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ROHDE&SCHWARZ

Test and Measurement
Division

Service Manual Instrument

SPECTRUM ANALYZER

R&S® FSP3
1164.4391.03

R&S® FSP7
1164.4391.07

R&S® FSP13
1164.4391.13

R&S® FSP30
1164.4391.30/.39

R&S® FSP40
1164.4391.40

Printed in the Federal
Republic of Germany

Dear Customer,

throughout this operating manual, the abbreviation FSP is used for your Spectrum Analyzer R&S FSP.
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Trade names are trademarks of the owners

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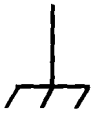
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Safety Instructions

This unit has been designed and tested in accordance with the EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards.

To maintain this condition and to ensure safe operation, the user must observe all instructions and warnings given in this operating manual.

Safety-related symbols used on equipment and documentation from R&S:

							
Observe operating instructions	Weight indication for units >18 kg	PE terminal	Ground terminal	Danger! Shock hazard	Warning! Hot surfaces	Ground	Attention! Electrostatic sensitive devices require special care

1. The unit may be used only in the operating conditions and positions specified by the manufacturer. Unless otherwise agreed, the following applies to R&S products:

   IP degree of protection 2X, pollution severity 2 overvoltage category 2, only for indoor use, altitude max. 2000 m.

   The unit may be operated only from supply networks fused with max. 16 A.

   Unless specified otherwise in the data sheet, a tolerance of ±10% shall apply to the nominal voltage and of ±5% to the nominal frequency.

2. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures should be taken to avoid any hazards.

   (using, for example, appropriate measuring equipment, fusing, current limiting, electrical separation, insulation).

3. If the unit is to be permanently wired, the PE terminal of the unit must first be connected to the PE conductor on site before any other connections are made. Installation and cabling of the unit to be performed only by qualified technical personnel.

4. For permanently installed units without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused such as to provide suitable protection for the users and equipment.

5. Prior to switching on the unit, it must be ensured that the nominal voltage set on the unit matches the nominal voltage of the AC supply network.

   If a different voltage is to be set, the power fuse of the unit may have to be changed accordingly.

6. Units of protection class I with disconnectible AC supply cable and appliance connector may be operated only from a power socket with earthing contact and with the PE conductor connected.

7. It is not permissible to interrupt the PE conductor intentionally, neither in the incoming cable nor on the unit itself as this may cause the unit to become electrically hazardous.

   Any extension lines or multiple socket outlets used must be checked for compliance with relevant safety standards at regular intervals.

8. If the unit has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device. In such cases it must be ensured that the power plug is easily reachable and accessible at all times (length of connecting cable approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply.

   If units without power switches are integrated in racks or systems, a disconnecting device must be provided at system level.

9. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.

   Prior to performing any work on the unit or opening the unit, the latter must be disconnected from the supply network.

   Any adjustments, replacements of parts, maintenance or repair may be carried out only by authorized R&S technical personnel.

   Only original parts may be used for replacing parts relevant to safety (eg power switches, power transformers, fuses). A safety test must be performed after each replacement of parts relevant to safety.

   (visual inspection, PE conductor test, insulation-resistance, leakage-current measurement, functional test).

continued overleaf

10. Ensure that the connections with information technology equipment comply with IEC950 / EN60950.
11. Lithium batteries must not be exposed to high temperatures or fire.

    Keep batteries away from children.

    If the battery is replaced improperly, there is danger of explosion. Only replace the battery by R&S type (see spare part list).

    Lithium batteries are suitable for environmentally-friendly disposal or specialized recycling. Dispose them into appropriate containers, only.

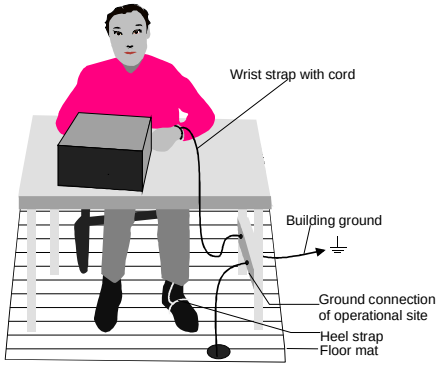
    Do not short-circuit the battery.
12. Equipment returned or sent in for repair must be packed in the original packing or in packing with electrostatic and mechanical protection.
13. Electrostatics via the connectors may damage the equipment. For the safe handling and operation of the equipment, appropriate measures against electrostatics should be implemented.
14. The outside of the instrument is suitably cleaned using a soft, lint-free dustcloth. Never use solvents such as thinners, acetone and similar things, as they may damage the front panel labeling or plastic parts.
15. Any additional safety instructions given in this manual are also to be observed.

Safety Instructions

The instrument contains components which are hazardous to electrostatic exposure and which are marked by the following symbol:



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

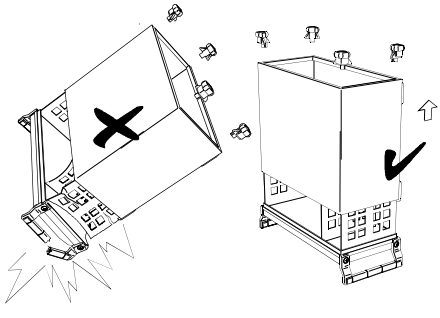


The following two methods of ESD protection may be used together or separately:

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

The batteries used in the instrument are high-power lithium cells with a life utility of approx. 5 years. If you do not handle them properly, there is a danger of explosion. Therefore, observe the following safety instructions:

- Avoid short-circuit and loading of the battery
- Do not expose lithium batteries to high temperature or fire.
- Do not open used batteries
- Keep batteries away from children.
- Replace battery only by R&S type battery (R&S ordering number 0565.1687.00)
- Make sure to connect the battery to the appropriate terminals when replacing
- Lithium batteries are suitable for environmentally-friendly disposal or specialized recycling. Dispose them into appropriate containers, only.



- *Put the instrument on the front handles before loosing the rear feet and the tube to avoid damage of the instrument.*
- *When mounting the tube take care not to damage or pull off cables.*

Spare Parts Express Service

Phone: **+49 89 4129 - 12465**

Fax: **+49 89 4129 - 13306**

E-mail:werner.breidling@rsd.rohde-schwarz.com

In case of urgent spare parts requirements for this Rohde & Schwarz unit, please contact our spare parts express service.

Outside business hours, please leave us a message or send a fax or e-mail. We shall contact you promptly.

Contents of Manuals for Spectrum Analyzer FSP

Service Manual - Instrument

The service manual - instrument informs on how to check compliance with rated specifications, on instrument function, repair, troubleshooting and fault elimination. It contains all information required for repairing the FSP by the replacement of modules.

The service manual comprises four chapters and an annex (chapter 5) containing the FSP circuit documentation:

Chapter 1 provides all the information necessary to check FSP for compliance with rated specifications. The required test equipment is included, too.

Chapter 2 describes the manual adjustment of the calibration source and of the frequency accuracy as well as the automatic adjustment of individual module data following module replacement.

Chapter 3 describes the design of FSP as well as simple measures for repair and fault diagnosis, in particular, the replacement of modules.

Chapter 4 contains information on the extension and modification of FSP by installing instrument software and retrofitting options.

Chapter 5 describes the shipping of the instrument and ordering of spare parts and contains spare parts lists and exploded views of FSP.

Operating Manual

In the operating manual for FSP you will find information about the technical specifications of FSP, the controls and connectors on the front and rear panel, necessary steps for putting the instrument into operation, the basic operating concept, manual and remote control.

For introduction typical measurement tasks are explained in detail using the functions of the user interface and program examples.

The operating manual further provides hints on preventive maintenance and fault diagnosis by means of warnings and error messages output by the unit.

Service and Repair

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

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

We require the following information in order to answer your inquiry fast and correctly and to decide whether the warranty still applies for your instrument:

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

Rohde & Schwarz offers the following calibrations:

- Calibration on R&S-type test systems. The calibration documentation meets the requirements of the quality management system ISO 9000.
- Calibration at an R&S calibration center approved by the German Calibration Service (DKD). The calibration documentation consists of the DKD calibration certificate.

Refer to Chapter 5 for a detailed description on shipping of the instrument and ordering of spare parts.

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1 Performance Test

Test Instructions

- The rated specifications of the analyzer are tested after a warm-up time of at least 15 minutes and overall calibration. Only in this case can compliance with the specified data be ensured. Start of overall adjustment: [***CAL** : CAL TOTAL*]
- Unless specified otherwise, all measurements will be performed with external reference frequency.
- Values specified in the following sections are not ensured. Only the technical specifications of the data sheet are binding.
- The values specified in the data sheet are the ensured limits. Due to measurement errors, these limits must be extended by the tolerance of the measurement equipment used in this performance test.
- Inputs for settings during measurements are shown as follows:

  [**<KEY>**] Press a key on the front panel, e.g. **[SPAN]** .

  [<SOFTKEY>] Press a softkey, e.g. [MARKER -> PEAK].

  [<**nn unit**>] Enter a value and terminate by entering the unit, e.g. [**12 kHz**] .

  Successive entries are separated by [:], e.g. [**BW** : RES BW MANUAL : **3 kHz**] .

Measurement Equipment and Accessories

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S Order No.	Use
1	Frequency counter	Accuracy < $1x10^{-9}$, Frequency range up to 10 MHz	Advantest R5361B with option 23		Frequency accuracy of reference oscillator
2	Signal generator	FSP 3: 10 MHz to 10 GHz FSP 7: 10 MHz to 10 GHz FSP 13: 10 MHz to 13.6 GHz FSP 30: 10 MHz to 30 GHz FSP 40: 1 MHz to 40 GHz	SMP02 SMP02 SMP02 SMP04 SMP04	1035.5005.02 1035.5005.02 1035.5005.02 1035.5005.04 1035.5005.04	Immunity to interference Third order intercept Frequency response
3	Signal generator	Phase noise at 498 MHz: < -100 dBc/Hz @ 100 Hz < -115 dBc/Hz @ 1 kHz < -127 dBc/Hz @ 10 kHz < -130 dBc/Hz @ 100 kHz < -142 dBc/Hz @ 1 MHz	SMHU	0835.8011.52	Calibration source 128 MHz 2nd order harmonic dist. Third order intercept IF filters Frequency response Display linearity RF attenuator Reference level switching Phase noise RF trigger
4	Signal generator	FSP 07: 10 MHz to 7 GHz FSP 13: 10 MHz to 13.6 GHz FSP 30: 10 MHz to 30 GHz	SMP02 SMP02 SMP04 SMP04	1035.5005.02	Third order intercept 1035.5005.02 1035.5005.04 1035.5005.04

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S Order No.	Use
5	3 dB coupler (power combiner)	Decoupling > 12 dB FSP 03: 10 MHz to 3 GHz FSP 07: 10 MHz to 7 GHz FSP 13: 10 MHz to 13.6 GHz FSP 30: 10 MHz to 30 GHz FSP 40: 10 MHz to 40 GHz			Third order intercept
6	6 dB divider (power divider)	Level imbalance 1 MHz to 1 GHz ≤ 0.1 dB 1 GHz to 7 GHz ≤ 0.2 dB 7 GHz to 13.6 GHz ≤ 0.3 dB 13.6 GHz to 40 GHz ≤ 0.4 dB FSP 03: 10 MHz to 3 GHz FSP 07: 10 MHz to 7 GHz FSP 13: 10 MHz to 13.6 GHz FSP 30: 10 MHz to 30 GHz FSP 40: 10 MHz to 40 GHz			Frequency response
7	50 Ω termination	FSP 03: to 3 GHz FSP 07: to 7 GHz FSP 13: to 13.6 GHz FSP 30: to 30 GHz FSP 40: to 40 GHz	RNA RNA Wiltron 28S50 Wiltron 28K50 Wiltron 28K50	0272.4510.50 0272.4510.50	Noise display
8	Power meter		NRVD	0857.8008.02	Frequency response
9	Power sensor	1 MHz to 3 GHz RSS ≤ 0.8% Meter noise ≤ 20 pW	NRV-Z4	0828.3618.02	Frequency response
10	Power sensor	RSS referenced to indic. power: 1 MHz to 1 GHz ≤1.5 % 1 GHz to 7 GHz ≤2 % 7 GHz to 13.6 GHz ≤3.5 % 13.6 GHz to 30 GHz ≤ 4 % FSP 03: 10 MHz to 3 GHz FSP 07: 10 MHz to 7 GHz FSP 13: 10 MHz to 13.6 GHz FSP 30: 10 MHz to 30 GHz FSP 40: 10 MHz to 40 GHz	 NRV-Z4 NRV-Z2 NRV-Z2 NRV-Z55' NRV-Z55	 0828.3218.02 0828.3218.02 0828.3218.02 1081.2005.02 1081.2005.02	Frequency response
11	Step attenuator	Variable attenuation 0 dB to 100 dB, 1 dB steps Attenuation accuracy < 0.1 dB (f = 128 MHz)	RSP	0831.3515.02	Reference level switching display linearity RF attenuator
12	Attenuator (2 x)	Fixed attenuation 10 dB FSP 03: 10 MHz to 3 GHz FSP 07: 10 MHz to 7 GHz FSP 13: 10 MHz to 13.6 GHz FSP 30: 10 MHz to 30 GHz FSP 40: 10 MHz to 40 GHz	 DNF DNF Wiltron 43KB-10 Wiltron 43KC-10 Wiltron 43KC-10	 0272.4210.50 0272.4210.50	Third order intercept
14	N cable	Attenuation < 0.2 dB to 3 GHz			TG output level
15	Spectrum analyzer	Frequency range to 3 GHz	FSP 3	1093.4495.03	TG modulation
16	Arbitrary waveform generator	Frequency range to 10 MHz 2 sinusoidal signals with 90 deg. phase difference	ADS		TG modulation
17	Voltmeter	DC and AC voltages	URE		TG modulation
18	TV signal source				Checking the TV trigger

Performance Test FSP

Checking Reference Frequency Accuracy

Test equipment: Frequency counter (refer to "Measurement Equipment", item 1):
Accuracy < $1x10^{-9}$
Frequency range up to 10 MHz

Test setup:
- Connect frequency counter to 10 MHz reference output of the FSP (rear panel).

FSP settings:
- [**SETUP** : REFERENCE INT / EXT]
- Toggle to internal reference (INT).

Measurement:
- Measure frequency with frequency counter.

Nominal frequency:
Model without OCXO (option FSP-B4).....10 MHz ± 10 Hz
.. Model with OCXO (option FSP-B4) .....10 MHz ± 1 Hz

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

Checking Immunity to Interference

Test equipment: Signal generator (refer to "Measurement Equipment", item 2):

Frequency range	FSP 3:	10 MHz to 10 GHz
	FSP 7:	10 MHz to 10 GHz
	FSP 13:	10 MHz to 13.6 GHz
	FSP 30:	10 MHz to 30 GHz
	FSP 40:	10 MHz to 40 GHz
Maximum level		≥ -10 dBm

Test setup:
- Connect RF output of the signal generator to RF input.

Signal generator settings:
Level: Adjust the output level of signal generator for an RF input level of -10 dBm.

FSP settings:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**AMPT** : REF LEVEL : **-30 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **3 kHz**]

1st IF Image Frequency Rejection

Additional signal generator settings: - Frequency f_{in} + 6952.8 MHz

Additional FSP settings: - [**FREQ** : CENTER : {f_{in}}]

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

Measurement: ➢ Set marker to peak of signal:
[**MKR** ⇒ : PEAK]

Evaluation: The image frequency rejection is the difference between the output level of the signal generator and the level reading of marker 1 (L_{dis}):

Image frequency rejection = -10 dBm – L_{dis}

2nd IF Image Frequency Rejection

Additional signal generator settings: - Frequency f_{in} + 808.8 MHz

Additional FSP settings: - [**FREQ** : CENTER : {f_{in}}]

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

Measurement: ➢ Set marker to peak of signal:
[**MKR** ⇒ : PEAK]

Evaluation: The image frequency rejection is the difference between the output level of the signal generator and the level reading of marker 1 (L_{dis}):

Image frequency rejection = –10 dBm – L_{dis}

3rd IF Image Frequency Rejection

Additional signal generator settings: - Frequency f_{in} + 40.8 MHz

Additional FSP settings: - [**FREQ** : CENTER : {f_{in}}]

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

Measurement: ➢ Set marker to peak of signal:
[**MKR** ⇒ : PEAK]

Evaluation: The image frequency rejection is the difference between the output level of the signal generator and the level reading of marker 1 (L_{dis}):

Image frequency rejection = –10 dBm – L_{dis}

1st IF Rejection

Additional signal generator settings: - Frequency 3476.4 MHz

Additional FSP settings: - [**FREQ** : CENTER : {f_{in}}]

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

Measurement: ➢ Set marker to peak of signal:
- [**MKR** ⇒ : PEAK]

Evaluation: The IF rejection is the difference between the output level of the signal generator and the level reading of marker 1 (L_{dis}):

IF rejection = –10 dBm – L_{dis}

2nd IF Rejection

Additional signal generator settings: - Frequency 404.4 MHz

Additional FSP settings: - [**FREQ** : CENTER : {f_{in}}]

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

Measurement: ➢ Set marker to peak of signal:
- [**MKR** ⇒ : PEAK]

Evaluation: The IF rejection is the difference between the output level of the signal generator and the level reading of marker 1 (L_{dis}):

IF rejection = –10 dBm – L_{dis}

Checking Nonlinearities

Third Order Intercept Point

Test equipment:

- 2 signal generators
  FSP 3: Refer to "Measurement Equipment", items 2 & 3.
  FSP 7/13/30/40: Refer to "Measurement Equipment", items 2 & 4.
  Frequency range:
  FSP 3: 10 MHz to 3 GHz
  FSP 7: 10 MHz to 7 GHz
  FSP 13: 10 MHz to 13.6 GHz
  FSP 30: 10 MHz to 30 GHz
  FSP 40: 10 MHz to 40 GHz
  Maximum level ≥ 0 dBm

- 2 attenuators (refer to "Measurement Equipment", item 12)
  Attenuation a_{ATT} = 10 dB
  Frequency range
  FSP 3: 10 MHz to 3 GHz
  FSP 7: 10 MHz to 7 GHz
  FSP 13: 10 MHz to 13.6 GHz
  FSP 30: 10 MHz to 30 GHz
  FSP 40: 10 MHz to 40 GHz

- 3 dB coupler (refer to "Measurement Equipment", item 5)
  Frequency range
  FSP 3: 10 MHz to 3 GHz
  FSP 7: 10 MHz to 7 GHz
  FSP 13: 10 MHz to 13.6 GHz
  FSP 30: 10 MHz to 30 GHz
  FSP 40: 10 MHz to 40 GHz
  Decoupling > 12 dB

Test setup:

- Connect RF outputs of the signal generators via 10 dB attenuators to the inputs of the 3 dB coupler.
- Connect output of the 3 dB coupler to RF input of the FSP.

Signal generator settings (both generators):

- Frequency: Generator 1 $f_{g1} = f_{in} - 50$ kHz
  Generator 2 $f_{g2} = f_{in} + 50$ kHz

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

- Adjust the output level of signal generators for an input level at the FSP of -20 dBm.

FSP settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**AMPT** : **-10 dBm**]
- [**SPAN** : **500 kHz**]
- [**BW** : RES BW MANUAL : **3 kHz**]
- [**FREQ** : CENTER : {f_{in}}]

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

Measurement:

- [**MKR FCTN** : TOI]

Evaluation:

The third order intercept point (TOI) referenced to the input signal is displayed in the marker field by the reading [TOI].

