.1.1 Removing the Rear Cover

**Figure 5-7: FPC Rear View**

To remove the rear cover, remove all screws marked above and pull off the rear cover.

#### 5.3.1.2 Mounting the Rear Cover

Place the rear cover over the base instrument and fasten the 7 screws that you have removed previously.

### 5.3.1.3 Separating / Mounting the Front Unit

Once you have removed the rear cover, you can split the base unit into two parts.

- The front unit with keyboard, front board and display.
- The mainboard with instrument main frame including the power supply.

To change any parts mounted to the main unit, it is necessary to separate the front unit from the instrument frame.

Parts mounted to the front unit:

- Key mat and front board, refer to 5.3.2.1.
- Display, refer to 5.3.2.2.
- N Connector, refer to 5.3.2.3.

**Separating the front unit**

To separate the front unit from the instrument frame, proceed as follows.

1. Remove the rear cover, refer to 5.3.1.1.
2. Remove the RF cable W400 on X100 at the mainboard.
3. Remove the RF cable W400 on X3300 at the mainboard (FPC1500 only).
4. Remove the control cable W600 from the mainboard on X2800.
5. Remove the display cable W500 from the mainboard on X2203.
6. Remove the 4 screws mounting the front unit to the instrument frame.

**Mounting front unit**

To assemble the front unit to the instrument frame, perform all tasks from 5.3.1.3 in reverse order.

### 5.3.2 Disassembling / Assembling Front Unit

Disassembling the front unit becomes necessary if you have to replace the following components:

- Front Board
- Key Mat
- Display

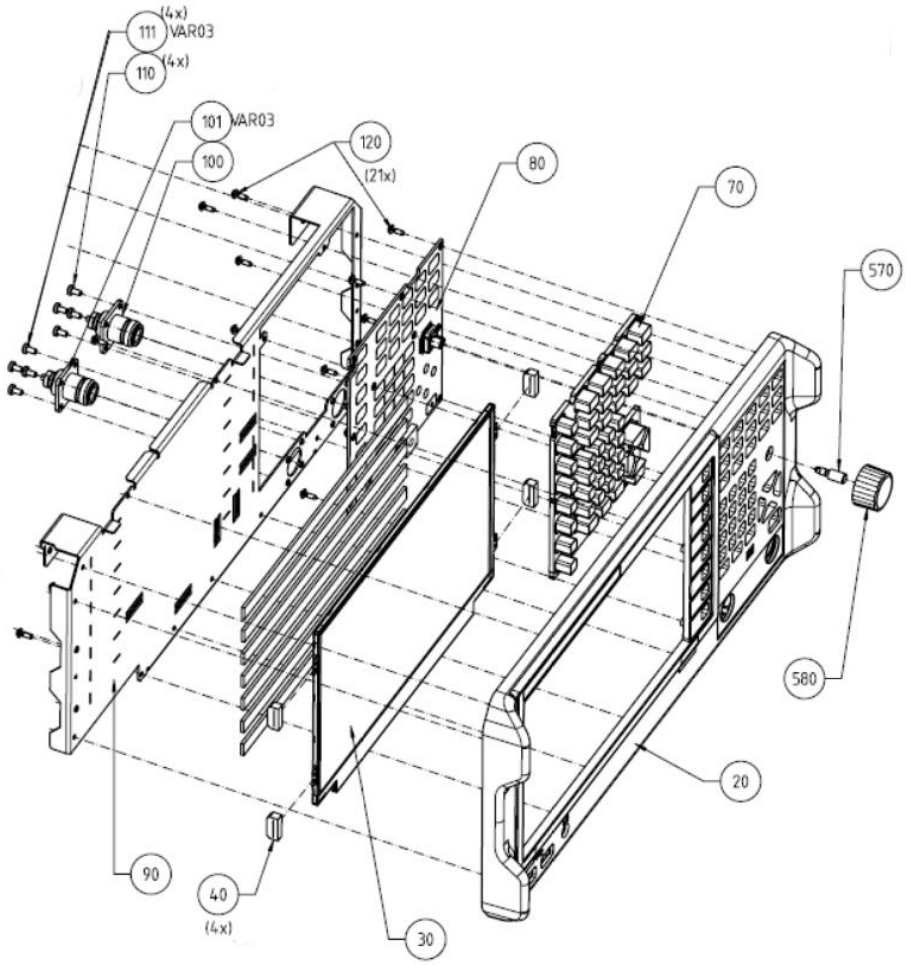



**Figure 5-8: Exploded front unit view**

### 5.3.2.1 Replacing Key Mat / Front Board

To replace the front board of the instrument, ensure the front unit is separated from the instrument frame (refer to 5.3.1.3). You can reassemble the front unit by following the steps in reverse order.

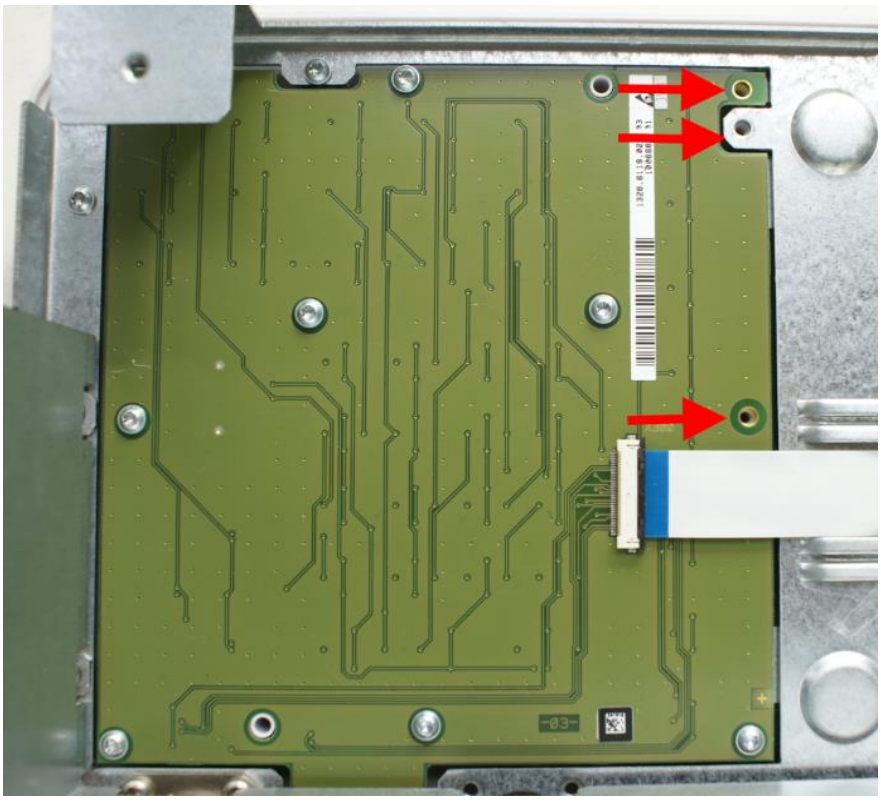
1. Remove Knob (Pos 580).
2. Remove W600 from front board connector X300.
3. Remove all screws (Pos120) mounting the front board to the front frame.
4. Now the front board can be removed (Pos 80) and replaced.

   a) Replacing the front board
   **Note:** In case a new front board is installed, the metal shaft (Pos 570) also has to be ordered and fit.

   b) Alternatively, at this stage the key mat might be replaced

**Mounting of Front**

To remount the front board to the front frame the 2 marked screws positions shall not be installed to avoid display marks.



### 5.3.2.2 Replacing Display

To replace the display of the instrument, ensure the front unit is separated from the instrument frame (refer to 5.3.1.3). You can reassemble the front unit by following the steps in reverse order.

1. Remove Knob (Pos 580).
2. Remove W600 from front board connector X300.
3. Remove all screws (Pos 120) mounting the front board to the front frame.
4. Remove the front board.
5. Remove all screws fixing the front frame to the front cover.
6. Lift the front frame.