Checking IF Filters

Test equipment: Signal generator (refer to "Measurement Equipment", item 3):
Frequency 128 MHz
Level ≥ 0 dBm

Test setup: ➢ Connect RF output of the signal generator to RF input of the FSP.

Checking Bandwidth Switching Level Accuracy

Reference measurement (RBW 10 kHz)

Signal generator settings:
- Frequency: 128 MHz
- Level: -30 dBm

FSP settings:
- [**PRESET**]
- [**AMPT** : **-20 dBm**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **5 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**BW** : RBW MANUAL : **10** : **kHz**]

Reference measurement:
➢ Set marker to peak of signal:
- [**MKR** ⇒ : PEAK]

➢ Set reference to peak of signal:
- [**MKR** : REFERENCE FIXED]

Checking level accuracy

FSP settings:
- [**SPAN** : {0.5 x RBW}]
- [**BW** : RBW MANUAL : {RBW} : **ENTER**]

Note: *To check the FFT filter, the resolution bandwidth has to be set manually to FFT mode.*

-[**BW** : BW MODE : FFT]

Measurement:
➢ Set marker to peak of signal:
- [**MKR** ⇒ : PEAK]

Evaluation: The level difference is displayed in the marker field by the reading ´Delta [T1 FXD] {xxx} dB´.

Checking Bandwidth

Signal generator settings:
- Frequency: 128 MHz
- Level: -10 dBm

FSP settings:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**FREQ** : CENTER : **128 MHz**]
- [**BW** : COUPLING RATIO : SPAN/RBW MANUAL : **3** : **ENTER**]

➢ Determine 3 dB bandwidth:
- [**MKR FCTN** : N DB DOWN : **3 dB**]
- [**SPAN** : {3 x RBW}]

Refer to "Performance Test Report" table for values of RBW.

Note: *To check the 10 MHz filter, the resolution bandwidth has to be set manually to 10 MHz. All other bandwidths will be set automatically by changing the span.*

-[**BW** : RES BW MANUAL : **10 MHz**]

Measurement:
- [**MKR** ⇒ : PEAK]

The 3 dB bandwidth is displayed by the reading ´BW {bandwidth}´.

Checking Shape Factor

Note: *To check the shape factor, you need to know the values of the 3 dB bandwidth . Please check these values before performing this measurement.*

Signal generator settings:
- Frequency: 128 MHz
- Level: 0 dBm

FSP settings:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**FREQ** : CENTER : **128 MHz**]
- [**BW** : COUPLING RATIO : SPAN/RBW MANUAL : **20 ENTER**]
- [**BW** : COUPLING RATIO : RBW/VBW NOISE [10]]
- [**MKR FCTN** : N DB DOWN : **60 dB**]
- [**SPAN** : {20 x RBW}]

Refer to "Performance Test Report" table for values of RBW.

Note: *To check the 10 MHz filter, the resolution bandwidth has to be set manually to 10 MHz. All other bandwidths will be set automatically by changing the span.*

-[**BW** : RES BW MANUAL : **10 MHz**]

Measurement:
- [**MKR** ⇒ : PEAK]

The 60 dB bandwidth is displayed by the reading ´BW {bandwidth}´.

Evaluation: The shape factor is calculated by BW (60 dB) / BW (3 dB).

Checking Noise Display

Test equipment: 50 Ω termination (refer to "Measurement Equipment", item 7)

Frequency range		
	FSP 3:	to 3 GHz
	FSP 7:	to 7 GHz
	FSP 13:	to 13.6 GHz
	FSP 30:	to 30 GHz
	FSP 40:	to 40 GHz

Test setup:

➢ Terminate the RF input of the FSP with 50 Ω.

FSP settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**SPAN** : **0 Hz**]
- [**BW**: RES BW MANUAL : **10 Hz**]
- [**BW** : VIDEO BW MANUAL : **1 Hz**]
- [**BW** : SWEEP TIME MANUAL : **0.1 s**]
- [**TRACE 1** : AVERAGE]
- [**TRACE 1** : SWEEP COUNT : **30 ENTER**]
- [**AMPT** : {RefLev}]
- [**FREQ** : CENTER : {f_n}]

Refer to table below for values of RefLev.

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

Measurement:

➢ Set marker to peak:

- [**MKR** ⇒ : PEAK]

Evaluation: The noise level is displayed by the level reading of marker 1.

Frequency	< 10 kHz	< 100 kHz	< 1 MHz	< 10 MHz	> 10 kHz
RefLev	-10 dBm	-20 dBm	-30 dBm	-60 dBm	-60 dBm

Checking Level Accuracy and Frequency Response

Test equipment:

- Signal generator:

  FSP 3: Refer to "Measurement Equipment", item 3.
  FSP 7/13/30: Refer to "Measurement Equipment", items 3 & 4.

Frequency range	FSP 3:	1 MHz to 3 GHz
	FSP 7:	1 MHz to 7 GHz
	FSP 13:	1 MHz to 13.6 GHz
	FSP 30:	1 MHz to 30 GHz
	FSP 40:	1 MHz to 40 GHz
Maximum level	≥ 0 dBm	

- Power meter (refer to "Measurement Equipment", item 8)

- Power sensor:

  FSP 3: Refer to "Measurement Equipment", item 9.
  FSP 7/13/30: Refer to "Measurement Equipment", items 9 & 10.

Frequency range	FSP 3:	1 MHz to 3 GHz
	FSP 7:	1 MHz to 7 GHz
	FSP 13:	1 MHz to 13.6 GHz
	FSP 30:	1 MHz to 30 GHz
	FSP 40:	1 MHz to 40 GHz

  Maximum power $P_{max} \geq 100\ \mu W$

  RSS referenced to indicated power

1 MHz to 1 GHz	≤ 1.5 %
1 GHz to 7 GHz	≤ 2 %
7 GHz to 13.6 GHz	≤ 3.5 %
13.6 GHz to 40 GHz	≤ 4 %

  Impedance Z = 50 Ω

- 6 dB divider (refer to "Measurement Equipment", item 6)

Frequency range	FSP 3:	1 MHz to 3 GHz
	FSP 7:	1 MHz to 7 GHz
	FSP 13:	1 MHz to 13.6 GHz
	FSP 30:	1 MHz to 30 GHz
	FSP 40:	1 MHz to 40 GHz
Level imbalance[1])	1 MHz to 1 GHz	≤ 0.1 dB
	1 GHz to 7 GHz	≤ 0.2 dB
	7 GHz to 13.6 GHz	≤ 0.3 dB
	13 GHz to 40 GHz	≤ 0.4 dB

  [1]) If a power divider with higher level imbalance is used, correction of the measured frequency response is recommended.

Determining the level accuracy at 128 MHz

Test setup:

- Connect power sensor (item 9) to the power meter and execute function ´ZERO´ when there is no signal applied to the power sensor.
- Connect power sensor to RF output of signal generator.

Signal generator settings:

- Frequency 128 MHz
- Level -30 dBm

Measurement:

- Determine output power of the signal generator with the power meter.
- Connect RF output of the signal generator to RF input of the FSP.

FSP settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-20 dBm**]
- [**SPAN** : **30 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

- Set marker to peak of signal:
- [**MKR** ⇒ : PEAK]

Evaluation:

The difference between the signal levels measured with the power meter and the FSP (level reading of marker 1) reflects the absolute level accuracy of the FSP. It can be calculated as follows:

$$\text{Level accuracy}_{128MHz} = L_{FSP} - L_{powermeter}$$

Checking frequency response

Test setup:
- ➢ Connect RF output of signal generator to input of divider.
- ➢ Connect output 1 of divider to power sensor / power meter.
- ➢ Connect output 2 of divider to RF input of the FSP.

Signal generator settings:
- Level 0 dBm
- Frequency 128 MHz

FSP settings:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

Reference measurement:
- ➢ Determine signal level $L_{powermeter}$.
- ➢ Set marker to peak of signal:
- [**MKR ⇒** : PEAK]

The signal level L_{FSP} is displayed by the level reading of marker 1.

$$Ref_{128MHz} = L_{FSP} - L_{powermeter}$$

Measurement

Signal generator settings:
- Frequency f_{fresp}

Refer to "Performance Test Report" table for values of f_{fresp}.

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

FSP settings:
- [**FREQ** : CENTER : {f_{fresp}}]

Refer to "Performance Test Report" table for values of f_{fresp}.

- ➢ - Set marker to peak of signal:
- [**MKR ⇒** : PEAK]

The signal level L_{FSP} is displayed by the level reading of marker 1.

Evaluation:
The frequency response can be calculated as follows:

$$\text{Frequency response} = L_{FSP} - L_{powermeter} - Ref_{128\ MHz}$$

Checking Display Linearity

Test equipment:

- Signal generator (refer to "Measurement Equipment", item 3)
  Frequency 128 MHz
  Maximum level ≥ 10 dBm
- Step attenuator (refer to "Measurement Equipment", item 11)
  Frequency 128 MHz
  Attenuation 0 to 100 dB in 1 dB steps
  Attenuation accuracy < 0.1 dB

Test setup:

- Connect RF output of the signal generator to RF input of the step attenuator.
- Connect RF output of the step attenuator to RF input of the FSP.

Signal generator settings:

- Frequency 128 MHz
- Level +10 dBm

Step attenuator settings: Attenuation 20 dB

FSP settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**FREQ** :CENTER : **128 MHz**]
- [**SPAN** : **0 Hz**]
- [**TRACE** : DETECTOR : RMS]

1st measurement:
- [**BW** : RES BW MANUAL : **300 Hz**]

2nd measurement:
- [**BW** : RES BW MANUAL : **300 kHz**]

Reference measurement:

- Set marker to peak of signal:
- [**MKR** ⇒ : PEAK]
- Set reference to peak of signal:
- [**MKR** : REFERENCE FIXED]

Measurement

Step attenuator settings: Attenuation $\{a_{ATT}\}$

Refer to "Performance Test Report" table for values of a_{ATT}.

Evaluation: The difference between the level of the input signal of the FSP and the reference (about 10 dB below the reference level) is displayed in the marker field by the reading ´Delta [T1 FXD]´.

Alternative measurement

FSP settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **0 Hz**]
- [**TRACE** : DETECTOR : AV]

- [**SWEEP**: SWEEP TIME MANUAL: **xx ms**]

Depending on the attenuation a_{ATT} of the step attenuator, the sweep time is set as follows:

a_{ATT}	Sweep time xx
$a_{ATT} \leq 50$ dB	200 ms
50 dB < $a_{ATT} \leq 70$ dB	600 ms
$a_{ATT} > 70$ dB	2000 ms

[**MEAS**: TIME DOM POWER: MEAN]

Note: The trace averaged across all test points is used for better averaging of the test results.

1st measurement:
- [**BW** : RES BW MANUAL : **300 Hz**]

2nd measurement:
- [**BW** : RES BW MANUAL : **300 kHz**]

Reference measurement:

Read the test result for the reference measurement (mean value in the marker output field).

Use the measured mean value as the reference:

➢ [**MEAS** : TIME DOM POWER: {right side menu}: Power Rel Set Reference]

Measurement

Step attenuator settings: Attenuation {a_{ATT}}

Refer to "Performance Test Report" table for values of a_{ATT}.

Evaluation: The difference between the level of the input signal of the FSP and the reference (approx. 10 dB below the reference level) is displayed in the marker field by the reading ´Power [T1]´.

Checking RF Attenuator

Test equipment:

- Signal generator (refer to "Measurement Equipment", item 3)
  Frequency 128 MHz
  Maximum level ≥ 0 dBm

- Step attenuator (refer to "Measurement Equipment", item 11)
  Frequency 128 MHz
  Attenuation 0 to 80 dB in 10 dB steps
  Attenuation accuracy < 0.1 dB

Test setup:

- ➢ Connect RF output of the signal generator to RF input of the step attenuator.
- ➢ Connect RF output of the step attenuator to RF input of the FSP.

Signal generator settings:

- Frequency 128 MHz
- Level 0 dBm

Step attenuator settings: Attenuation 70 dB

FSP settings:

- [**PRESET**]
- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **500 Hz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**BW** : VIDEO BW MANUAL : **100 Hz**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-30 dBm**]

Reference measurement:

- ➢ Set marker to peak of signal:
- [**MKR** ⇒ : PEAK]

- ➢ Set reference to peak of signal:
- [**MKR** : REFERENCE FIXED]

Measurement

Step attenuator settings: Attenuation { 80 dB - a_{FSP} }
Refer to table below for values of a_{ATT}.

FSP settings:

- [**AMPT** : RF ATTEN MANUAL : { a_{FSP} }]
- [**AMPT** : {-40 dBm + a_{FSP} } **dBm**]
- [**MKR** ⇒ : PEAK]

Refer to table below for values of a_{FSP} , a_{ATT} and reference level.

Evaluation: The difference between the level of the input signal of the FSP and the reference (at 10 dB RF attenuation) is displayed in the marker field by the reading ´Delta [T1 FXD]´.

a_{ATT}	80 dB	70 dB	60 dB	50 dB	40 dB	30 dB	20 dB	10 dB
a_{FSP}	0 dB	10 dB	20 dB	30 dB	40 dB	50 dB	60 dB	70 dB
Reference level	-40 dBm	-30 dBm	-20 dBm	-10 dBm	0 dBm	+10 dBm	+20 dBm	+30 dBm

Checking Reference Level Switching (IF Gain)

Test principle:

The IF gain of the FSP can be switched from 0 to 50 dB by changing the reference level at fixed RF attenuation. To prevent the IF gain accuracy from being confused with the log amplifier accuracy, it is determined by comparison using an external precision attenuator.

Test equipment:

- Signal generator (refer to "Measurement Equipment", item 3)
  Frequency 128 MHz
  Maximum level ≥ -10 dBm
- Step attenuator (refer to "Measurement Equipment", item 11)
  Frequency 128 MHz
  Attenuation 0 to 60 dB in 1 dB steps
  Attenuation accuracy < 0.1 dB

Test setup:

- ➢ Connect RF output of the signal generator to RF input of the step attenuator.
- ➢ Connect RF output of the step attenuator to RF input of the FSP.

Signal generator settings:

- Frequency 128 MHz
- Level -10 dBm

Step attenuator settings:

Attenuation 20 dB

FSP settings:

- [**PRESET**]
- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **2 kHz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**BW** : VIDEO BW MANUAL : **100 Hz**]
- [**TRACE** : DETECTOR : RMS]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : -**10 dBm**]

Reference measurement:

- ➢ Set marker to peak of signal:
- [**MKR** ⇒ : PEAK]
- ➢ Set reference to peak of signal:
- [**MKR** : REFERENCE FIXED]

Measurement

Step attenuator settings: Attenuation {a_{ATT}}

Refer to table below for values of a_{ATT}.

FSP settings: - [**AMPT** : {reference level} **dBm**]

Refer to table below for values of reference level.

- [**MKR** ⇒ : PEAK]

Evaluation: The difference between the level of the input signal of the FSP and the reference (at 10 dB IF gain) is displayed in the marker field by the reading ´Delta [T1 FXD]´.

10 dB gain steps:

a_{ATT}	10 dB	20 dB	30 dB	40 dB	50 dB	60 dB
Reference level	0 dBm	-10 dBm	-20 dBm	-30 dBm	-40 dBm	-50 dBm

1 dB gain steps:

a_{ATT}	20 dB	21 dB	22 dB	23 dB	24 dB	25 dB	26 dB	27 dB	28 dB	29 dB
Reference level	-10 dBm	-11 dBm	-12 dBm	-13 dBm	-14 dBm	-15 dBm	-16 dBm	-17 dBm	-18 dBm	-19 dBm

Checking Phase Noise

Test equipment:

Signal generator (refer to "Measurement Equipment", item 3)

Frequency	498 MHz
Level	≥ 0 dBm
Phase noise at 498 MHz:	< -100 dBc/Hz @ 100 Hz
	< -115 dBc/Hz @ 1 kHz
	< -127 dBc/Hz @ 10 kHz
	< -130 dBc/Hz @ 100 kHz
	< -142 dBc/Hz @ 1 MHz

Test setup:

- Connect RF output of the signal generator to RF input of the FSP.
- Connect signal generator EXT REF output to the EXT REF input of the FSP.

Signal generator settings:

- Frequency 498 MHz
- Level 0 dBm

FSP settings:

- [**PRESET**]

- [**FREQ** : CENTER : **498 MHz**]
- [**AMPT** : **0 dBm**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**SPAN** : {span}]

  Depending on offset, refer to table below for values of span.

- [**BW** : COUPLING RATIO : RBW/VBW NOISE[10]]
- [**BW** : RBW MANUAL : {RBW}]

  Depending on offset, refer to table below for values of RBW.

- [**TRACE 1** : AVERAGE]
- [**SWEEP** : SWEEP COUNT : **20** : **ENTER**]

- Activate phase noise marker:

- [**MKR FCTN**: PHASE NOISE]

- [**FREQ** : CENTER : {498 MHz + offset}]

  Refer to table below for values of offset.

- [**AMPT** : {reference level}]

  Depending on offset, refer to table below for values of reference level.

- [**AMPT** : RF ATTEN MANUAL : {a_{FSP}}]

  Depending on offset, refer to table below for values of a_{FSP}.

- Set phase noise marker
  [**MKR :** MARKER 2 : {offset}]

  Refer to table below for values of offset.

  ***Note**: Do not measure on a spurious signal.*

Evaluation: The phase noise is displayed in the marker field by the reading ´Delta 2 [T1 PHN]´.

Phase noise measurement settings				
Offset	**Span**	**RBW**	**Reference level**	**a_{FSP}**
100 Hz	20 Hz	10 Hz	0 dBm	10 dB
1 kHz	200 Hz	100 Hz	0 dBm	10 dB
10 kHz	2 kHz	300 Hz	-10 dBm	10 dB
100 kHz	10 kHz	3 kHz	-20 dBm	0 dB
1 MHz	100 kHz	30 kHz	-20 dBm	0 dB

Note: *To obtain a precise measurement of the phase noise at high offsets, the level used at the FSP input is 20 dB higher than the reference level. To reduce the measurement time, the phase noise is measured with a small span around the frequency offset. This prevents the FSP from being overloaded.*

Performance Test Option TV and RF Trigger: FSP-B6

Checking RF Trigger

Test equipment: - Signal generator (refer to "Measurement Equipment", item 3)
Frequency 128 MHz

Test setup: ➢ Connect test output of the signal generator to RF input of the FSP.

Signal generator settings:
- Frequency 128 MHz
- Level - {L_{GEN}}
- Modulation AM, 90%, 100 Hz

FSP settings:
- **[PRESET]**
- **[AMPT: 0 dBm]**
- **[AMPT**: RF ATTEN MANUAL : **10 dB]**
- **[FREQ**: CENTER : **128 MHz]**
- **[SPAN**: ZERO **]**
- **[TRIG**: RF POWER : {L_{TRG}} **]**
- **[SWEEP**: SWEEPTIME MANUAL : **10 ms]**
- **[MARKER**: 0 s **]**

Measurement: Set marker to sweep start:
- **[MKR : 0 s]**

Set trigger level L_{TRG} and generator level L_{GEN} (L_{GEN} = L_{TRG}). Check trigger threshold using the marker.
Refer to "Performance Test Report" table for values of L_{TRG}.

Checking TV Trigger

Test equipment: - TV signal source (e.g. TV antenna)

Test setup: ➢ Connect the TV signal source to the RF input of the FSP.