Now you have access to replace the display.

#### Installing the display

To install the new display, the 4 rubber display holders (Pos 40) have to be changed from the old display or renewed.

**Note:** The mounting direction of the display holders have to be correct, refer to Figure 5-9.

**Figure 5-9: Display holder direction**

### 5.3.2.3 Replacing N Connector with Cable

The N Front connectors for the RF input as well as the Tracking Generator RF out can be changed if required. Both N connectors with cables are identical.

**NOTICE**

**Frequency correction necessary**

After replacing the N Connector with cable, a new frequency correction shall be performed, (refer to section 4.3).

To replace the N connector with cable, proceed as follows.

1. Remove rear cover, refer to section 5.3.1.1.
2. Remove cable W400 from input connector X100 an additional from X3300 (Generator out at FPC1500 only)
3. Remove each 4 screws (Pos 110) to replace the N connector.
4. Mount the N connector to the front frame by fastening the each 4 screws (Pos 110).
5. Connect the RF In cable W400 to X100 of the FPC Mainboard and cable 4000 to the X3300 of the FDPC Mainboard (FPC1500 only).
6. Mount the rear cover (refer to section 5.3.1.1).
7. Perform frequency correction programming (refer to section 4.3).

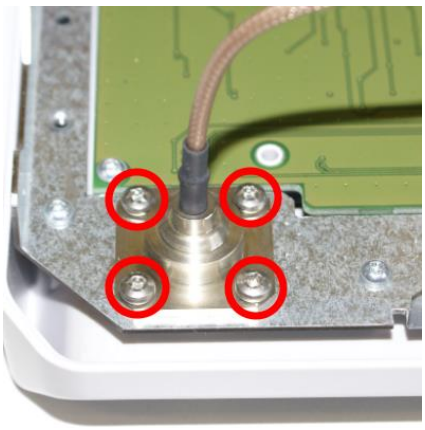


**Figure 5-10: Input connector replacement**

### 5.3.3 Replacing Power Supply

**CAUTION**

**Shock hazard**

Make sure to turn off the R&S FPC and disconnect it from the power supply before you open the housing.

Not doing so can result in physical harm (shock hazard).

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

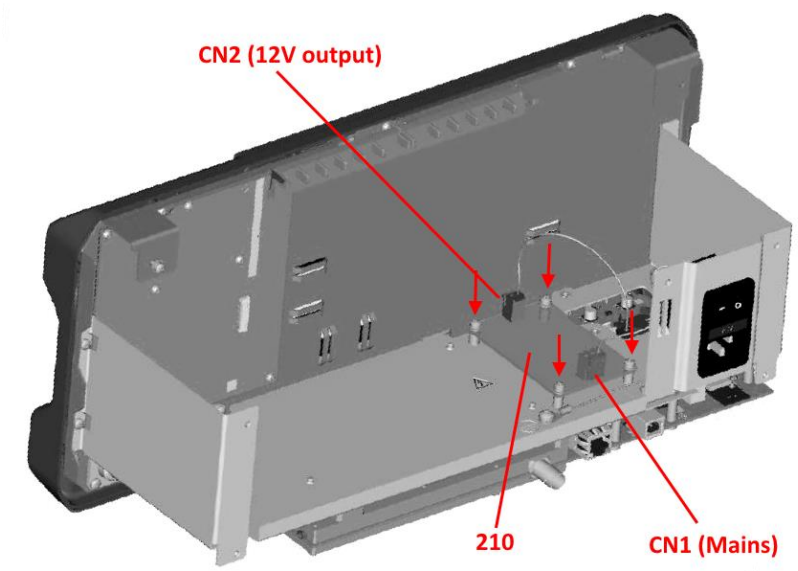



**Figure 5-11: Power supply**

**Removing the power supply**

1. Remove rear cover, refer to section 5.3.1.1.
2. Remove cable W100 from CN1.
3. Remove cable W200 from CN2.
4. Remove 4 screws fixing the power supply (210) to the instrument frame.

**Installing the power supply**

1. Mount the new power supply (210) with 4 screws to the instrument frame.
2. Connect cable W100 to CN1.
3. Connect cable W200 to CN2.
4. Complete the instrument refer to section 5.3.1.1.

### 5.3.4 Replacing Mainboard

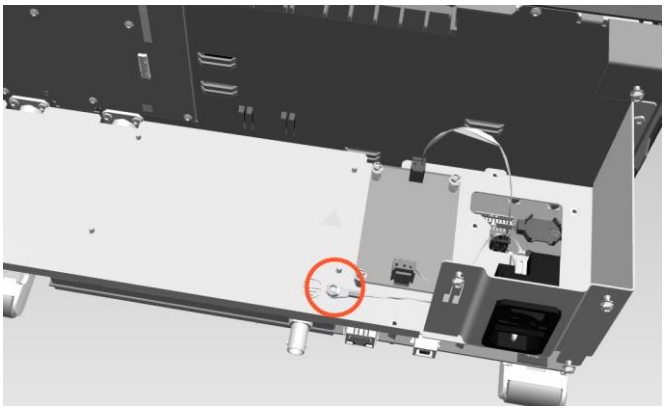
Replacing the Mainboard from the instrument, proceed as follows.

#### 5.3.4.1 Removing all cable connections

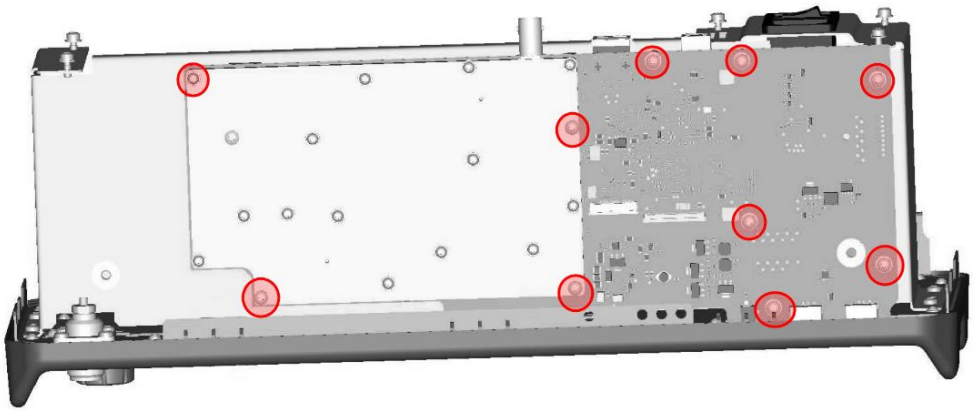
1. Remove the rear cover, refer to 5.3.1.1.
2. Remove cables W400 from input connector X100 and Generator out X3300 (FPC1500 only)
3. Remove Display cable W500.
4. Remove Front Board cable W600
5. Remove cable W100 from the power Supply

#### 5.3.4.2 Removing the Mainboard

1. Remove screw, fixed at the to side of the chassis, fixing the protective earth cable W300 from the chassis



2. Turn the Instrument to get access to the bottom side and remove all10 screws mounting the Mainboard to the instrument frame



### 5.3.5 Installing the new Mainboard

To install the new Mainboard all steps described in chapter Removing the Mainboard and Removing all cable connections shall performed in reverse order.

After the Mainboard replacement following actions have to performed in addition. For needed equipment and SW refer to chapter Adjustment.

- Recovery of the Device information
- Programming of the frequency correction
- Alignment of the reference oscillator
- Performing electrical safety test

**Device Recovery**

Programming of the device data has to be carried out after replacement of the base unit. The replacement unit is not working without recovering the original instrument identity.

**CAUTION**

**Performing electrical safety test**

After reassembling the instrument a electrical safety test of device is essential and shall be performed every time.

Note: In case the test fails check if the PE cable W300 is connected correctly!

### 5.3.5.1 Replacing Buffer Battery

**CAUTION**

**Shock hazard**

Make sure to turn off the R&S FPC and disconnect it from the power supply before you open the housing.