FSP settings:
- **[PRESET]**
- **[AMPT**: RF ATTEN MANUAL : **0 dB]**
- **[AMPT**: {L_{TV}} **]**
- **[FREQ**: CENTER : {f_{TV}} **]**
- **[SPAN**: ZERO **]**
- **[SWEEP**: SWEEP TIME MANUAL: **128 µs]**
- **[TRIG**: NEXT: TV TRIG SETTINGS: HOR SYNC **]**
- **[AMPT**: RANGE LINEAR **]**

The frequency f_{TV} is the vision carrier frequency of the TV signal.
The level L_{TV} is the vision carrier level.

Evaluation: Test lines 17 and 18 are displayed on the screen of the FSP.

Note: *A CCVS monitor can be connected to the CCVS IN/OUT connector for checking the TV picture.*

Performance Test Option Tracking Generator - FSP-B9

Checking Output Level

Test equipment:
- N cable (refer to "Measurement Equipment", item 14)
  Frequency up to 3 GHz
  Maximum attenuation < 0.2 dB

Test setup:
➢ Connect tracking generator output to RF input of the FSP.

FSP settings:
- [**PRESET**]
- [**MODE NETWORK**]
- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **0 Hz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-0 dBm**]
- [**NETWORK** : SOURCE POWER {level}]
  {level} : 0 dBm; -5 dBm; -10 dBm; -15 dBm; -20 dBm; -25 dBm

Measurement:
Set marker to peak:
- [**MKR** ⇒ : PEAK]

Checking Frequency Response

Test equipment:
- N cable (refer to "Measurement Equipment", item 14)
  Frequency up to 3 GHz
  Maximum attenuation < 0.2 dB

Test setup:
Connect tracking generator output to RF input of the FSP.

FSP settings:
- [**PRESET**]
- [**NETWORK**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**SWT** : MANUAL : **2 s**]

Range 1:
- [**FREQ** : START : **9 kHz**]
- [**FREQ** : STOP : **100 kHz**]

Range 2:
- [**FREQ** : START : **100 kHz**]
- [**FREQ** : STOP : **1 MHz**]

Range 3:
- [**FREQ** : START : **1 MHz**]
- [**FREQ** : STOP : **2 GHz**]

Range 4:
- [**FREQ** : START : **2 GHz**]
- [**FREQ** : STOP : **3 GHz**]

- [**NETWORK** : SOURCE POWER {level}]
Values for {level} : 0 dBm; -10 dBm; -20 dBm

Measurement: Set marker to peak:
- [**MKR ⇒** : PEAK]
Set marker to minimum value:
- [**MKR ⇒** : MIN PEAK]

Checking Modulation

Checking I/Q Modulation

Test equipment:
- ADS (refer to "Measurement Equipment", item 16)
- Spectrum Analyzer (refer to "Measurement Equipment", item 15)
- 2 Voltmeters (refer to "Measurement Equipment", item 17)
- 2 BNC T pieces

Test setup:
- ➢ Apply the I and Q outputs of ADS to the I and Q inputs of the analyzer. Check the ADS voltages in parallel via T pieces.
- ➢ Connect spectrum analyzer to the TG output.

ADS settings:
- ➢ Set DC voltage (offset) to 0 mV ± 3 mV
  AC voltage: V(pp) = 1 V ± 10 mV
  Frequency: 200 kHz
  Phase (I/Q) = 90 degrees

Spectrum analyzer settings:
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **1 MHz**]
- [**REF** : REF LEVEL : **0 dBm**]

FSP settings:
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **0 MHz**]
- [**REF** : REF LEVEL : **0 dBm**]
- [**NETWORK** : SOURCE POWER 0 dBm
- [MODULATION EXT I/Q]

Measurement of residual carrier:
- ➢ Switch off I and Q channels on ADS.
  Voltmeter display: DC voltage < 3 mV
  AC voltage < 3 mV
  Set marker to peak:
- [**MKR ⇒** : PEAK]

  Read measured value on spectrum analyzer (marker peak).

Measurement of impairments (imbalance of I and Q path):
- ➢ Switch on I and Q channels on ADS.
  Measure carrier amplitude at 1 GHz and lines at 1 GHz + 200 kHz and 1 GHz – 200 kHz.

Checking Amplitude Modulation

Test equipment:
- ADS (refer to "Measurement Equipment", item 16)
- Spectrum analyzer (refer to "Measurement Equipment", item 15)
- 2 voltmeters (refer to "Measurement Equipment", item 17)
- 2 BNC T pieces

Test setup:
- ➢ Apply the I and Q outputs of ADS to the I and Q inputs of the analyzer. Check the ADS voltages in parallel via T pieces.
- ➢ Connect spectrum analyzer to the TG output.

ADS settings:
- ➢ AC voltage: V(pp) = 1 V ± 10 mV
  Frequency: 1 MHz

Spectrum analyzer settings:
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **10 MHz**]
- [**REF** : REF LEVEL : **0 dBm**]

FSP settings:
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **0 MHz**]
- [**REF** : REF LEVEL : **0 dBm**]
- [**NETWORK** : SOURCE POWER 0 dBm
- [MODULATION EXT AM]

Measurement:
- ➢ Determine the level spacing between the carrier signal at 1 GHz and the modulation lines at 1 GHz ± 1 MHz.

Checking Frequency Modulation

Test equipment:
- ADS (refer to "Measurement Equipment", item 16)
- Spectrum analyzer (refer to "Measurement Equipment", item 15)
- 2 voltmeters (refer to "Measurement Equipment", item 17)
- 2 BNC T pieces

Test setup:
- ➢ Apply the I and Q outputs of ADS to the I and Q inputs of the analyzer. Check the ADS voltages in parallel via T pieces.
- ➢ Connect spectrum analyzer to the TG output.

ADS settings:
- ➢ AC voltage: V(pp) = 100 mV ± 10 mV
  Frequency: 100 kHz

Spectrum analyzer settings:
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **100 MHz**]
- [**BW** : **1 MHz**]
- [**REF** : REF LEVEL : **0 dBm**]

FSP settings:
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **0 MHz**]
- [**REF** : REF LEVEL : **0 dBm**]
- [**NETWORK** : SOURCE POWER 0 dBm
- [MODULATION EXT FM]

Measurement: Determination of the peak spacing = 2 x DEVIATION

Performance Test Option WCDMA Demodulation Hardware - FSP-B15

Checking Comb Line Level

FSP settings:

- [**PRESET**]
- [**SETUP** : SERVICE : NEXT : CAL GEN COMB 62,5 kHz]
- [**FREQ** : CENTER : **40,0625 MHz**]
- [**SPAN** : **100 kHz**]
- [**AMPT** : **- 40 dBm**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**TRACE** : AVERAGE]
- [**SWEEP** : SWEEP COUNT : **20 ENTER**]

Measurement:

➢ Set marker to peak:

- [**MKR** ⇒ : PEAK]

- [**FREQ** : CENTER : **50,0625 MHz**]
- [**MKR** ⇒ : PEAK]

The signal level L_{FSP} is displayed by the level reading of marker 1.

Performance Test Option Electronic Attenuator- FSP-B25

Checking Noise Display with Preamplifier (B25)

Test equipment: 50 Ω termination (refer to "Measurement Equipment", item 7)

Frequency range: FSP 3 to 3 GHz
FSP 7 to 7 GHz

Test setup:
- Terminate the RF input of the FSP with 50 Ω.

FSP settings:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**SPAN** : **0 Hz**]
- [**BW** : RES BW MANUAL : **10 Hz**]
- [**BW** : VIDEO BW MANUAL : **1 Hz**]
- [**BW** : SWEEP TIME MANUAL : **0.1 s**]
- [**TRACE 1** : AVERAGE]
- [**TRACE 1** : SWEEP COUNT : **30 ENTER**]
- [**AMPT** : **- 80 dBm**]
- [**SETUP** : PREAMP ON]
- [**FREQ** : CENTER : {f_n}]

Measurement:
- Set marker to peak:
- [**MKR** ⇒ : PEAK]

Evaluation: The noise level is displayed by the level reading of marker 1.

Checking Level Accuracy and Frequency Response with Preamplifier

Test equipment:

- Signal generator :
  FSP 3: Refer to "Measurement Equipment", item 3.
  FSP 7: Refer to "Measurement Equipment", items 3 & 4.

  Frequency range:
  FSP 3: 10 MHz to 3 GHz
  FSP 7: 10 MHz to 7 GHz

  Maximum level ≥ 0 dBm

- Power meter (refer to "Measurement Equipment", item 8)
- Power sensor:
  FSP 3: Refer to "Measurement Equipment", item 9.
  FSP 7 0: Refer to "Measurement Equipment", items 9 & 10.

  Frequency range:
  FSP 3: 10 MHz to 3 GHz
  FSP 7: 10 MHz to 7 GHz

  maximum power $P_{max} \geq 100\ \mu W$

  RSS referenced to indicated power
  1 MHz to 1 GHz ≤ 1.5 %
  1 GHz to 7 GHz ≤ 2 %

  impedance Z = 50 Ω

- 6 dB divider (refer to "Measurement Equipment", item 6)

  Frequency range:
  FSP 3: 10 MHz to 3 GHz
  FSP 7: 10 MHz to 7 GHz

  Level imbalance[1]) 1 MHz to 1 GHz ≤ 0.1 dB
  1 GHz to 7 GHz ≤ 0.2 dB

  [1]) If a power divider with higher level imbalance is used, correction of the measured frequency response is recommended.

Determining the level accuracy at 128 MHz

Test setup:

- Connect power sensor (item 9) to the power meter and execute function ´ZERO´ when there is no signal applied to the power sensor.
- Connect power sensor to RF output of signal generator.

Signal generator settings:

- Frequency 128 MHz
- Level -30 dBm

Measurement:

- determine output power of the signal generator with the power meter.
- Connect RF output of the signal generator to RF input of the FSP.

FSP settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-20 dBm**]
- [**SETUP** : PREAMP ON]
- [**SPAN** : **10 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

Set marker to peak of signal:
- [**MKR** $\Rightarrow$: PEAK]

Evaluation:

The difference between the signal levels measured with the power meter and the FSP (level reading of marker 1) reflects the absolute level accuracy of the FSP. It can be calculated as follows:

$$\text{Level accuracy}_{128MHz} = L_{FSP} - L_{powermeter}$$

Checking frequency response

Test setup:
- ➢ Connect RF output of the signal generator to input of the divider.
- ➢ Connect output 1 of the divider to the power sensor / power meter.
- ➢ Connect output 2 of the divider to RF input of the FSP.

Signal generator settings:
- Level 0 dBm
- Frequency 128 MHz

FSP settings:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**AMPT** : **0 dBm**]
- [**SETUP** : PREAMP ON]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

Reference measurement:
- ➢ Determine signal level $L_{powermeter}$.
- ➢ Set marker to peak of signal:
- [**MKR ⇒** : PEAK]

The signal level L_{FSP} is displayed by the level reading of marker 1.

$$Ref_{128MHz} = L_{FSP} - L_{powermeter}$$

Measurement

Signal generator settings:
- Frequency f_{fresp}

Refer to "Performance Test Report" table for values of f_{fresp}.

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

FSP settings:
- [**FREQ** : CENTER : {f_{fresp}}]

Refer to "Performance Test Report" table for values of f_{fresp}.

Set marker to peak of signal:
- [**MKR ⇒** : PEAK]

The signal level L_{FSP} is displayed by the level reading of marker 1.

Evaluation:
The frequency response can be calculated as follows:

$$\text{Frequency response} = L_{FSP} - L_{powermeter} - Ref_{128\ MHz}$$

Checking Frequency Response with Electronic Attenuator

Test equipment:

- Signal generator :
  FSP 3: Refer to "Measurement Equipment", item 3.
  FSP 7: Refer to "Measurement Equipment", items 3 & 4.

  Frequency range:
  FSP 3: 10 MHz to 3 GHz
  FSP 7: 10 MHz to 7 GHz

  Maximum level ≥ 0 dBm

- Power meter (refer to "Measurement Equipment", item 8)
- Power sensor:
  FSP 3: Refer to "Measurement Equipment", item 9.
  FSP 7 0: Refer to "Measurement Equipment", items 9 & 10.

  Frequency range:
  FSP 3: 10 MHz to 3 GHz
  FSP 7: 10 MHz to 7 GHz

  Maximum power $P_{max} \geq 100\ \mu W$

  RSS referenced to indicated power:
  1 MHz to 1 GHz ≤ 1.5 %
  1 GHz to 7 GHz ≤ 2 %

  Impedance Z = 50 Ω

- 6 dB divider (refer to "Measurement Equipment", item 6)

  Frequency range:
  FSP 3: 10 MHz to 3 GHz
  FSP 7: 10 MHz to 7 GHz

  Level imbalance[1]) 1 MHz to 1 GHz ≤ 0.1 dB
  1 GHz to 7 GHz ≤ 0.2 dB

  [1]) If a power divider with higher level imbalance is used, correction of the measured frequency response is recommended.

Test setup:

- Connect RF output of the signal generator to input of the divider.
- Connect output 1 of the divider to the power sensor / power meter.
- Connect output 2 of the divider to RF input of the FSP.

Signal generator settings:

- Level 0 dBm
- Frequency 128 MHz

FSP settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : NEXT : ELEC ATTEN MANUAL : {E_{ATT}} : **dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

Refer to "Performance Test Report" table for values of E_{ATT}.

Reference measurement:

- Determine signal level $L_{powermeter}$.
- Set marker to peak of signal:
  - [**MKR** ⇒ : PEAK]

The signal level L_{FSP} is displayed by the level reading of marker 1.

$$Ref_{128MHz} = L_{FSP} - L_{powermeter}$$

Measurement

Signal generator settings:

- Frequency f_{fresp}

Refer to "Performance Test Report" table for values of f_{fresp}.

Power meter settings:

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

FSP settings:

- [**FREQ** : CENTER : {f_{fresp}}]

Refer to "Performance Test Report" table for values of f_{fresp}.

Set marker to peak of signal:

- [**MKR** ⇒ : PEAK]

The signal level L_{FSP} is displayed by the level reading of marker 1.

Evaluation:

The frequency response can be calculated as follows:

$$\text{Frequency response} = L_{FSP} - L_{powermeter} - Ref_{128\ MHz}$$

Checking Nonlinearities with Electronic Attenuator

Third Order Intercept

Test equipment:

- 2 signal generators
  - FSP 3: Refer to "Measurement Equipment", items 2 & 3.
  - FSP 7: Refer to "Measurement Equipment", items 2 & 4.
  - Frequency range:
    - FSP 3: 10 MHz to 3 GHz
    - FSP 7: 10 MHz to 7 GHz
  - Maximum level ≥ 0 dBm
- 2 attenuators (refer to "Measurement Equipment", item 12)
  - Attenuation a_{ATT} = 10 dB
  - Frequency range:
    - FSP 3: 10 MHz to 3 GHz
    - FSP 7: 10 MHz to 7 GHz
- 3 dB coupler (refer to "Measurement Equipment", item 5)
  - Frequency range:
    - FSP 3: 10 MHz to 3 GHz
    - FSP 7: 10 MHz to 7 GHz
  - Decoupling > 12 dB

Test setup:

- Connect RF outputs of the signal generators via 10 dB attenuators to the inputs of the 3 dB coupler.
- Connect output of the 3 dB coupler to RF input of the FSP.

Signal generator settings (both generators):

- Frequency: generator 1 $f_{g1} = f_{in} – 50$ kHz
  generator 2 $f_{g2} = f_{in} + 50$ kHz

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

- Adjust the output level of signal generators for an input level at the FSP of -20 dBm.

FSP settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**AMPT** : NEXT : ELEC ATTEN MANUAL : **0 dB**]
- [**AMPT** : **-10 dBm**]
- [**SPAN** : **500 kHz**]
- [**BW** : RES BW MANUAL : **3 kHz**]
- [**FREQ** : CENTER : {f_{in}}]

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

Measurement:

- [**MKR FCTN** : TOI]

Evaluation:

The third order intercept point (T.O.I) referenced to the input signal is displayed in the marker field by the reading [TOI].

Checking RF Attenuator (with Option B25)

Test equipment:

- Signal generator (refer to "Measurement Equipment", item 3)
  Frequency 128 MHz
  Maximum level ≥ 10 dBm

- Step attenuator (refer to "Measurement Equipment", item 11)
  Frequency 128 MHz
  Attenuation 0 to 80 dB in 5 dB steps
  Attenuation accuracy < 0.1 dB

Test setup:

- ➢ Connect RF output of the signal generator to RF input of the step attenuator.
- ➢ Connect RF output of the step attenuator to RF input of the FSP.

Signal generator settings:

- Frequency 128 MHz
- Level 10 dBm

Step attenuator settings: Attenuation 70 dB

FSP settings:

- [**PRESET**]
- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **500 Hz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**BW** : VIDEO BW MANUAL : **100 Hz**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-35 dBm**]

Reference measurement:

- ➢ Set marker to peak of signal:
- [**MKR** ⇒ : PEAK]

- ➢ Set reference to peak of signal:
- [**MKR** : REFERENCE FIXED]

Measurement

Step attenuator settings: Attenuation { 80 dB - a_{FSP} }
Refer to table below for values of a_{ATT}.

FSP settings:

- [**AMPT** : RF ATTEN MANUAL : {a_{FSP}}]
- [**AMPT** : {-45 dBm + a_{FSP} } **dBm**]
- [**MKR** ⇒ : PEAK]

Refer to table below for values of a_{FSP} , a_{ATT} and reference level.

Evaluation: The difference between the level of the input signal of the FSP and the reference (at 10 dB RF-Attenuation) is displayed in the marker field by the reading ´Delta [T1 FXD]´.

a_{ATT} in dB	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5
a_{FSP} in dB	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
Ref. level in dBm	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30

Checking Electronic Attenuator Accuracy

Test equipment:

- Signal generator (refer to "Measurement Equipment", item 3)
  Frequency 128 MHz
  Maximum level ≥ 0 dBm

- Step attenuator (refer to "Measurement Equipment", item 11)
  Frequency 128 MHz
  Attenuation 0 to 40 dB in 5 dB steps
  Attenuation accuracy < 0.1 dB

Test setup:

- Connect RF output of the signal generator to RF input of the step attenuator.
- Connect RF output of the step attenuator to RF input of the FSP.

Signal generator settings:

- Frequency 128 MHz
- Level 0 dBm

Step attenuator settings: Attenuation 40 dB

FSP settings:

- [**PRESET**]
- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **500 Hz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**BW** : VIDEO BW MANUAL : **100 Hz**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **- 30 dBm**]

Reference measurement:

- Set marker to peak of signal:
- [**MKR** ⇒ : PEAK]

- Set reference to peak of signal:
- [**MKR** : REFERENCE FIXED]

Measurement

Step attenuator settings: Attenuation { 40 dB - a_{FSP} }
Refer to table below for values of a_{ATT}.

FSP settings:

- [**AMPT** : NEXT : ELEC ATTEN MANUAL : {a_{FSP}}]
- [**AMPT** : {-30 dBm + a_{FSP} } **dBm**]
- [**MKR** ⇒ : PEAK]

Refer to table below for values of a_{FSP} , a_{ATT} and reference level.

Evaluation: The difference between the level of the input signal of the FSP and the reference (at 10 dB RF-Attenuation) is displayed in the marker field by the reading ´Delta [T1 FXD]´.

a_{ATT}	40 dB	35 dB	20 dB	25 dB	20 dB	15 dB	10 dB
a_{FSP}	0 dB	5 dB	10 dB	15 dB	20 dB	25 dB	30 dB
Reference level	-30 dBm	-25 dBm	-20 dBm	-15 dBm	-10 dBm	-5 dBm	0 dBm

Performance Test Report FSP

Table 1-1 Performance Test Report

ROHDE & SCHWARZ Performance Test Report Spectrum Analyzer FSP Version 27-Jul-00
Model (FSP-3/7/13/30/40):
Order number: 1093.4495.
Serial number:
Test person:
Date:
Signature:

Characteristic	**Included in**	**Min. value**	**Actual value**	**Max. value**	**Unit**	**Tolerance**
Frequency accuracy Reference oscillator	Page 1.3					
Model w/o Opt. B4		9.99999	_____	10.00001	MHz	
Model with Opt. B4		9.999999	_____	10.000001	MHz	
Image frequency rejection, 1st IF, f_{in}	Page 1.4					
11 MHz		70	_____	-	dB	
100 MHz		70	_____	-	dB	
1701 MHz		70	_____	-	dB	
2999 MHz		70	_____	-	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Image frequency rejection, 2nd IF, f_{in}	Page 1.4					
FSP 3 / 7 / 13 / 30 / 40:						
100 MHz		70	_____	-	dB	
FSP 7:						
3100 MHz		70	_____	-	dB	
5000 MHz		70	_____	-	dB	
6999 MHz		70	_____	-	dB	
FSP 13 / 30 / 40:						
10100 MHz		70	_____	-	dB	
13100 MHz		70	_____	-	dB	
FSP 30 / 40:						
20100 MHz		70	_____	-	dB	
29100 MHz		70	_____	-	dB	
FSP 40:						
30100 MHz		70	_____	-	dB	
39100 MHz		70	_____	-	dB	
Image frequency rejection 3rd IF, f_{in}	Page 1.4					
FSP 3 / 7 / 13 / 30/ 40:				-		
100 MHz		70	_____	-	dB	
FSP 7/ 13 / 30/ 40:						
3100 MHz		70	_____	-	dB	
1st IF rejection f_{in}	Page 1.5					
11 MHz		70	_____	-	dB	
100 MHz		70	_____	-	dB	
1701 MHz		70	_____	-	dB	
2990 MHz		70	_____	-	dB	
2nd IF rejection f_{in}	Page 1.5					
100 MHz		70	_____	-	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
3rd order intercept point, f_{in}	Page 1.6					
FSP 3 / 7 / 13 / 30/ 40:						
28 MHz		5	_____	-	dBm	
106 MHz		5	_____	-	dBm	
261 MHz		7	_____	-	dBm	
640 MHz		7	_____	-	dBm	
1000 MHz		7	_____	-	dBm	
1700 MHz		7	_____	-	dBm	
2500 MHz		7	_____	-	dBm	
2990 MHz		7	_____	-	dBm	
FSP 7 / 13 / 30/ 40:						
3100 MHz		10	_____	-	dBm	
5000 MHz		10	_____	-	dBm	
6999 MHz		10	_____	-	dBm	
FSP 13 / 30/ 40:						
7100 MHz		10	_____	-	dBm	
10000 MHz		10	_____	-	dBm	
13000 MHz		10	_____	-	dBm	
FSP 30:						
15100 MHz		10	_____	-	dBm	
20000 MHz		10	_____	-	dBm	
26000 MHz		8	_____	-	dBm	
FSP 40:						
15100 MHz		10	_____	-	dBm	
20000 MHz		10	_____	-	dBm	
26000 MHz		10	_____	-	dBm,	
35000 MHz		10	_____	-	dBm,	
39900 MHz		10	_____	-	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
IF bandwidth switch.	Page 1.7					
Level accuracy						
100 Hz		-0.1	_____	+0.1	dB	
300 Hz		-0.1	_____	+0.1	dB	
1 kHz		-0.1	_____	+0.1	dB	
3 kHz		-0.1	_____	+0.1	dB	
10 kHz		-	Reference	-		
30 kHz		-0.1	_____	+0.1	dB	
100 kHz		-0.1	_____	+0.1	dB	
300 kHz		-0.2	_____	+0.2	dB	
1 MHz		-0.2	_____	+0.2	dB	
3 MHz		-0.2	_____	+0.2	dB	
10 MHz		-0.2	_____	+0.2	dB	
FFT bandwidth	Page 1.7					
Level accuracy						
1 Hz		-0.2	_____	+0.2	dB	
3 Hz		-0.2	_____	+0.2	dB	
10 Hz		-0.2	_____	+0.2	dB	
30 Hz		-0.2	_____	+0.2	dB	
100 Hz		-0.2	_____	+0.2	dB	
300 Hz		-0.2	_____	+0.2	dB	
1 kHz		-0.2	_____	+0.2	dB	
3 kHz		-0.2	_____	+0.2	dB	
IF bandwidth	Page 1.8					
Bandwidth						
100 Hz		97 Hz	_____	103	Hz	
300 Hz		291	_____	309	Hz	
1 kHz		970	_____	1030	Hz	
3 kHz		2.91	_____	3.09	kHz	
10 kHz		9.7	_____	10.3	kHz	
30 kHz		29.1	_____	30.9	kHz	
100 kHz		90	_____	110	kHz	
300 kHz		270	_____	330	kHz	
1 MHz		900	_____	1100	kHz	
3 MHz		2.7	_____	3.3	MHz	
10 MHz		7	_____	11	MHz	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
IF Bandwidth Shape factor	Page 1.8					
100 Hz		-	_____	5	-	
300 Hz		-	_____	5	-	
1 kHz		-	_____	5	-	
3 kHz		-	_____	5	-	
10 kHz		-	_____	5	-	
30 kHz		-	_____	5	-	
100 kHz		-	_____	15	-	
300 kHz		-	_____	15	-	
1 MHz		-	_____	15	-	
3 MHz		-	_____	15	-	
10 MHz		-	_____	6	-	
Noise display f_{noise}:	Page 1.9					
9 kHz		-	_____	-95	dBm	
95 kHz		-	_____	-100	dBm	
999 kHz		-	_____	-120	dBm	
Noise display **FSP 3:** f_{noise}	Page 1.9					
10.99 MHz		-	_____	-142	dBm	
19.99 MHz		-	_____	-142	dBm	
49.99 MHz		-	_____	-142	dBm	
99.99 MHz		-	_____	-142	dBm	
199.9 MHz		-	_____	-142	dBm	
499.9 MHz		-	_____	-142	dBm	
999.9 MHz		-	_____	-142	dBm	
1499 MHz		-	_____	-140	dBm	
1999 MHz		-	_____	-140	dBm	
2499 MHz		-	_____	-140	dBm	
2999 MHz		-	_____	-140	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise display **FSP 7 / 13 / 30/40:** f_{noise}	Page 1.9					
10.99 MHz		-	_____	-140	dBm	
19.99 MHz		-	_____	-140	dBm	
49.99 MHz		-	_____	-140	dBm	
99.99 MHz		-	_____	-140	dBm	
199.9 MHz		-	_____	-140	dBm	
499.9 MHz		-	_____	-140	dBm	
999.9 MHz		-	_____	-140	dBm	
1499 MHz		-	_____	-138	dBm	
1999 MHz		-	_____	-138	dBm	
2499 MHz		-	_____	-138	dBm	
2999 MHz		-	_____	-138	dBm	
Noise display **FSP 7:** f_{noise}	Page 1.9					
3099 MHz		-	_____	-138	dBm	
3499 MHz		-	_____	-138	dBm	
3999 MHz		-	_____	-138	dBm	
4499 MHz		-	_____	-138	dBm	
4999 MHz		-	_____	-138	dBm	
5499 MHz		-	_____	-138	dBm	
5999 MHz		-	_____	-138	dBm	
6499 MHz		-	_____	-138	dBm	
6999 MHz		-	_____	-138	dBm	
Noise display **FSP 13 / 30/40:** f_{noise}	Page 1.9					
3099 MHz		-	_____	-135	dBm	
3499 MHz		-	_____	-135	dBm	
3999 MHz		-	_____	-135	dBm	
4499 MHz		-	_____	-135	dBm	
4999 MHz		-	_____	-135	dBm	
5499 MHz		-	_____	-135	dBm	
5999 MHz		-	_____	-135	dBm	
6499 MHz		-	_____	-135	dBm	
6999 MHz		-	_____	-135	dBm	
7999 MHz		-	_____	-132	dBm	
8999 MHz		-	_____	-132	dBm	
9999 MHz		-	_____	-132	dBm	
10999 MHz		-	_____	-132	dBm	
11999 MHz		-	_____	-132	dBm	
12999 MHz		-	_____	-132	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise display **FSP 30/40:** f_{noise}	Page 1.9					
13999 MHz		-	_____	-120	dBm	
14999 MHz		-	_____	-120	dBm	
15999 MHz		-	_____	-120	dBm	
16999 MHz		-	_____	-120	dBm	
17999 MHz		-	_____	-120	dBm	
18999 MHz		-	_____	-120	dBm	
19999 MHz		-	_____	-120	dBm	
20999 MHz		-	_____	-120	dBm	
21999 MHz		-	_____	-120	dBm	
			_	-		
Noise display **FSP 30:** f_{noise}	Page **Fehler! Textmarke nicht definiert.**					
22999 MHz		-	_____	-115	dBm	
23999 MHz		-	_____	-115	dBm	
24999 MHz		-	_____	-115	dBm	
25999 MHz		-	_____	-115	dBm	
26999 MHz		-	_____	-115	dBm	
27999 MHz		-	_____	-115	dBm	
28999 MHz		-	_____	-115	dBm	
29999 MHz		-	_____	-115	dBm	
Noise display **FSP 40:** f_{noise}	Page **Fehler! Textmarke nicht definiert.**					
22999 MHz		-	_____	-120	dBm	
23999 MHz		-	_____	–120	dBm	
24999 MHz		-	_____	–120	dBm	
25999 MHz		-	_____	–120	dBm	
26999 MHz		-	_____	–120	dBm	
27999 MHz		-	_____	–120	dBm	
28999 MHz		-	_____	–120	dBm	
29999 MHz		-	_____	–120	dBm	
30999 MHz		-	_____	–112	dBm	
31999 MHz		-	_____	–112	dBm	
32999 MHz		-	_____	–112	dBm	
33999 MHz		-	_____	–112	dBm	
34999 MHz		-	_____	–112	dBm	
35999 MHz		-	_____	–112	dBm	
36999 MHz		-	_____	–112	dBm	
37999 MHz		-	_____	–112	dBm	
38999 MHz		-	_____	–112	dBm	
39999 MHz		-	_____	–112	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Level accuracy at 128 MHz –30 dBm	Page 1.10	 -0.2	 _____	 +0.2	 dB	
Frequency response RF attenuation 10 dB **FSP 3 / 7/ 13 / 30 / 40:** f_{fresp} 1 MHz 10 MHz 50 MHz 100 MHz 200 MHz 300 MHz 400 MHz 500 MHz 600 MHz 700 MHz 800 MHz 900 MHz 1000 MHz 1500 MHz 2000 MHz 2500 MHz 2990 MHz	Page 1.10	 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5	 _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____	 +0.5 +0.5 +0.5 +0.5 +0.5 +0.5 +0.5 +0.5 +0.5 +0.5 +0.5 +0.5 +0.5 +0.5 +0.5 +0.5 +0.5	 dB dB dB dB dB dB dB dB dB dB dB dB dB dB dB dB dB	
Frequency response RF attenuation 10 dB **FSP 7/ 13/30/40:** f_{fresp} 3010 MHz 3500 MHz 4000 MHz 4500 MHz 5000 MHz 5500 MHz 6000 MHz 6500 MHz 6990 MHz	Page 1.10	 -2 -2 -2 -2 -2 -2 -2 -2 -2	 _____ _____ _____ _____ _____ _____ _____ _____ _____	 +2 +2 +2 +2 +2 +2 +2 +2 +2	 dB dB dB dB dB dB dB dB dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response RF attenuation 10 dB **FSP 13 / 30 / 40:** f_{fresp}	Page 1.10					
7100 MHz		-2.5	_____	+2.5	dB	
8000 MHz		-2.5	_____	+2.5	dB	
9000 MHz		-2.5	_____	+2.5	dB	
10000 MHz		-2.5	_____	+2.5	dB	
11000 MHz		-2.5	_____	+2.5	dB	
12000 MHz		-2.5	_____	+2.5	dB	
13000 MHz		-2.5	_____	+2.5	dB	
13500 MHz		-2.5	_____	+2.5	dB	
Frequency response RF attenuation 10 dB **FSP 30 / 40:** f_{fresp}	Page 1.10					
14000 MHz		-3	_____	+3	dB	
15000 MHz		-3	_____	+3	dB	
16000 MHz		-3	_____	+3	dB	
17000 MHz		-3	_____	+3	dB	
18000 MHz		-3	_____	+3	dB	
19000 MHz		-3	_____	+3	dB	
20000 MHz		-3	_____	+3	dB	
21000 MHz		-3	_____	+3	dB	
22000 MHz		-3	_____	+3	dB	
23000 MHz		-3	_____	+3	dB	
24000 MHz		-3	_____	+3	dB	
25000 MHz		-3	_____	+3	dB	
26000 MHz		-3	_____	+3	dB	
27000 MHz		-3	_____	+3	dB	
28000 MHz		-3	_____	+3	dB	
29000 MHz		-3	_____	+3	dB	
29990 MHz		-3	_____	+3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response RF attenuation 10 dB **FSP 40:** f_{fresp}	Page **Fehler! Textmarke nicht definiert.**					
31000 MHz		-4	_____	+4	dB	
32000 MHz		–4	_____	+4	dB	
33000 MHz		–4	_____	+4	dB	
34000 MHz		–4	_____	+4	dB	
35000 MHz		–4	_____	+4	dB	
36000 MHz		–4	_____	+4	dB	
37000 MHz		–4	_____	+4	dB	
38000 MHz		–4	_____	+4	dB	
39000 MHz		–4	_____	+4	dB	
39999 MHz		-4	_____	+4	dB	
Frequency response RF attenuation 20 dB f_{fresp}	Page 1.10					
1 MHz		-0.5	_____	+0.5	dB	
10 MHz		-0.5	_____	+0.5	dB	
50 MHz		-0.5	_____	+0.5	dB	
100 MHz		-0.5	_____	+0.5	dB	
200 MHz		-0.5	_____	+0.5	dB	
300 MHz		-0.5	_____	+0.5	dB	
400 MHz		-0.5	_____	+0.5	dB	
500 MHz		-0.5	_____	+0.5	dB	
600 MHz		-0.5	_____	+0.5	dB	
700 MHz		-0.5	_____	+0.5	dB	
800 MHz		-0.5	_____	+0.5	dB	
900 MHz		-0.5	_____	+0.5	dB	
1000 MHz		-0.5	_____	+0.5	dB	
1500 MHz		-0.5	_____	+0.5	dB	
2000 MHz		-0.5	_____	+0.5	dB	
2500 MHz		-0.5	_____	+0.5	dB	
2990 MHz		-0.5	_____	+0.5	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response RF attenuation 40 dB f_{fresp}	Page 1.10					
1 MHz		-0.5	_____	+0.5	dB	
10 MHz		-0.5	_____	+0.5	dB	
50 MHz		-0.5	_____	+0.5	dB	
100 MHz		-0.5	_____	+0.5	dB	
200 MHz		-0.5	_____	+0.5	dB	
300 MHz		-0.5	_____	+0.5	dB	
400 MHz		-0.5	_____	+0.5	dB	
500 MHz		-0.5	_____	+0.5	dB	
600 MHz		-0.5	_____	+0.5	dB	
700 MHz		-0.5	_____	+0.5	dB	
800 MHz		-0.5	_____	+0.5	dB	
900 MHz		-0.5	_____	+0.5	dB	
1000 MHz		-0.5	_____	+0.5	dB	
1500 MHz		-0.5	_____	+0.5	dB	
2000 MHz		-0.5	_____	+0.5	dB	
2500 MHz		-0.5	_____	+0.5	dB	
2990 MHz		-0.5	_____	+0.5	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Display linearity RBW 300 Hz a_{ATT} :	Page 1.13					
10 dB		9.8	_____	10.2	dB	
12 dB		7.8	_____	8.2	dB	
14 dB		5.8	_____	6.2	dB	
16 dB		3.8	_____	4.2	dB	
18 dB		1.8	_____	2.2	dB	
20 dB		-	Reference	-	-	
22 dB		-2.2	_____	-1.8	dB	
24 dB		-4.2	_____	-3.8	dB	
26 dB		-6.2	_____	-5.8	dB	
28 dB		-8.2	_____	-7.8	dB	
30 dB		-10.2	_____	-9.8	dB	
32 dB		-12.2	_____	-11.8	dB	
34 dB		-14.2	_____	-13.8	dB	
36 dB		-16.2	_____	-15.8	dB	
38 dB		-18.2	_____	-17.8	dB	
40 dB		-20.2	_____	-19.8	dB	
42 dB		-22.2	_____	-21.8	dB	
44 dB		-24.2	_____	-23.8	dB	
46 dB		-26.2	_____	-25.8	dB	
48 dB		-28.2	_____	-27.8	dB	
50 dB		-30.2	_____	-29.8	dB	
52 dB		-32.2	_____	-31.8	dB	
54 dB		-34.2	_____	-33.8	dB	
56 dB		-36.2	_____	-35.8	dB	
58 dB		-38.2	_____	-37.8	dB	
60 dB		-40.2	_____	-39.8	dB	
65 dB		-45.2	_____	-44.8	dB	
70 dB		-50.2	_____	-49.8	dB	
75 dB		-55.2	_____	-54.8	dB	
80 dB		-60.2	_____	-59.8	dB	
85 dB		-65.5	_____	-65.5	dB	
90 dB		-70.5	_____	-69.5	dB	
95 dB		-75.5	_____	-74.5	dB	
100 dB		-80.5	_____	-79.5	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Display linearity RBW 300 kHz a_{ATT} :	Page 1.13					
10 dB		9.8	_____	10.2	dB	
12 dB		7.8	_____	8.2	dB	
14 dB		5.8	_____	6.2	dB	
16 dB		3.8	_____	4.2	dB	
18 dB		1.8	_____	2.2	dB	
20 dB		-	Reference	-	-	
22 dB		-2.2	_____	-1.8	dB	
24 dB		-4.2	_____	-3.8	dB	
26 dB		-6.2	_____	-5.8	dB	
28 dB		-8.2	_____	-7.8	dB	
30 dB		-10.2	_____	-9.8	dB	
32 dB		-12.2	_____	-11.8	dB	
34 dB		-14.2	_____	-13.8	dB	
36 dB		-16.2	_____	-15.8	dB	
38 dB		-18.2	_____	-17.8	dB	
40 dB		-20.2	_____	-19.8	dB	
42 dB		-22.2	_____	-21.8	dB	
44 dB		-24.2	_____	-23.8	dB	
46 dB		-26.2	_____	-25.8	dB	
48 dB		-28.2	_____	-27.8	dB	
50 dB		-30.2	_____	-29.8	dB	
52 dB		-32.2	_____	-31.8	dB	
54 dB		-34.2	_____	-33.8	dB	
56 dB		-36.2	_____	-35.8	dB	
58 dB		-38.2	_____	-37.8	dB	
60 dB		-40.2	_____	-39.8	dB	
65 dB		-45.5	_____	-44.5	dB	
70 dB		-50.5	_____	-49.5	dB	
75 dB		-55.5	_____	-54.5	dB	
80 dB		-60.5	_____	-59.5	dB	
Attenuator accuracy a_{ATT} :	Page 1.15					
0 dB		-9.8	_____	-10.2	dB	
10 dB		-	Reference	-	-	
20 dB		+9.8	_____	+10.2	dB	
30 dB		+19.8	_____	+20.2	dB	
40 dB		+29.8	_____	+30.2	dB	
50 dB		+39.8	_____	+40.2	dB	
60 dB		+49.8	_____	+50.2	dB	
70 dB		+59.8	_____	+60.2	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Reference level switching accuracy	Page 1.16					
Reference level						
0 dBm		+9.8	_____	+10.2	dB	
-10 dBm		-	Reference	-	-	
-20 dBm		-10.2	_____	-9.8	dB	
-30 dBm		-20.2	_____	-19.8	dB	
-40 dBm		-30.2	_____	-29.8	dB	
-50 dBm		-40.2	_____	-39.8	dB	
-11 dBm		-1.2	_____	-0.8	dB	
-12 dBm		-2.2	_____	-1.8	dB	
-13 dBm		-3.2	_____	-2.8	dB	
-14 dBm		-4.2	_____	-3.8	dB	
-15 dBm		-5.2	_____	-4.8	dB	
-16 dBm		-6.2	_____	-5.8	dB	
-17 dBm		-7.2	_____	-6.8	dB	
-18 dBm		-8.2	_____	-7.8	dB	
-19 dBm		-9.2	_____	-8.8	dB	
Phase noise	Page 1.18					
Offset frequency:						
100 Hz		-	_____	-84	dbc (1 Hz)	
1 kHz		-	_____	-100	dbc (1 Hz)	
10 kHz		-	_____	-106	dbc (1 Hz)	
100 kHz		-	_____	-110	dbc (1 Hz)	
1 MHz		-	_____	-120	dbc (1 Hz)	