Not doing so can result in physical harm (shock hazard).

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

The Buffer Battery Pos 300 is placed on the mainboard and provides the backup voltage to operate the internal date and clock if no power is provided.

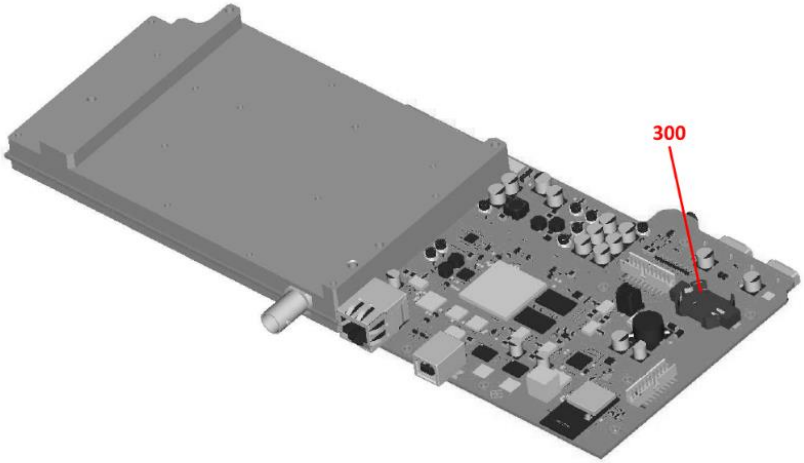



**Figure 5-12: Mainboard view**

To replace the backup battery (Pos300)

1. Remove rear cover, refer to section 5.3.1.1.
2. Now you have access via the cutaway beside power supply to change the battery.

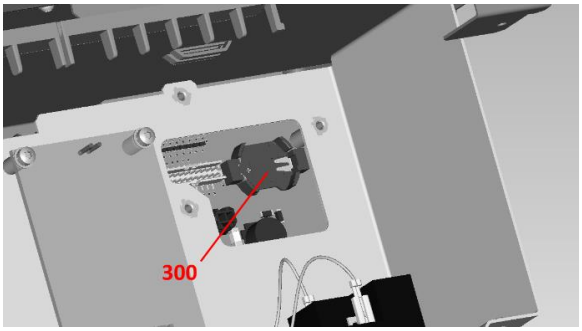



**Figure 5-13: View of battery cutout at main frame**

# 6 Firmware Update and Installing Options

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

## 6.1 Firmware Update

New firmware versions usually contain new features, improvements of existing functionality, bug fixes etc. When a new firmware version is available, it is recommended to replace the old firmware with the new one.

**Updating the firmware**

The latest firmware version is available for download on the internet:
http://www.rohde-schwarz.com/firmware/fpc

Before you update the firmware, you should make a backup of the data that you have stored on the R&S FPC Spectrum Analyzer (datasets, screenshots, transducer factors etc.). You can make a backup with the tools available in the R&S InstrumentView software package. The firmware update itself does not delete or modify that data, but it is recommended to perform a factory reset after the firmware update to update predefined limit lines, channel tables etc. The factory reset, however, does delete user data.

1. Download the firmware installer from the internet.

   The firmware comes in a single `.exe` file.

2. Save the file to the root directory of a memory stick.

3. Run the `.exe` file to unpack the self-extracting zip archive.

   The following files are extracted.

   ```
   FPC_<version>_bootloader.bin
   FPC_<version>_osimage.bin
   FPC_<version>_updater.bin
   FPC_<version>_xmegaloadfiles.bmp
   ```

   Make sure that only these files are present in the root directory of the memory stick.

4. Turn off the R&S FPC Spectrum Analyzer.

5. Connect the memory stick to one of the USB interfaces of the R&S FPC Spectrum Analyzer.

6. Press the "Preset" key and the number "8" key simultaneously.


7. Turn on the R&S FPC Spectrum Analyzer and keep pressing the two keys for at least 5 seconds after the startup screen appears.
8. Release the keys.