Performance Test Report Option FSP-B6

Table 1-1: Performance Test Report Option FSP-B6

ROHDE & SCHWARZ Performance Test Report Option FSP – B6 Version 11-June-02
Serial number:
Test person:
Date:
Signature:

Characteristic	**Included in**	**Min. value**	**Actual value**	**Max. value**	**Unit**	**Tolerance**
RF trigger level at 128 MHz	Page 1.20					
- 5 dBm		-7.5	_____	-2.5	dBm	
–10 dBm		–12.5	_____	–7.5	dBm	
–15 dBm		–17.5	_____	–12.5	dBm	
–20 dBm		–22.5	_____	–17.5	dBm	
–25 dBm		–27.5	_____	–22.5	dBm	
-30 dBm		–32.5	_____	–27.5	dBm	
–35 dBm		–37.5	_____	–32.5	dBm	
–40 dBm		–42.5	_____	–37.5	dBm	

Performance Test Report Option FSP-B9

Table 1-2: Performance Test Report Option FSP-B9

ROHDE & SCHWARZ	Performance Test Report	Option FSP-B9	Version 27-Jul-00
Serial number:			
Test person:			
Date:			
Signature:			

Characteristic	**Included in**	**Min. value**	**Actual value**	**Max. value**	**Unit**	**Tolerance**
Level accuracy Output level	Page 1.21					
0 dBm		-1	_____	+ 1	dBm	
- 5 dBm		- 6	_____	- 4	dBm	
-10 dBm		- 12	_____	- 8	dBm	
-15 dBm		- 17	_____	- 13	dBm	
-20 dBm		- 23	_____	- 17	dBm	
-25 dBm		- 28	_____	- 23	dBm	
Frequency response Tracking generator Range 9kHz 100kHz Output level	Page 1.21					
0 dBm		-3	_____	+3	dBm	
-10 dBm		-13	_____	-7	dBm	
-20 dBm		-23	_____	-17	dBm	
Frequency response Tracking generator Range 100kHz - 1MHz Output level:	Page 1.21					
0 dBm		-1	_____	+1	dBm	
-10 dBm		-11	_____	-9	dBm	
-20 dBm		-21	_____	-19	dBm	
Frequency Response Tracking Generator Range 1 MHz – 2 GHz Output level:	Page **Fehler! Textmarke nicht definiert.**					
0 dBm		-1	_____	+1	dBm	
-10 dBm		-11	_____	-9	dBm	
-20 dBm		-21	_____	-19	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response Tracking generator Range 2 GHz - 3 GHz Output level:	Page 1.21					
0 dBm		-3	_____	+3	dBm	
-10 dBm		-13	_____	-7	dBm	
-20 dBm		-23	_____	-17	dBm	
Checking modulation Tracking generator I/Q modulation	Page 1.22					
Carrier feedthrough		-	_____	-30	dBm	
Signal 1 GHz		-	_____	-25	dBm	
Sideband		-	_____	-25	dBm	
Checking modulation Tracking generator AM modulation Level difference:	Page 1.23	- 9	_____	- 3	dBc	
Checking modulation Tracking generator FM modulation Deviation:	Page 1.24	18	_____	22	MHz	

Performance Test Report Option FSP-B15

Table 1-2: Performance Test Report Option FSP-B15

ROHDE & SCHWARZ Performance Test Report Option FSP – B15 Version 11-June-02
Serial number: Test person: Date: Signature:

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Comb line level f_{comb}	Page 1.25					
40.0625 MHz		-58.3	_____	-52.3	dBm	
50.0625 MHz		–59.4	_____	–52.4	dBm	

Performance Test Report Option FSP-B25

Table 1-3 Performance Test Report Option FSP-B25

ROHDE & SCHWARZ	Performance Test Report	Option FSP-B25	Version 27-Jul-00
Serial number:			
Test person:			
Date:			
Signature:			

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise display with preamplifier (B25) **FSP 3 / 7**: f_{noise}	Page 1.26					
10.99 MHz		-	_____	-152	dBm	
19.99 MHz		-	_____	-152	dBm	
49.99 MHz		-	_____	-152	dBm	
99.99 MHz		-	_____	-152	dBm	
199.9 MHz		-	_____	-152	dBm	
499.9 MHz		-	_____	-152	dBm	
999.9 MHz		-	_____	-152	dBm	
1499 MHz		-	_____	-152	dBm	
1999 MHz		-	_____	-152	dBm	
2499 MHz		-	_____	-150	dBm	
2999 MHz		-	_____	-150	dBm	
Noise display with preamplifier (B25) **FSP 7:** f_{noise}	Page 1.26					
3099 MHz		-	_____	-150	dBm	
3499 MHz		-	_____	-150	dBm	
3999 MHz		-	_____	-150	dBm	
4499 MHz		-	_____	-150	dBm	
4999 MHz		-	_____	-150	dBm	
5499 MHz		-	_____	-150	dBm	
5999 MHz		-	_____	-150	dBm	
6499 MHz		-	_____	-150	dBm	
6999 MHz		-	_____	-150	dBm	
Level accuracy with preamplifier (B25) at 128 MHz, -30 dBm	Page 1.27	-0.2	_____	+0.2	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response with preamplifier (B25) **FSP 3 / 7:** f_{fresp}	Page 1.27					
1 MHz		-1	_____	+1	dB	
10 MHz		-1	_____	+1	dB	
50 MHz		-1	_____	+1	dB	
100 MHz		-1	_____	+1	dB	
200 MHz		-1	_____	+1	dB	
300 MHz		-1	_____	+1	dB	
400 MHz		-1	_____	+1	dB	
500 MHz		-1	_____	+1	dB	
600 MHz		-1	_____	+1	dB	
700 MHz		-1	_____	+1	dB	
800 MHz		-1	_____	+1	dB	
900 MHz		-1	_____	+1	dB	
1000 MHz		-1	_____	+1	dB	
1500 MHz		-1	_____	+1	dB	
2000 MHz		-1	_____	+1	dB	
2500 MHz		-1	_____	+1	dB	
2990 MHz		-1	_____	+1	dB	
Frequency response with preamplifier (B25) **FSP 7:** f_{fresp}	Page 1.27					
3010 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	
6500 MHz		-2	_____	+2	dB	
6990 MHz		-2	_____	+2	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response with electronic attenuator (B25)	Page 1.30					
E_{ATT} = 5 dB		-1	_____	+1	dB	
FSP 3 / 7: f_{fresp}		-1	_____	+1	dB	
10 MHz		-1	_____	+1	dB	
50 MHz		-1	_____	+1	dB	
100 MHz		-1	_____	+1	dB	
200 MHz		-1	_____	+1	dB	
300 MHz		-1	_____	+1	dB	
400 MHz		-1	_____	+1	dB	
500 MHz		-1	_____	+1	dB	
600 MHz		-1	_____	+1	dB	
700 MHz		-1	_____	+1	dB	
800 MHz		-1	_____	+1	dB	
900 MHz		–1	_____	+1	dB	
1000 MHz		–1	_____	+1	dB	
1500 MHz		–1	_____	+1	dB	
2000 MHz		–1	_____	+1	dB	
2500 MHz						
2990 MHz						
Frequency response with electronic attenuator (B25)	Page 1.30					
E_{ATT} = 5 dB		-2	_____	+2	dB	
FSP 7: f_{fresp}		–2	_____	+2	dB	
3010 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	
6500 MHz						
6990 MHz						

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response with electronic attenuator (B25)	Page 1.30					
E_{ATT} = 10 dB		-1	_____	+1	dB	
FSP 3 / 7: f_{fresp}		–1	_____	+1	dB	
10 MHz		–1	_____	+1	dB	
50 MHz		–1	_____	+1	dB	
100 MHz		–1	_____	+1	dB	
200 MHz		–1	_____	+1	dB	
300 MHz		–1	_____	+1	dB	
400 MHz		–1	_____	+1	dB	
500 MHz		–1	_____	+1	dB	
600 MHz		–1	_____	+1	dB	
700 MHz		–1	_____	+1	dB	
800 MHz		–1	_____	+1	dB	
900 MHz		–1	_____	+1	dB	
1000 MHz		–1	_____	+1	dB	
1500 MHz		–1	_____	+1	dB	
2000 MHz		–1	_____	+1	dB	
2500 MHz						
2990 MHz						
Frequency response with electronic attenuator (B25)	Page 1.30					
E_{ATT} = 10 dB		-2	_____	+2	dB	
FSP 7: f_{fresp}		–2	_____	+2	dB	
3010 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	
6500 MHz						
6990 MHz						

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response with electronic attenuator (B25)	Page 1.30					
E_{ATT} = 15 dB		-1	_____	+1	dB	
FSP 3 / 7: f_{fresp}		-1	_____	+1	dB	
10 MHz		-1	_____	+1	dB	
50 MHz		-1	_____	+1	dB	
100 MHz		-1	_____	+1	dB	
200 MHz		-1	_____	+1	dB	
300 MHz		-1	_____	+1	dB	
400 MHz		-1	_____	+1	dB	
500 MHz		-1	_____	+1	dB	
600 MHz		-1	_____	+1	dB	
700 MHz		-1	_____	+1	dB	
800 MHz		-1	_____	+1	dB	
900 MHz		-1	_____	+1	dB	
1000 MHz		-1	_____	+1	dB	
1500 MHz		-1	_____	+1	dB	
2000 MHz		-1	_____	+1	dB	
2500 MHz						
2990 MHz						
Frequency response with electronic attenuator (B25)	Page 1.30					
E_{ATT} = 15 dB		-2	_____	+2	dB	
FSP 7: f_{fresp}		-2	_____	+2	dB	
3010 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	
6500 MHz						
6990 MHz						

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
3rd order intercept point with elec. att.,f_{in}	Page 1.32					
FSP 3 / 7:						
28 MHz		7	_____	-	dBm	
106 MHz		7	_____	-	dBm	
261 MHz		10	_____	-	dBm	
640 MHz		10	_____	-	dBm	
1000 MHz		10	_____	-	dBm	
1700 MHz		10	_____	-	dBm	
2500 MHz		10	_____	-	dBm	
2990 MHz		10	_____	-	dBm	
FSP 7:						
3010 MHz		12	_____	-	dBm	
5000 MHz		12	_____	-	dBm	
6990 MHz		12	_____	-	dBm	
Attenuator accuracy, a_{ATT} :	Page 1.33					
0 dB		-9.8	_____	-10.2	dB	
5 dB		-4.8	_____	-5.2	dB	
10 dB		-	Reference	-	-	
15 dB		+4.8	_____	+5.2	dB	
20 dB		+9.8	_____	+10.2	dB	
25 dB		+14.8	_____	+15.2	dB	
30 dB		+19.8	_____	+20.2	dB	
35 dB		+24.8	_____	+25.2	dB	
40 dB		+29.8	_____	+30.2	dB	
45 dB		+34.8	_____	+35.2	dB	
50 dB		+39.8	_____	+40.2	dB	
55 dB		+44.8	_____	+45.2	dB	
60 dB		+49.8	_____	+50.2	dB	
65 dB		+54.8	_____	+55.2	dB	
70 dB		+59.8	_____	+60.2	dB	
75 dB		+64.8	_____	+65.2	dB	
Electronic attenuator accuracy, a_{ATT}	Page 1.34					
0 dB		-0.2	_____	+0.2	dB	
5 dB		+4.8	_____	+5.2	dB	
10 dB		+9.8	_____	+10.2	dB	
15 dB		+14.8	_____	+15.2	dB	
20 dB		+19.8	_____	+20.2	dB	
25 dB		+24.8	_____	+25.2	dB	
30 dB		+29.8	_____	+30.2	dB	

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2 Adjustment

The following chapter describes the adjustment of the reference sources as well as the software-controlled adjustment of individual module data following module replacement.

The FSP permits the following manual adjustments:

- Adjustment of the 10 MHz reference oscillator which determines the frequency accuracy of the FSP
- Adjustment of the 128 MHz calibration source which determines the level accuracy of the FSP

The adjustment permits to maintain and restore the data integrity of the instrument.

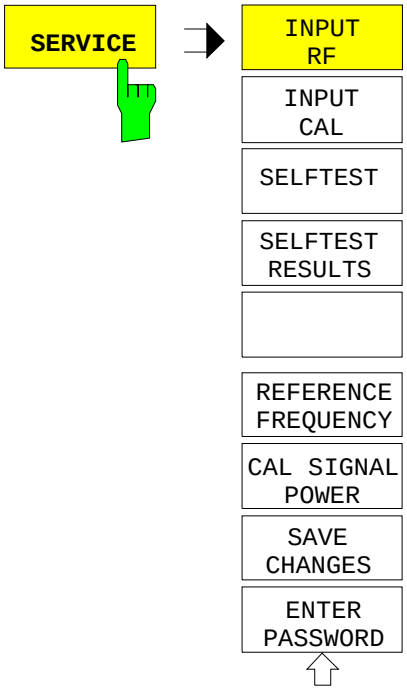
Manual adjustments must be performed at an ambient temperature between +20 °C and +30 °C after the instrument has warmed up.

After the adjustment and an internal total calibration has been performed, the FSP is ready for use and offers full data integrity.

Service Menu

The service functions for adjusting the boards are only useable after the entry of a password to prevent impairment of instrument functionality by unintended data changes.

SETUP menu:



The *SERVICE* softkey opens a submenu for selection of the service function

Entering the Password

SETUP SERVICE submenu:



The *ENTER PASSWORD* softkey allows the entry of a password.

The FSP contains a variety of service functions which, if incorrectly used, can impair the functionality of the analyzer. These functions are normally not accessible and are only usable after the entry of a password.

The password permits change of data which must be modified for calibration or repair of the instrument (for example reference frequency adjustment, level adjustment, general board data). The password is „894129“.

IEC/IEEE-bus command: `SYST:PASS "<Password>"`

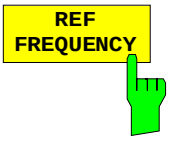
Adjustment Functions



Caution:

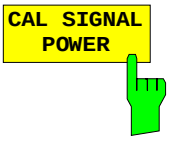
The re-alignment should be carried out by qualified personnel since any change considerably influences the measurement accuracy of the instrument. This is the reason why the softkeys REF FREQUENCY, CAL SIGNAL POWER and SAVE CHANGES can only be accessed after entering a password.

SETUP SERVICE submenu:



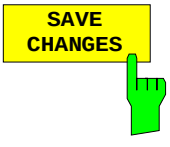
The *REF FREQUENCY* softkey opens the data input for the adjustment of the reference frequency. Values can be selected between 0 and 255 (without option FSP-B4 OCXO) or between 0 to 4095 (with option FSP-B4 OXCO). They modify the setting of the associated D/A converter. The setting is first stored in the volatile memory. The *SAVE CHANGES* softkey is used to store it permanently in the nonvolatile memory.

IEC/IEEE-bus command: `SENS:ROSC:INT:TUN 155`



The *CAL SIGNAL POWER* softkey opens the data input for the adjustment of the currently set level of the calibration signal (0 dBm or -30 dBm, compare *INPUT CAL* softkey). Values can be selected between 0 and 255. They modify the setting of the associated D/A converter. The setting is first stored in the volatile memory. The *SAVE CHANGES* softkey is used to store it permanently in the nonvolatile memory.

IEC/IEEE-bus command: --



The *SAVE CHANGES* softkey stores the modifications in the nonvolatile memory of the instrument. Since these modifications considerably influence the measurement accuracy of the instrument, confirmation by the user is requested before storing.

IEC/IEEE-bus command: `SENS:ROSC:INT:TUN:SAV`

Manual Adjustment

In the following, the measuring instruments and auxiliary means required for the manual adjustment of the FSP, the appropriate preparations of the instrument as well as the individual adjustments will be explained.

Test Instructions

- The adjustment of the analyzer must be done after a warm-up time of at least 30 minutes and overall calibration. Only in this case can the compliance with the guaranteed data be ensured.
- Inputs for setting the FSP during measurements are shown as following:

  [**<KEY>**] Press a key on the front panel, e.g. **[SPAN]**

  [<SOFTKEY>] Press a softkey, e.g. [MARKER -> PEAK]

  [<**nn unit**>] Enter a value and terminate by entering the unit, e.g. [**12 kHz**]

  Successive entries are separated by [:], e.g. [**BW** : RES BW MANUAL : **3 kHz**]

Measuring Equipment and Accessories

Table 2-1 Measuring Equipment and Accessories for manual adjustment of the FSP

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S Order No.	Use
1	Frequency counter	error < $1x10^{-9}$, frequency range up to 10 MHz	Advantest R5361B with option 23		Frequency Accuracy of Reference Oscillator
2	Signal generator	frequency range to 1 GHz: output level -10 dBm	SMHU	0835.8011.52	Calibration Source 128 MHz Frequency Accuracy of Reference Oscillator
3	Power meter		NRVD	0857.8008.02	Calibration Source 128 MHz
4	Power sensor	1 MHz to 3 GHz RSS ≤ 0.8% Meter noise ≤ 20 pW	NRV-Z4	0828.3618.02	Calibration Source 128 MHz

Adjusting the level measurement accuracy

Test equipment:

- Signal generator (Section "Measurement Equipment", item 2):
  frequency 128 MHz
  level -30 dBm
- power meter (Section "Measurement Equipment", item 3)
- power sensor (Section "Measurement Equipment", item 4)
  frequency 128 MHz
  maximum power $P_{max} \geq 1$ µW
  meter noise ≤ 20 pW
  RSS ≤ 0.8% referred to indicated power
  impedance Z = 50 Ω

Power meter settings:

- ➢ connect power sensor to power meter and carry out function ´ZERO´ when no signal is applied to the power sensor.
- ➢ connect power sensor to RF output of signal generator.

Signal generator settings:

- frequency 128 MHz
- level –30 dBm ± 0.05 dB
- ➢ use power meter for exact level adjustment.

Test setup:

- ➢ connect RF output of the signal generator to RF input of the FSP

Overall calibration of FSP:

- [**PRESET**]
- [**CAL** : CAL TOTAL]

FSP settings:

- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **15 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**BW** : VID BW MANUAL : **1 kHz**]
- [**TRACE** : DETEKTOR : RMS]
- [**AMPT** : REF LEVEL : **-20 dBm**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]

Reference measurement

- ➢ set marker to peak of signal
- [**MKR SEARCH** : PEAK]
- ➢ set reference to peak of signal
- - [**MKR** : REFERENCE FIXED]
- ➢ switch internal reference generator to RF input
- [**SETUP** : SERVICE : INPUT CAL]
- ➢ set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Adjustment:

The reading ´Delta [T1 FXD]´ displays the difference between the output level of the signal generator and the level of the calibration source.



Caution:

The following re-alignment changes the level of the internal calibration source. Since this adjustment influences the level measurement accuracy of the FSP, it is strongly recommended to perform this adjustment only if the level is not within the tolerance. .

FSP settings:

- [**SETUP :** SERVICE : ENTER PASSWORD : **894129 ENTER**]
- [**SETUP :** SERVICE : CAL SIGNAL POWER]

➢ The correction value for the calibration signal level will be displayed in the data entry field. Change the value with the step keys or spin wheel until the marker reading ´Delta [T1 FXD]´ displays a value of 0 ± 0,05 dB.

Store value in instrument

- [**SETUP :** SERVICE : SAVE CHANGES]

➢ Confirm message on display with ´YES´ . The correction values will be stored in the non volatile memory of the boards.

Note:

The changed level of the calibration source will be used with the following total calibration.

- [**CAL :** TOTAL CALIBRATION]
- [**CAL :** CALIBRATION RESULTS]

➢ Check the calibration results. The calibration must be performed with the status ´PASSED`.

Adjusting the frequency accuracy

Preparation: The measurement can be performed either with a signal generator at connector RF INPUT (front of FSP) at 1 GHz or at connector EXT REF OUT (rear of FSP) at 10 MHz using a frequency counter
For the adjustment, the FSP must be set to internal reference.

Note: *The measurement at 1 GHz can be performed with a lower frequency counter resolution in order to achieve a faster adjustment.*

Preparations for adjustment with signal generator:

Test equipment: - Signal generator (Section "Measurement Equipment", item 2):

frequency	1000 MHz
level	-20 dBm
frequency accuracy	$<1x10^{-9}$

If the frequency accuracy of the signal generator is not sufficient, adjust the frequency with a frequency counter to the correct frequency before the adjustment.

Test setup:

- connect RF output of the signal generator to RF input of the FSP

FSP settings:

- [**PRESET**]
- [**FREQ** : CENTER : **1 GHz**]
- [**SPAN** : **0 Hz**]
- [**BW** : RES BW MANUAL : **1 MHz**]
- [**AMPT** : REF LEVEL : **-20 dBm**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**SETUP** : REFERENCE INT / EXT]

- toggle to internal reference (INT)

Note: *Before the following measurement, the FSP must warm up for at least 30 minutes to heat the reference oscillator.*

Measurement:

- switch on marker frequency counting:

- [**MKR** : SIGNAL COUNT]

- Set the necessary resolution:

  Model without OCXO (Option B4) 1 GHz ± 1 kHz

- [**MKR** : **NEXT** : CNT RESOL 100 HZ]

  Model with OCXO (Option B4) 1 GHz ± 100 Hz

- [**MKR** : **NEXT**: CNT RESOL 10 HZ]

Preparation for adjustment with frequency counter:

Test equipment:

Frequency counter (Section "Measurement Equipment", item 1):
error < $1x10^{-9}$
frequency range up to 10 MHz

Test setup:

- connect frequency counter to 10-MHz reference output of the FSP (rear panel)

FSP settings:

- [**SETUP** : REFERENCE INT / EXT]
- toggle to internal reference (INT)

Frequency counter settings:

- set the necessary resolution:

model without OCXO (option FSP-B4): 1 Hz
model with OCXO (option FSP-B4): 0.1 Hz

Note:

Before the following measurement, the FSP must warm up at least 30 minutes to heat the reference oscillator.

Measurement:

- measure frequency with frequency counter:

nominal frequency:
model without OCXO (option FSP-B4)..... 10 MHz ± 10 Hz
model with OCXO (option FSP-B4)..... 10 MHz ± 1 Hz

Adjustment:



Important Note !

The following adjustment changes the frequency of the internal reference source. Since this adjustment influences the frequency accuracy of the FSP, it is strongly recommended to perform this adjustment only if the frequency is not within the tolerance.

FSP settings:

- [**SETUP :** SERVICE : ENTER PASSWORD : **894129 ENTER**]
- [**SETUP :** SERVICE : REF FREQUENCY]

- The correction value for the reference frequency adjust will be displayed in the data entry field. Change the value with the step keys or spin wheel until the frequency counter reading or the marker count reading displays a value within the tolerance.

Store value in instrument

- [**SETUP :** SERVICE : SAVE CHANGES]

- Confirm message on display with ´YES´ . The correction values will be stored in the non volatile memory of the boards.

Adjustment of Module Data

All boards of the FSP contain EEPROMS for storage of board data.
In addition to some standard information such as module name, serial number, hardware status and date of manufacture, these stored data items contain important pieces of information within value tables from module pre-testing, e.g. frequency responses for module error data. This EEPROM data is read out during a cold boot and stored on the hard disk. In normal operation, the data record stored on the hard disk is always used.

In order to match the data stored in EEPROMs on the respective modules to the complete instrument, a cold boot should always be performed after replacing a module so that module data can be adjusted.

The complete contents of the new module are read from the EEPROM and copied to the hard disk of the FSP. The existing calibration data (results from the latest total calibration) are deleted and the instruments displays UNCAL. Thus, the FSP must always be calibrated again after replacement of a module (softkey *CAL TOTAL*).
After the total calibration has been successfully performed, a backup of the EEPROM files must be made on the hard disk with the aid of a service function:

Settings on the FSP:
- [**SETUP :** SERVICE : ENTER PASSWORD : **30473035 ENTER**]
- [**SETUP :** SERVICE : SERVICE FUNCTION : **3.0.11 ENTER**]

If the IF filter module has been replaced, the calibration data should also be written back to the EEPROM:

Settings on the FSP:
- [**SETUP :** SERVICE : SERVICE FUNCTION : **3.0.7 ENTER**]

If an instrument has been downgraded through the removal of an option module, the EEPROM file associated with this module must be deleted as well as any existing .Bak file on the D:\r_s\instr\eeprom\ drive and on the C:\r_s\instr\eeprom\backup drives.

Frequency response correction

With some boards (see chapter 3, section "Module Exchange") an frequency response correction is necessary in addition to the automatic adjustment of module data. This correction is performed by means of the software *FSP-FRQ*.

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3 Repair

This chapter describes the design of the FSP, simple measures for repair and troubleshooting and, in particular, the replacement of modules. For troubleshooting and diagnostics, a selftest is available for polling diagnostic voltages of the modules and detecting limit violations.

The firmware update and the installation of options are described in chapter 4 of this service manual.

Instrument Design and Function Description

A detailed schematic of the FSP design is presented in the block diagrams below and in the attachments (see also chapter 5).
The following functional description of the instrument refers to the block diagram.

Block Diagram

See also the drawings in chapter 5 for a detailed block circuit.

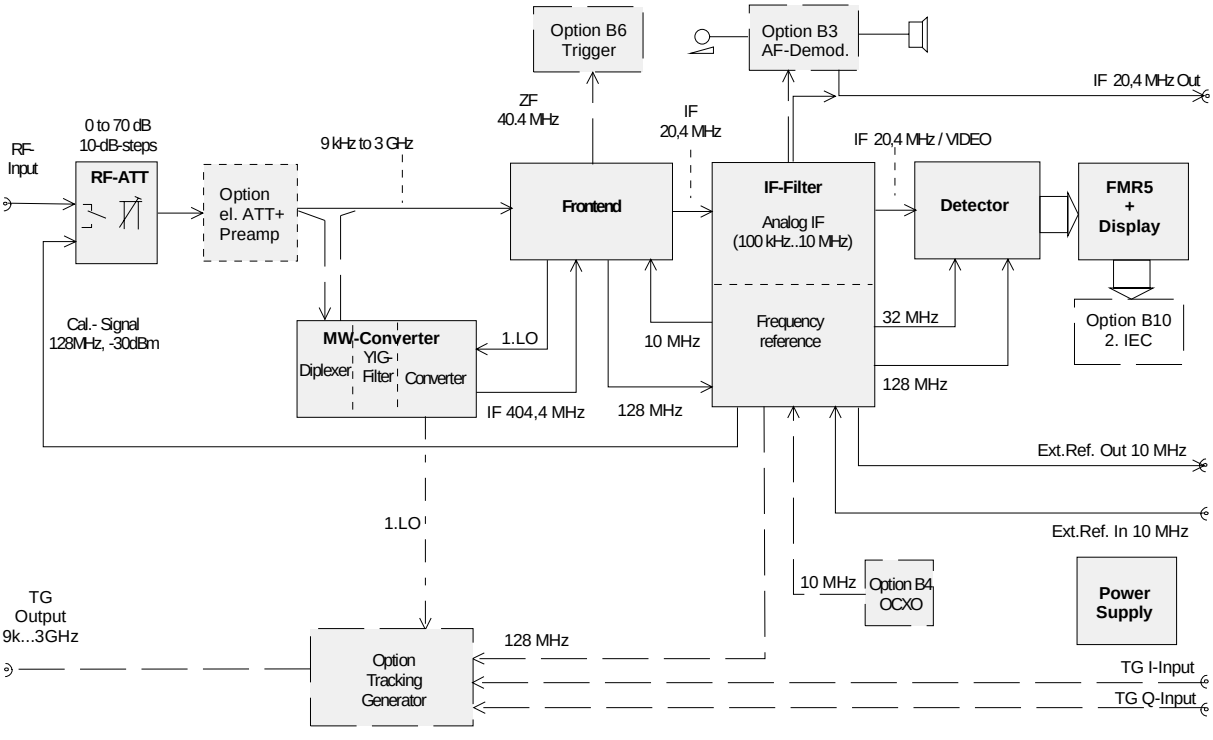


Fig. 3-1 Block diagram

Description of Block Diagram

The FSP is a triple-conversion superjet receiver (double-conversion for receive frequencies >3 GHz) for the frequency range from 9 kHz to several GHz, depending on the instrument model. The signals are processed by one RF board (two for models > 3 GHz), one IF board, one signal detection board and a controller comprising a Pentium-driven commercially available PC, an I/O interface and a graphics controller. The instrument can be upgraded to meet future requirements by retrofitting options in the analog and digital sections.

The input signal is reduced in level by the attenuator and routed to the RF modules depending on the instrument type. In instruments with option FSP-B25 (electronic attenuator), this module follows in the signal path. In 3 GHz models, it directly follows the RF frontend; in the high-frequency models, a diplexer is connected in between. The high-frequency signal component >3 GHz is routed to the microwave converter module following the diplexer. The IF module is the same in all instrument models, and likewise for the signal path through signal detection to the display.

The internal reference and calibration signals are generated in the frequency and level reference part on the IF filter board. Here the 128 MHz reference frequency from the frontend is amplified and made available to the instrument as a reference frequency, and a level-controlled output signal is generated as an internal level reference for instrument calibration.

The tracking generator produces an output signal at the receive frequency with a frequency offset of ±150 MHz. The output level of the module is regulated and can be set in the range -30 dBm to 0 dBm. The output signal can be externally I/Q-, AM- and FM-modulated.

A detailed description of the modules is provided in the following.

Attenuator

The RF signal passes from the input connector via the input switch to the input attenuator, which can be set from 0 to 70 dB in steps of 10 dB. The input signal is applied to the switch as well as a 128 MHz signal which has a close tolerance level of -30 dBm for calibration purposes or 0 dBm for the selftest of the instrument.

Electronic Attenuator (Option FSP-B25)

The electronic attenuator is fitted in the RF signal path directly behind the input attenuator. It consists of three different parts: an 5 dB attenuator, which changes the input attenuation to 5 dB steps; an electronic attenuator, which can be switched from 0 to 30 dB in steps of 5 dB; and a switchable preamplifier to reduce the noise figure of the instrument.

RF to IF Conversion for Frequencies < 3 GHz – Frontend

The frontend converts the receive frequencies in the range 9 kHz to 3 GHz to the low 20.4 MHz IF. The frontend also includes the required local oscillators and associated frequency processing circuits. The unit is made up of two PCBs accommodated in a common housing.

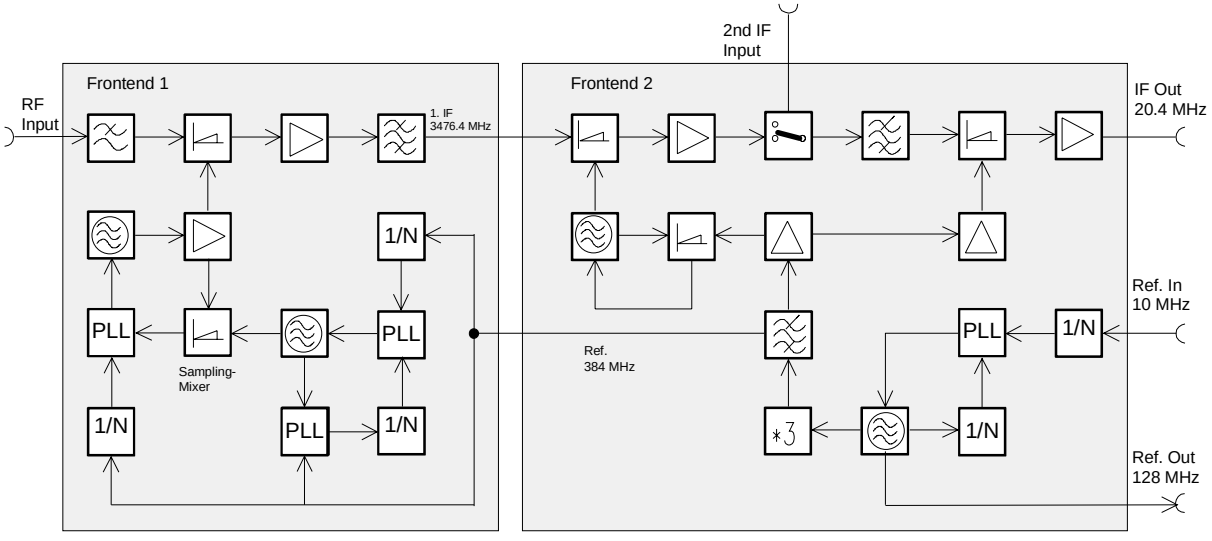


Fig. 3-2 RF-to-IF conversion for frequencies < 3 GHz

On frontend 1, the input signal in the range 0 to 3 GHz is converted to the first IF of 3476.4 MHz. The input signal passes via the input lowpass to the first mixer. This lowpass at the mixer input provides for suppression of the image frequency (image = LO + IF), such that the conversion remains unambiguous. In the first mixer, the input signal is converted to an IF of 3476.4 MHz by means of the first LO (3476.4 to 6476.4 MHz). 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 100 MHz for filtering the first intermediate frequency. The local oscillator frequency (3.4 to 6.6 GHz) required for this conversion is also generated on this board. This signal is generated by three VCOs, which are synchronized to a low phase noise VCO running from 320 to 352 MHz. The synchronization is done with a sampling mixer; the resulting IF is variable. A signal with 384 MHz from frontend 2 is the reference frequency The conversion gain of frontend 1 is approximately 0 dB.

Generation of the second and third local oscillator frequencies and conversion from the first to the third IF are performed on frontend 2.
The module has 2 inputs for IF signals which can be selected using a changeover switch.
The signal from frontend 1 is converted to the second IF of 404.4 MHz in the second mixer. The signal is then amplified, and the input switch for selection of the input signal is connected into the signal path.
The signal is routed to a 404.4 MHz filter with a 3 dB bandwidth of 10 MHz for further signal processing. This filter functions as a resolution filter if the resolution bandwidth is set to 10 MHz, and it suppresses the image frequency which might occur with the third conversion. The filter is followed by the third mixer, which converts to 20.4 MHz. The conversion gain of frontend 2 is approximately 8 dB against the first IF input and approximately 0 dB against the second IF input.

Located on frontend 2 is also the reference frequency generation for 128 MHz. This signal is generated by a VTXO, which is synchronized to the 10 MHz reference applied from the IF filter. The third LO is generated by multiplication of the oscillator signal (*3) and filtering of the comb line; this signal is also used as a reference for frontend 1. The second LO for the second conversion is obtained using an oscillator which is synchronized to a harmonic of the 384 MHz reference.

RF to IF Conversion for Frequencies > 3 GHz - Microwave Converter

The high frequency models of the FSP (frequency range > 3 GHz) also comprise a microwave converter board. This module converts the analyzer input signals in the range above 3 GHz to the second IF of 404.4 MHz. After the attenuator, the input signals are split within the diplexer into the two signal paths < 3 GHz and > 3 GHz. Signals above 3 GHz are forwarded to the mixer via the YIG filter.

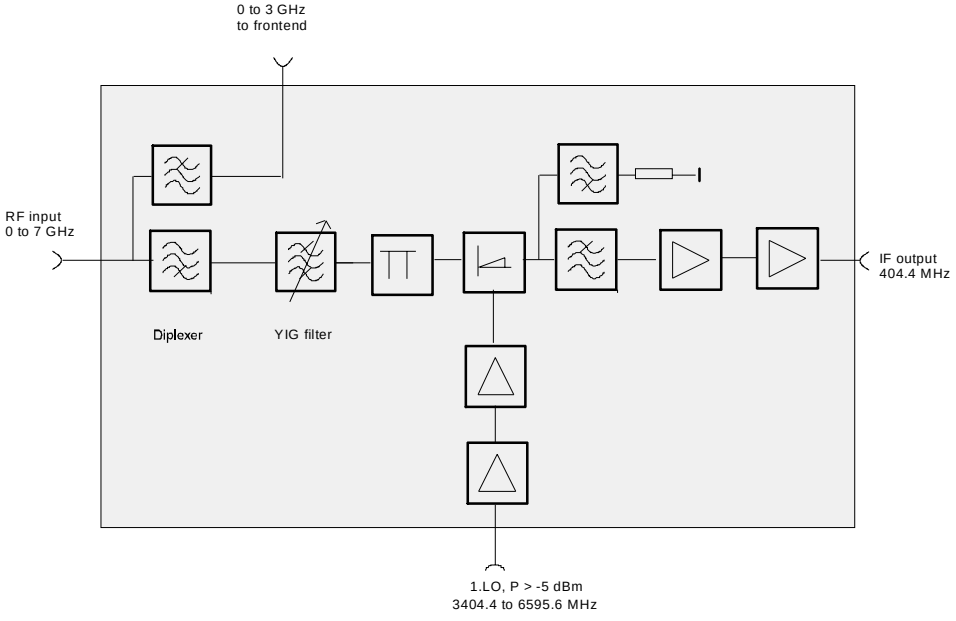


Fig. 3-3 RF-to-IF conversion for frequencies > 3 GHz

The first LO converts the input frequency to the 404.4 MHz IF (by mixing fundamental and harmonics). For this purpose, the LO signal (3.4 to 6.6 GHz) generated in the RF frontend is amplified to the required LO level.
The basic model is equipped with the necessary interfaces (IF input 404.4 MHz, LO output 3.4 to 6.6 GHz) for extending the frequency range by simply adding a microwave converter.