   The booting process continues. After a couple of seconds, the R&S FPC Spectrum Analyzer asks you if you really want to update the firmware.
9. Press the "Enter" ("✓") key to update the firmware.
   (You can cancel the firmware update with the "Esc" key.)

   The firmware update takes several minutes. While it is done, the R&S FPC Spectrum Analyzer shows a corresponding message.

   **Note**: Do not turn off the R&S FPC Spectrum Analyzer during the firmware update.
10. Turn off the R&S FPC Spectrum Analyzer.
11. Turn on the R&S FPC Spectrum Analyzer.

    The R&S FPC Spectrum Analyzer boots with the new firmware version.
12. Optional: It is recommended to perform a "back to factory defaults" after a firmware update to replace the predefined limit lines, channel tables and other data with the latest updates.

    **Note**: Before you start a factory reset, make sure to make a backup of your data that you have saved on the R&S FPC Spectrum Analyzer. Otherwise that data is deleted.

## 6.2 Enabling Firmware Options via Option Key Codes

You can equip the R&S FPC Spectrum Analyzer with optional functionality or firmware options like the analog demodulation application or the receiver application. These firmware options expand the functionality of the R&S FPC Spectrum Analyzer with new measurement functions settings etc.

**Installing firmware options**

To install a new firmware option, you have to enter a license key for validation.

The license key is included in the delivery of the firmware option.

1. Press the "Setup" key to enter the instrument setup menu.
2. Select the "Installed Options" menu item.
   The R&S FPC Spectrum Analyzer shows a list of all options that are currently installed on your R&S FPC Spectrum Analyzer.
3. Select the "Install Option" button and press the "Enter" key.
   The R&S FPC Spectrum Analyzer opens an input field.
4. Enter the license key with the alphanumeric keys and confirm the entry with the "Enter" key.

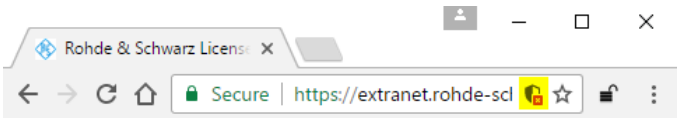
   The license key is a 32-digit number.

   The R&S FPC Spectrum Analyzer confirms a successful installation.
   If the R&S FPC Spectrum Analyzer shows an "Invalid Key Code" message, try to enter the license key again.

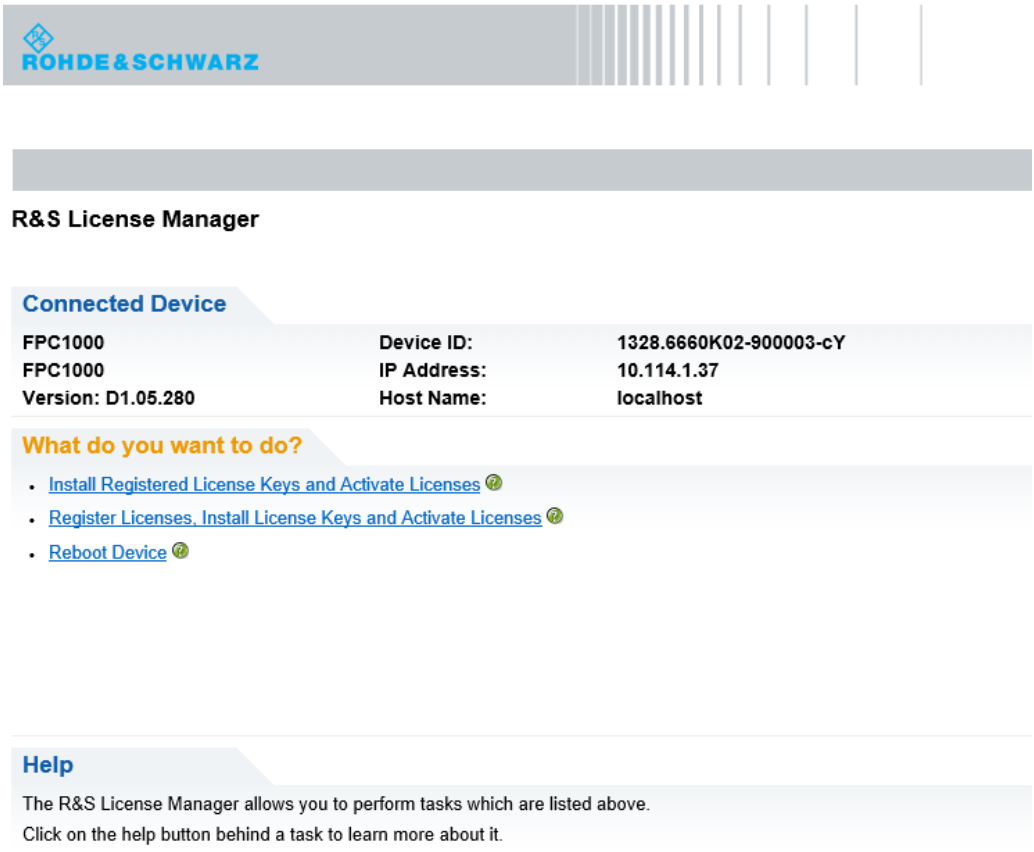
## 6.3 Enabling Firmware Options via the R&S License Manager