IF Filter – Module

The frontend in the signal path is followed by the IF filter module (analog IF):

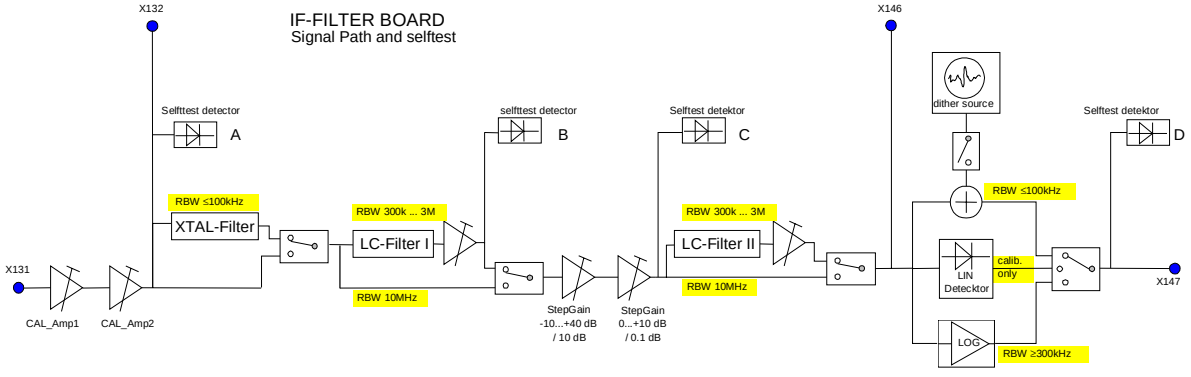


Fig. 3-4 IF filter

The FSP offers resolution bandwidths from 1 Hz to 10 MHz in steps of 1/3/10. The selection filter at the second IF of 404.4 MHz in the frontend yields the 10 MHz bandwidth. Selection is not performed at the IF of 20.4 MHz.

The tunable bandwidths from 100 kHz to 3 MHz are at the third IF (20.4 MHz) on the IF filter module. The bandwidths from 100 kHz to 3 MHz are provided by 4 decoupled LC circuits.

The IF filter module also comprises circuits for the IF gain (step gain) from 0 to 50 dB in 0.1 dB steps, level correction for all bandwidths and frequency response correction using a variable gain amplifier each.
The IF filters are followed by a log detector to obtain the display dynamic range.
The module also comprises a limiting amplifier (in the log-amp) with a TTL output for the frequency counter.

For the digitally implemented resolution bandwidths from 1 Hz to 30 kHz, the 20.4 MHz IF signal at the IF filter output is routed to the A/D converter.

Reference Frequency 10 MHz - IF Filter Module

The reference frequency is generated by a TCXO, and the frequency is adjustable by means of a D/A converter. As another choice, an OCXO or an external reference input (REF IN) can be switched on. In any case, the active reference will be routed to the reference output.

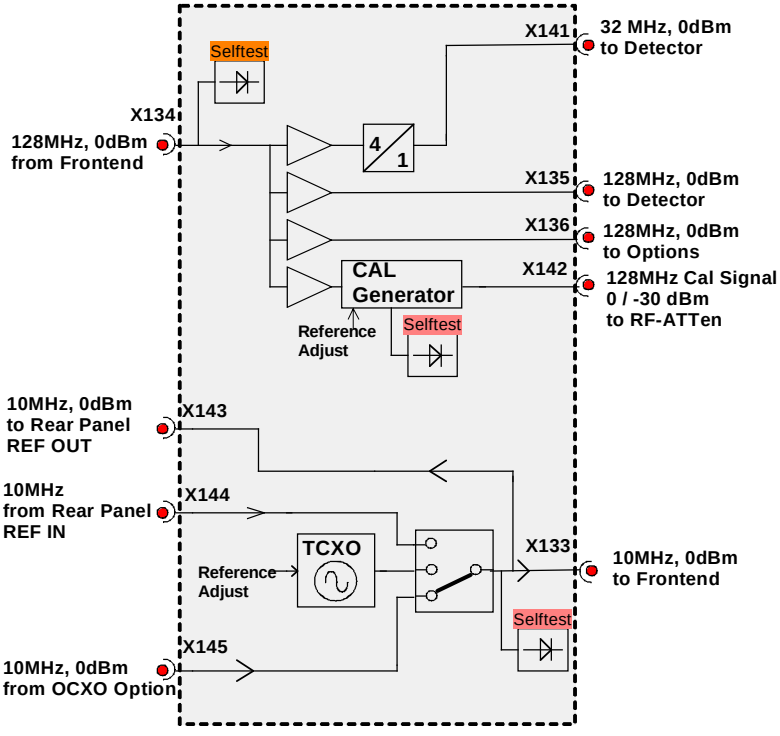


Fig. 3-5 Reference frequency

Reference Frequency 128 MHz - IF Filter Module

This reference is generated on the frontend and is synchronized to the 10 MHz reference.
The signal from the frontend (128 MHz reference) is decoupled and distributed to the detector and to other options.
The 128 MHz calibration signal is generated with automatic level control. The level is switchable between 0 dBm and -30 dBm. The level is adjustable with a D/A converter.
A 4:1 divider generates the 32 MHz clock for the detector board (A/D converter).

OCXO Reference (Option FSP-B4)

The FSP contains the option FSP-B4, an oven-controlled crystal oscillator (OCXO). This OCXO generates a 10 MHz signal, which is routed to the IF filter board and used as a reference signal.

WCDMA Demodulation Hardware (Option FSP-B15)

Option FSP-B15 is required for broadband vector analysis. The module is inserted into the line of the 128 MHz calibration signal between the IF module and the attenuator. A pulse with a frequency of 62.5 kHz is generated from the 128 MHz signal by frequency division. This pulse is used to calibrate the 10 MHz IF filter.

Processing of Measured Data - Detector Board

The following sections explain the signal and data paths required for result processing in the various operating modes:

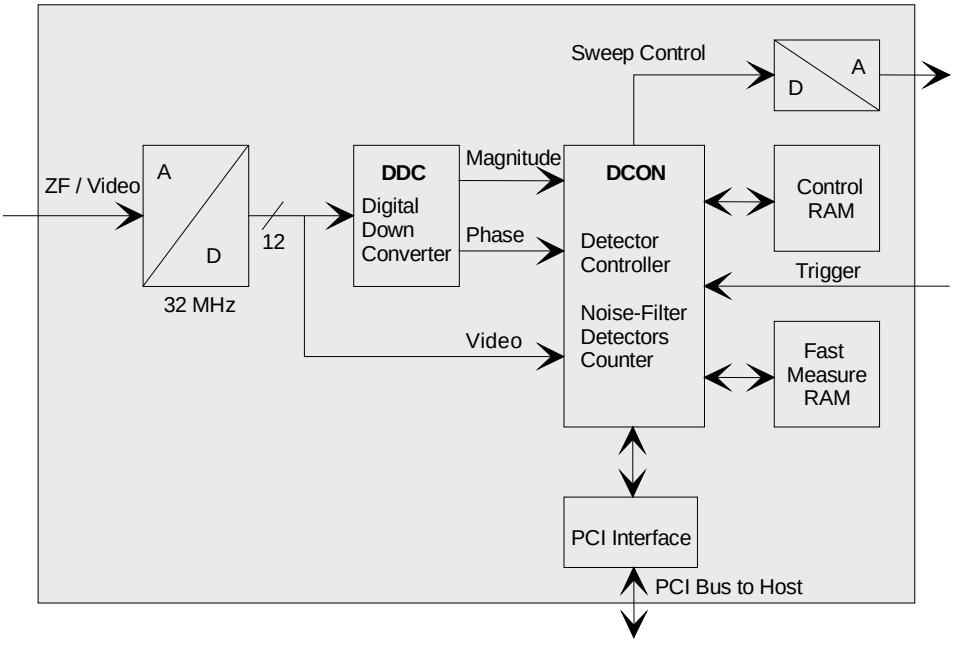


Fig. 3-6 Processing of measured data

Spectrum Analysis Using an RBW >100 kHz

In this mode, only the analog resolution filters on the IF filter board are used. The signal applied to the A/D converter via the input IF/Video is therefore already a log video signal. The signal is continuously sampled at 32 MHz in the ADC and digitized.
The signal path is now directly routed to DCON.
In the DCON, the data are directly applied to the noise filter. The noise filter is used to limit the video bandwidth or to average the noise content. The signal path is routed to the detector logic where the results are processed, i.e. peak max, peak min, sample, average and RMS values as well as the number of measured values and quasi-peak values are determined.
With measurement data rates > 1 MHz, detector data have to be stored in the measurement RAM because online storage is no longer possible at these high speeds. Upon completion of the sweep, the sweep data are read by the host from the measurement RAM, processed and displayed.

Spectrum Analysis Using an RBW ≤ 100 kHz

In this operating mode, the resolution bandwidths are generated digitally with the aid of the DDC. This IC first mixes its input IF into the baseband using an NCO, and then filters the obtained I/Q signal via an HDF (**h**igh **d**ecimation **f**ilter) and an FIR (**f**inite **i**mpulse **r**esponse) stage. At the end of the DDC processing chain, the I/Q signal in the CORDIC block is split into magnitude and phase. For signal processing in the DDF, the IF signal from the IF filter module directly represents the linear IF.
For a conventional log display of the analyzed spectrum, the magnitude data is logarithmized in the DCON between the DDC interface and the noise filter.
Further signal processing on the detector board is identical to that of operating mode RBW > 100 kHz.

FFT Bandwidth

In the FFT bandwidth mode, the synthesizer is set to the desired frequency via the DCON which also generates the tuning voltages for the analog hardware. The signal path is routed via ADC, Corr RAM and DDC. The DDC first mixes the input IF into the baseband using an NCO, and then the obtained I/Q signal is filtered in an HDF (**h**igh **d**ecimation **f**ilter) and FIR stage (**f**inite **i**mpulse **r**esponse). The I/Q output data are then stored by the DDC in the I/Q RAM. With data logging completed, the I/Q data from the I/Q RAM is transferred to the host via DDC and PCI interface FPGA. The host then performs the FFT for this sweep section.

Video Bandwidths (VBW)

The video filters of the FSP can be adjusted between 1 Hz and 10 MHz in steps of 1/3/10. They are designed as a digital lowpass filter for the video signal. The video bandwidth can either be coupled to the resolution bandwidth (= default setting) or manually set to a fixed value.

Detectors

The FSP uses a detector for the positive peak (peak+) and one for the negative peak value (peak-). In the sample mode, the video signal can also be directly sampled by the A/D converter without a peak detector being required . *Quasi-Peak, Average* and *RMS* detectors are available in addition. The RMS detector forms the rms value of the input signal for one point in the display during the measurement time.

AF Demodulation (Option FSP-B3)

The FSP may contain option FSP-B3 as an AM/FM demodulator. In the analyzer mode, the signal at the position of the reference marker during a sweep can be demodulated. In this case, the FSP stops the sweep for a selectable time and demodulates the input signal. The loudness is adjusted with the volume control knob.

TV and RF Trigger (Option FSP-B6)

By using the TV and RF trigger option FSP-B6, you can set triggering to a TV signal or to the presence of an RF signal on the FSP.

For this purpose, the option module has a TV demodulator that provides the trigger signals required for analyzing TV signals. In addition to the pure trigger function, the demodulated TV signal is available as a CCVS video signal for operating a TV monitor. The FSP can also derive the trigger signals from an externally applied CCVS signal. The associated connector is located on the rear panel of the FSP.

The FSP derives different trigger signals from the video signal to display defined sections of the TV video signal in the time domain. Triggering in response to field frequency and to each line of the TV video signal is possible.

In addition, the option module contains a broadband RF detector (bandwidth = 80 MHz) that allows detection of a carrier signal far from the selected frequency range. This RF power trigger will function as long as the RF signal applied to the input mixer is between -10 dBm and -50 dBm.

Tracking Generator (Option FSP-B9)

The tracking generator generates a signal exactly at the input frequency of the FSP during normal operation.

For frequency-converting measurements, it is possible to set a constant frequency offset of ±150 MHz between the receive frequency of the FSP and the output signal of the tracking generator. In addition, I/Q modulation or AM and FM modulation of the output signal can be performed using two analog input signals.

The output level is regulated and can be set between –30 dBm and 0 dBm in 0.1 dB steps.

External Generator Control (Option FSP-B10)

The external generator control option enables different commercial generators to be operated as a tracking generator on the FSP. The generator is controlled via the optional second IEC/IEEE bus interface of the FSP (= IEC2, supplied with the option) and via the TTL synchronizing interface contained in the AUX interface of the FSP on some Rohde & Schwarz generators.

LAN Interface (Option FSP-B16)

The instrument can be connected to an Ethernet LAN (local area network) using the LAN interface option. This option comprises a network card that can be operated with a 10 MHz Ethernet IEEE 802.3 or a 100 MHz Ethernet IEEE 802.3u.

DC Power Supply (Option FSP-B30)

With the DC power supply option, the FSP can be operated from a DC voltage of 10 to 28 V. A DC/DC converter transforms the input voltage to a voltage of 120 to 360 VDC that can be directly processed by the FSP power supply. The option is installed on the rear panel of the FSP.

Battery Pack (Option FSP-B31/32)

Option FSP-B31 is a battery pack for the FSP. If option FSP-B30 is installed, the FSP can be operated independently of the AC supply for up to 2 hours (depending on model). The option comprises a charger, two NiMH battery packs and an external power supply. The charger and the batteries are accommodated in a housing that can be installed on the top of the FSP in no time.

The battery pack is charged by means of the power supply that is included. Option B32 is an additional battery pack (without external power supply).

Front Panel

The front panel consists of an aluminum case panel (part of the FSP frame) and a mounting plate which accommodates the LCD, the backlight inverter, the keyboard mat with the membrane and the spinwheel. The case panel incorporates the front-module controller

LCD
The color LCD provides a visible output of any information, measurements etc. to the user. The resolution of the LCD is 640 * 480 pixels (VGA).
The display incorporates a cold cathode tubes for the illumination. The high voltage required for this purpose is generated in an extra DC/AC converter mounted next to the display on the mounting plate and connected both to the display and the controller board via a cable.

Keyboard
The keyboard consisting of a keyboard mat and a membrane release a contact when the rubber key is pressed. Two LEDs for the STANDBY/ON key (orange for STANDBY/green for ON) are also accommodated on this membrane.
The key evaluation and LED control are effected via a film cable connector on the controller board. Like the control of the two LEDs, it is controlled in a special microprocessor on the controller board by means of a matrix technique. This microprocessor permits to store the status of the STANDBY/ON key when switching off using the power switch.

Front module controller
The front module controller contains all the necessary components on a board such as processor, memory chips (SIMM modules), I/O devices (ISA bus), lithium battery, IEC-bus controller (IEEE), two serial interfaces (COM1/2), a parallel interface (LPT), LCD graphics controller, external VGA monitor graphics interface (monitor) and an external keyboard connection (keyboard PS/2).
In addition, a floppy controller for an external floppy disk drive and an IDE hard disk controller are integrated on the controller board.

Hard disk

The hard disk is screwed to the rear of the aluminum case panel and connected to the printed circuit board via a ribbon cable.

Flash Disk (Option FSP-B20)

A flash disk can be installed in the instrument instead of the hard disk by means of option FSB-B20. The compact flash board contains 2 connectors for compact flash cards of type 1 and a connector for establishing the connection to the IDE interface of the front-module controller.

Power Supply Module

The power supply module provides all currents necessary for the operation of the FSP. It can be switched off by means of the power switch on the rear panel.
The power supply module is a primary clocked switching power supply with Power Factor Correction (PFC) and Standby circuit (+12 V Standby).On the secondary side, it generates DC voltages (+3.3 V; +5.2 V; +6 V; +8 V; +12 V; +12 VFAN; +12 V Standby; +28 V; -12 V).

The control signal STANDBY/ON controlled by the front module controller (depending on the STANDBY/ON key on the front of the instrument frame) activates the power supply. In standby operation, it only supplies the 12V-standby voltage for the crystal oscillator and the LED STANDBY on the front panel.
The secondary voltages are open-circuit-proof and short-circuit-proof with respect to ground and each other.

An overtemperature protective circuit is additionally installed to prevent overheating. This status is taken to the front module controller via a status signal (*OT*).

Fuses
Two fuses are also fitted in the power supply as a means of fire protection.

Note: *These fuses are not accessible to the user from outside and are only blown in the case of a serious fault of the power supply (servicing required!).*

Motherboard

The motherboard generates the –6V supply for the analog boards with an integrated DC/DC-Converter.
The Noise source output (28V Noise Source) is also generated on this board.
All external supplies (Probe, Keyboard,...) are protected by polyswitches (current-dependent, self-opening and closing fuses) or electronically against external short circuit.
On the motherboard a circuit for temperature-dependent instrument fan control is also implemented.

Probe / Keyboard

The probe / keyboard board is located at the front of the instrument frame and serves for supply and connection of the connectors located at the front panel, the KEYBOARD (PS/2) and a PROBE POWER connector. For connection with motherboard a ribbon cable is used.

Volume / Phones

This board is only fitted with option FSP-B3 (AF-demodulator).
The volume/phones board is located at the front of the instrument frame and is used to connect the rotary encoder for the Volume setting of the AF-Demodulator and the Headphones connector with the motherboard.
For connection with the motherboard a 10-pin ribbon cable is used.

Module Replacement

This section describes the service concept and contains the spare parts list and the basic documents for the overall the FSP instrument. Replacement of modules is described in detail in Section 3 under "Module Replacement".

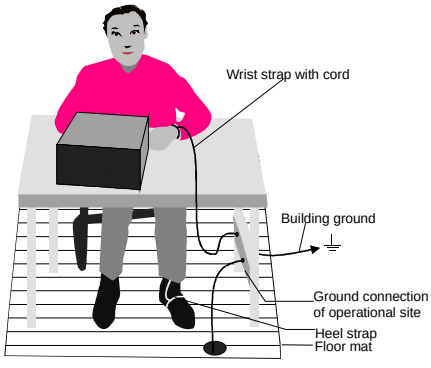
Note: *The numbers indicated in brackets refer to the position in the list of mechanical parts in Section 5.*
These items correspond to the item numbers in the illustrations on board replacement (see also Section 5):
1164.4391 (FSP Basic Model, Its. 1-455),
1164.4404 (Dig. Basic Unit, Its. 500-775),
1093.4708 (Display Unit, Its. 800-950),
1130.2396 (Converter Unit 8 GHz, Its. 2000-2008),
1130.2544 (Converter Unit 8 GHz, Its. 2000-2035),
1093.8249 (MW Converter Unit 13/30 GHz, Its. 2110-2150),
1093.8584 (MW Converter Unit 40 GHz, Its. 2210-2245),
1096.6224 (Option FSP-B1),
1129.6540 (Option FSP-B3, Its. 1000-1080)
1129.6791 (Option FSP-B4, Its. 1110-1130).
1129.8613 (Option FSP-B6, Its. 1800-1880),
1129.8613 (Option FSP-B9, Its. 1500-1566),
1129.7298 (Option FSP-B10, Pos. 1600-1626),
1155.1012 (Option FSP-B15, Its. 1160-1180),
1129.8107 (Option FSP-B16, Its. 1240-1310),
1155.1712 (Option FSP-B20, Its. 1700-1770) and
1155.1764 (Option FSP-B21, Pos. 2900-2970),
1129.7800 (Option FSP-B25, Pos. 1400-1490),
1162.9921 (Option FSP-B28, Pos. 1360-1385),
(Option FSP-B30, Pos. 3000-3020),
(Option FSP-B31, Pos. 3040-3060),
1157.0607 (option FSP-B70, Its. 1900-1950).