**Prerequisite**: Your PC must be connected via Ethernet to the R&S FPC Spectrum Analyzer and to the internet.

**Note**: Make sure to allow the execution of mixed-mode scripts, e.g. allow in Google Chrome the loading of scripts from unsafe sources.




1. Open your browser and type in the IP address of your the R&S FPC Spectrum Analyzer.




2. Select "License Manager" > "Manage Licenses".
3. Choose "Register Licenses, Install License Keys and Activate Licenses" and follow the instructions.

# 7 Documents

This chapter provides information on the ordering of spare parts and contains the spare part list and the documents for the complete R&S FPC unit.

## 7.1 Replacement Unit

The R&S FPC is a replacement unit.

In case of any major malfunctions or defects during the warranty period, the whole unit is replaced instead of being repaired. Any custom configuration (for example hardware or software options) is transferred to the new R&S FPC with the key code exchange process.

Customer data may get lost during this process.

| Item No: | Designation | Stock No. | Recommended Part |
|---|---|---|---|
| **10** | FPC1000 (Base Unit) | 1328.6660P01 | X |
| **20** | FPC1500 (Base Unit) | 1328.6660P11 | X |

## 7.2 Spare Parts

The stock numbers necessary for ordering replacement parts and modules can be found in the spare part list further down.

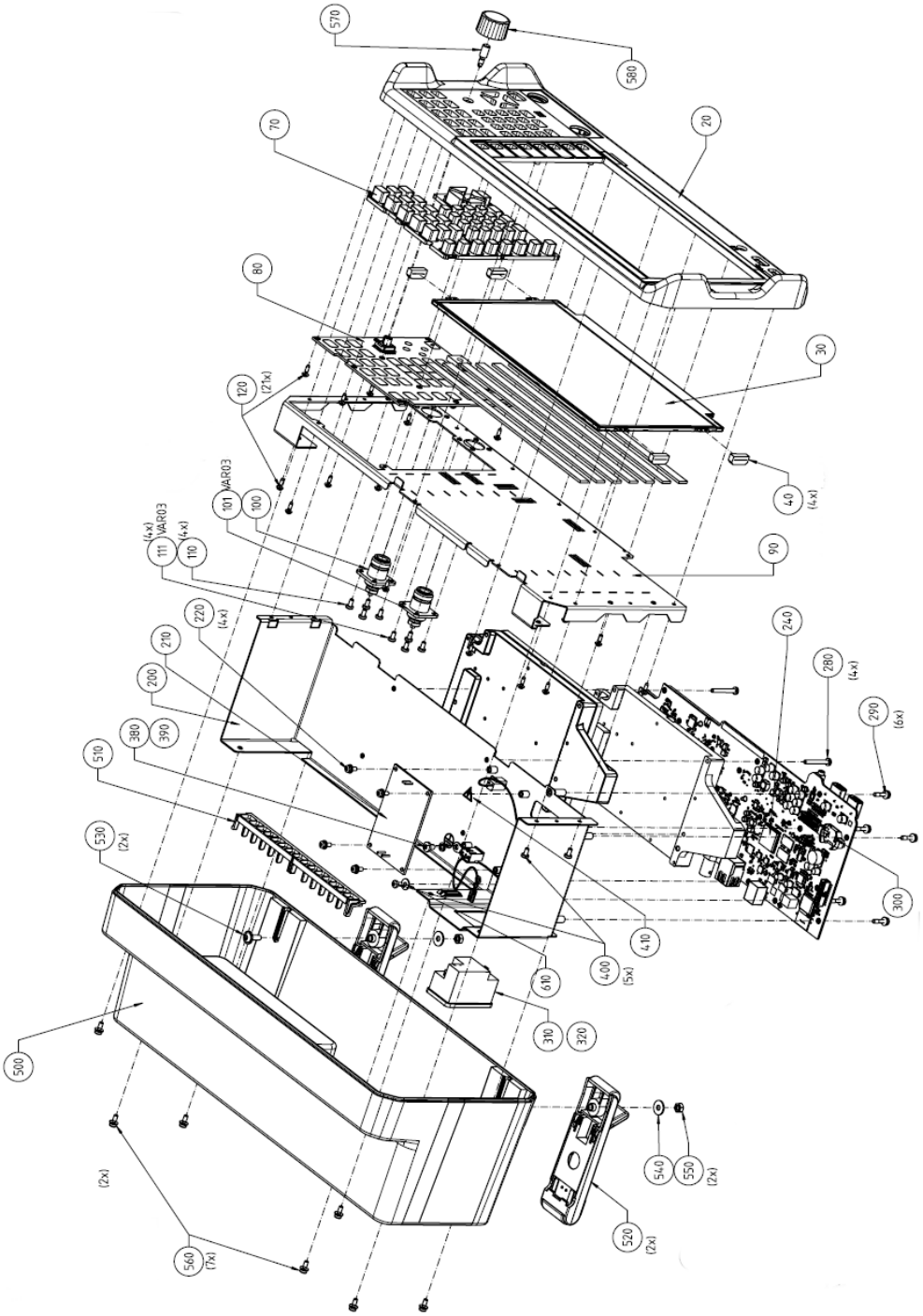
**NOTICE**

**Risk of damaging a module**

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

| Item No: | Designation | Stock No. | Recommended Part |
|---|---|---|---|
| **30** | TFT LIQUID CRYSTAL DISPLAY MODULE | 3592.8636.00 | |
| **40** | HOLDER DISPLAY | 1328.7038.00 | |
| **60** | DISPLAYCABLE | 1323.1431.00 | |
| **70** | SILCONE KEY PAD | 1328.6648.00 | |
| **80** | FRONTBOARD | 1328.6119.02 | |
| **100** | W400 N-CONNECTOR WITH CABLE | 1328.7167.00 | |
| **210** | POWER SUPPLY AC/DC 12V 25W | 3592.9161.00 | X |
| **230** | MAINBOARD FPC1000 | 1328.6131.03 | |
| **231** | MAINBOARD FPC1500 | 1328.6131.02 | |
| **300** | BATTERIES NON-RECHARGEABLE | 0858.2049.00 | |
| **320** | FUSE, 2A T | 0020.7546.00 | |
| **500** | REAR CASE | 1328.6631.00 | |
| **510** | STABILIZER GANYMEDES | 1328.7115.00 | |
| **520** | INSTRUMENT FOOT INCL. STAND | 5705.5873.00 | X |
| **570** | METAL SHAFT TYPE 30 6 X 10MM | 1329.6712.00 | |
| **580** | KNOB 25 | 1329.6770.00 | X |
| **590** | REAR LABEL FPC1000 | 1328.7015.00 | |

## 7.3 Mechanical drawings



## 7.4 Electrical Drawings