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



Caution!

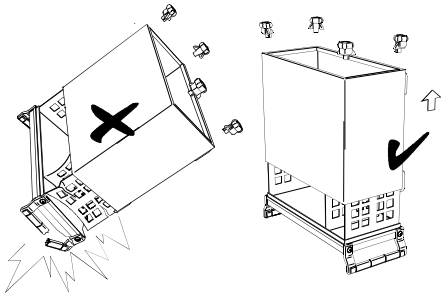
- *Please note the safety instructions at the beginning of this manual.*
- *Disconnect the instrument from the mains before opening the case.*
- *Protect the replacement site against electrostatic discharge to avoid damage of electronic components of the modules.*



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

- Wrist strap with cord to ground connection

- Conductive floor mat and heel strap combination



- *Put the instrument on the front handles before loosing the rear feet and the tube to avoid damage of the instrument.*
- *When mounting the tube take care not to damage or pull off cables.*

Overview of the Modules

Table 3-1 Overview - module replacement

Module	**Required tests and adjustments after replacement**		
	Function tests and system error correction	**Adjustment**	**Other**
Front module controller	SYSTEM MESSAGES/ SELFTEST / CAL		DOS/BIOS update
Lithium battery	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot
Hard disk	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot / FW update
LCD / DC/AC converter			
Keyboard membrane or mat			
Labelling panel			
Floppy disk drive	Check of directories		
Power supply	SYSTEM MESSAGES/ SELFTEST / CAL		
Fan			
RF input connector	SELFTEST / CAL	Frequency response	
Motherboard	SYSTEM MESSAGES/ SELFTEST / CAL		EEPROM entry Cold boot
RF attenuator	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
Key probe and vol./phone	Voltage / keyboard / volume		
RF frontend	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
Detector	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot
IF filter	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency accuracy/ cal. source	Cold boot
MW converter	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency accuracy/ frequency response	Cold boot
AF demodulator FSP-B3	SYSTEM MESSAGES/ headphone / volume		Cold boot
OCXO FSP-B4	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency accuracy	Cold boot
TV and RF trigger FSP-B6	SYSTEM MESSAGES/ SELFTEST / CAL	Trigger level	Cold boot
Tracking generator FSP-B9	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot
External generator control FSP-B10	SYSTEM MESSAGES/ SELFTEST / CAL		
WCDMA Demodulation Hardware FSP-B15	SYSTEM MESSAGES/ SELFTEST / CAL	Cal. source	Cold boot
LAN interface FSP-B16	SYSTEM MESSAGES/ SELFTEST / CAL		
Flash disk FSP-B20	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot/ FW update
Electronic attenuator/ preamp FSP-B25	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
Broadband demodulator FSP-B70	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot

Performing a Cold Boot

- Connect power cable, switch on power switch.
- Simultaneously while switching on with the ON button, press and hold down the decimal-point key until the computer responds with a beep.
- Windows XP subsequently boots the instrument firmware.

Replacing the Front Module Controller A90

(*See chapter 5, spare parts list, item 570, and explosion drawings 1164.4391, 1164.4404.)*

The front module controller is mounted behind the front panel.

Opening the Instrument and Removing the Front Panel

- Switch off the instrument and pull the mains plug.
- Unscrew the four screws (430) of the front handles on both sides and take off the front handles.
- Remove the volume control knob (Option FSP-B3), if present, by pulling it off.
- Pull off the labelling panel (270) towards the front.
- Unscrew two countersunk screws (610) in the front frame each at the top and at the bottom.
- Remove the front panel with keyboard and display (600, 620, 630, 640, 650, 660) to the front and rotate it to the top of the instrument.



Caution:

Note the connecting cables are still connected to the controller.

- Pull off the connecting cables to the adapter board (LCD, DC/AC illumination converter), keyboard membrane and spinwheel.

  Note: *When pulling off the connecting cables be careful with the cable connecting to the keyboard. It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.*

Removing the Front Module Controller

- Unscrew the ten screws with washers of the front module controller board and take out the front module controller as follows (see Fig. 3-17)

Note: *The force to disconnect the controller connectors of the motherboard are very high.*
The pulling of the controller to the front side will be done with the help of the slits at the bottom side of the mounting plate.
Please push the board with a flat, blunt tool carefully and step by step to the front.

Caution:

Do not insert the tool too deep in the slits and press only against the pc board !.
Pull out the board by pressing at alternate slits.
The board must not be bent!

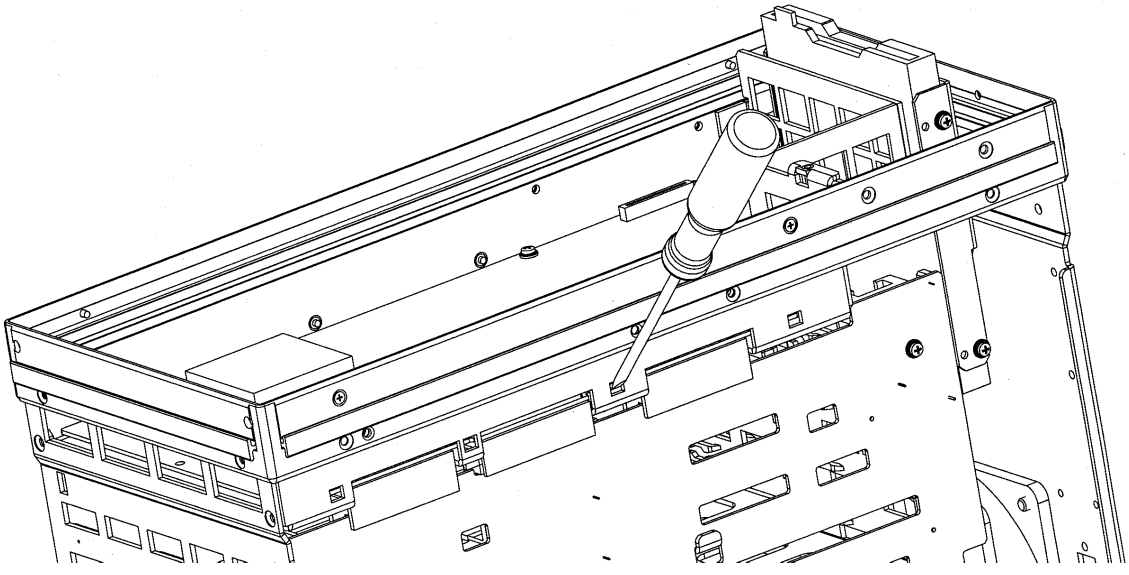


Fig. 3-7 Removing the front module controller

Installing the New Front Module Controller and Completing the Instruments

- Carefully plug the new front module controller to the motherboard and fasten it using the ten screws with washers (590).
- Carefully insert the cable connectors to the controller board, taking care not to reverse the polarities.

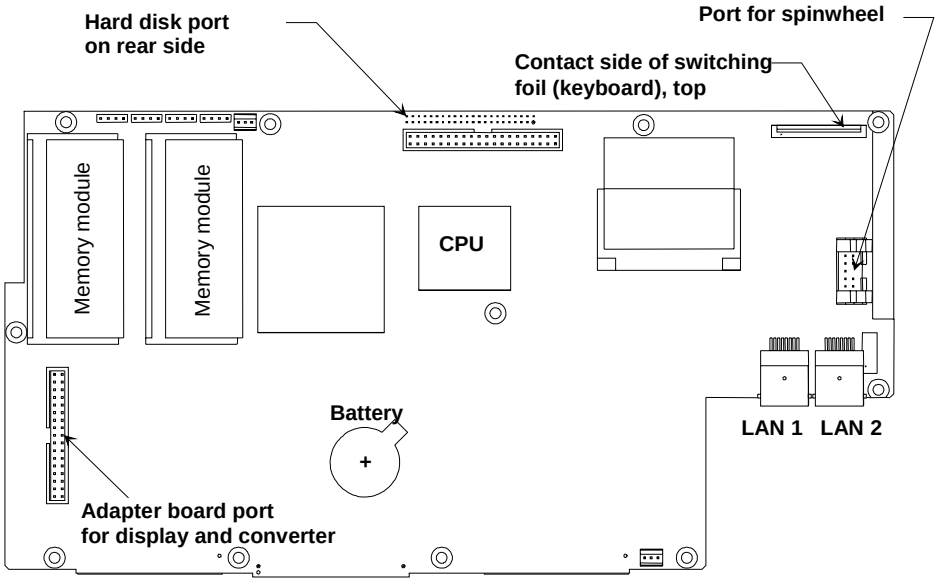


Fig. 3-8 Installing a new front module controller - position of connectors

- Rotate the front panel into the instrument and screw with four countersunk screws (610) in the front frame at the top and at the bottom.



Caution:

Make sure to route the cables properly.

- Install the labelling panel (270).
- Push the 2 front handles (420) on the instrument and mount them with the 4 screws (430).
- Replace the volume control knob (Option FSP-B3), if it was removed.

Putting into Operation

- Connect the instrument to the mains and switch on the instrument power switch. The instrument is now in stand-by mode.
- Insert a floppy disk with DOS and BIOS-Update in the floppy disk drive.
- Switch ON the FSP and wait until the first beep. Press the FILE key. The BIOS-Update starts.
- During the programming of the flash EEPROM the FSP must not be switched off.
- Follow the message indicated on the display, then switch off and on the FSP.
- After starting the instrument check for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- Start selftest and check results:
  - [**SETUP** : SELFTEST] , then- [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]

Replacing the Lithium Battery on the Front Module Controller

(*See chapter 5, spare parts list, item 775, and explosion drawings 1093.4495 and 1093.4537.)*

The lithium battery is accommodated on the front module controller board behind the front panel.



Caution:

Lithium batteries must not be exposed to high temperatures or fire.

Keep away from children.

If the battery is replaced improperly, there is danger of explosion. Only replace the battery by R&S type (see spare parts list, item 775).

Lithium batteries are hazardous waste and must be disposed of in dedicated containers.

Do not short-circuit the battery!

Opening the Instrument and Removing the Front Panel

- Switch off the instrument and pull the mains plug.
- Unscrew the four screws (430) of the front handles on both sides and take off the front handles.
- Remove the volume control knob (Option FSP-B3), if present, by pulling it off.
- Pull off the labelling panel (270) towards the front.
- Unscrew each two countersunk screws (610) in the front frame at the top and at the bottom.

Remove the front panel with keyboard and display (600, 620, 630, 640, 650, 660) to the front and rotate it to the top of the instrument

Removing the Lithium Battery

➢ Carefully push contact springs of the battery holder up and remove battery.

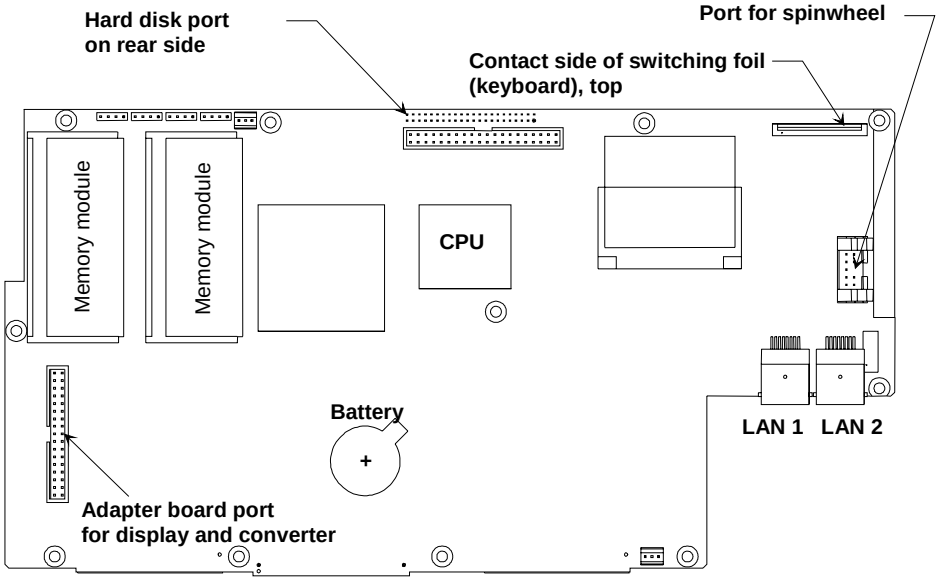


Fig. 3-9 Position of lithium battery and jumper 12 on the front module controller

Installing the New Battery and Completing the Instrument

- Carefully push contact springs of the battery holder up and insert battery into the holder beneath the springs.

  Note: *The plus pole (+) of the battery points upwards.*



Warning!
Do not short-circuit the battery!

- REFRotate the front panel into the instrument and screw with four countersunk screws (610) in the front frame at the top and at the bottom.



Caution:
Make sure to route the cables properly.

- Install the labelling panel (270).
- Push the 2 front handles (420) on the instrument and mount them with the 4 screws (430).
- Replace the volume control knob (Option FSP-B3), if it was removed.

Putting into Operation

- Connect the instrument to the mains and switch on the instrument power switch. The instrument is now in stand-by mode.
- After the change of the battery a cold boot is necessary. See section "Performing a Cold Boot" in this chapter.
- After starting the instrument check for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]

Replacing Hard Disk A60

(*See chapter 5, spare parts list, item 710, and explosion drawings 1164.4391 and 1164.4404.)*

The hard disk is incorporated between the front module and the analog boards.
The spare part is already formatted for the FSP and contains the complete software.

Opening the Instrument and Removing the Hard Disk

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the two countersunk screws (260) at the top of the instrument and the three countersunk screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Disconnect the ribbon cable (720) at the hard disk.
- Unscrew the two countersunk screws (740) on the hard disk mounting plate (730).
- Take the hard disk (710) completely with the hard disk mounting plate (730 out of the FSP.
- Unscrew the four countersunk screws (750) remove the hard disk and mount a new hard disk to the mounting plate (730).

Installing the New Hard Disk and Putting into Operation

- Fit the hard disk and the disk holder with two screws (740) to the instrument
  Note: *Be careful with the lower cover plate locking in the corresponding opening.*
- Connect the ribbon cable (720) to the hard disk.
  Note: *Connect cable as drawing* 1164.4404.
- Put the top cover (240) on the instrument and mount it with two countersunk screws (260) and three countersunk screws (250).
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains and switch on the instrument power switch. The instrument is now in stand-by mode.
- After the change of the hard disk a cold boot is necessary. See section "Performing a Cold Boot" in this chapter.

- After starting the instrument check for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]

Replacing Flash Disk A60 (Option FSP-B20)

(See chapter 5, spare parts list, item 1700, and drawings 1093.4495 and 1155.1612.)

The flash disk is located in the instrument between the controller panel and the modules. The spare part is supplied with pre-installed software.

Opening the Instrument and Removing the Flash Disk

- Switch off unit, disconnect it from power supply, unscrew 4 rear-panel feet (450) and pull off enclosure (410) towards rear.
- Unscrew the two countersunk screws (260) at the top of the instrument and the three countersunk screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Disconnect the ribbon cable (720) on the flash disk.
- Unscrew the two countersunk screws (740) on the flash disk mounting plate (730).
- Remove the flash disk (1700) with the mounting plate (730).

Replacing the Compact Flash Board A60

- Undo 4 countersunk screws (750), remove compact flash board (1700) and screw the new board to the mounting plate (730).

Replacing the Flash Memory A61

- Unlock and disconnect 2 flash memory cards (1713). Insert the new flash memory cards according to the labelling in view A and lock them in place with the clamp (1730).

Installing the New Flash Disk and Putting into Operation

- Using two countersunk screws (740), fasten the flash disk and the disk holder to the instrument.

  Note: *The disk holder is plugged into a metal panel at the bottom.*

- Connect the ribbon cable (720) to the flash disk.

  Note: *Connect cable as shown in drawing 1164.4404 in chapter 5.*

- Put the top cover (240) on the instrument and fasten it in place with 2 countersunk screws (260) and 3 countersunk screws (250).
- Slide on enclosure (410) and screw on 4 rear-panel feet (450).
- Connect the AC supply cable and switch on the power switch. The unit is now in the standby mode.
- A cold boot is required after replacing the flash disk. See section "Performing a Cold Boot" in this chapter.

- After starting the instrument, make sure that no messages are recorded in the log file:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]
- Start the selftest and check the results to make sure that no errors occurred:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start the system error correction and check the results to make sure that no errors occurred:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]

Replacing the LCD and DC/AC Converter in the Front Module

(See chapter 5, *spare parts list, items 600 and 870, and explosion drawings 1164.4391, 1164.4404, 1093.4708.*)

The LCD is accommodated on the mounting plate together with the associated DC/AC converter. It is connected to the front module controller via cables, which can also be replaced individually. For replacement proceed as follows:

Opening the Instrument and Removing the Front Module

- Switch off the instrument and pull the mains plug.
- Unscrew the four screws (430) of the front handles on both sides and take off the front handles.
- Remove the volume control knob (Option FSP-B3), if present, by pulling it off.
- Pull off the labelling panel (270) towards the front.
- Unscrew two countersunk screws (610) in the front frame each at the top and at the bottom.
- Remove the front panel with keyboard and display (600, 620, 630, 640, 650, 660) to the front and rotate it to the top of the instrument.



Caution:

Note the connecting cables are still connected to the controller

- Pull off the connecting cables to the adapter board (LCD, DC/AC illumination converter), keyboard membrane and spinwheel.

  Note: *When pulling off the connecting cables be careful with the cable connecting to the keyboard. It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.*

- Place the Front Module onto a clean surface.

Removing the DC/AC Converter

- Pull off the plug of the connecting cable to the DC/AC converter (870).
- Unplug the display cable (947) leading from the adapter board to the DC/AC converter (870) on the converter.
- Unscrew the two screws (890) and remove the DC/AC converter (870) with the *spacing pieces* (900).

Removing the LCD

- Unscrew two screws with washers (950) and plug off the display cable (947)
- Unscrew the four screws at the display (930) and remove the display.

Installing the New LCD and DC/AC Converter and Completing the Instrument

- Install the new LCD or new DC/AC converter in reverse order, fasten all screws, and connect and mount the corresponding cables.
- **When mounting the display cable (947), make sure it is free of mechanical stress.**
- Observe the following order when installing parts:
  1) Before installing the display, connect the display cable (947) to the adapter board. You must hear the connection engage.
  2) Reattach the display (920) with four screws (930).
  3) Mount the display cable (947) with 2 screws (950), making sure it is free of mechanical stress.
- Place the front panel with the keys on the top of the instrument, with the cables in the right direction to the front module controller.
- Carefully plug the cable connectors to the controller board without reversing the polarities and replace the mounting plate in the reverse order.

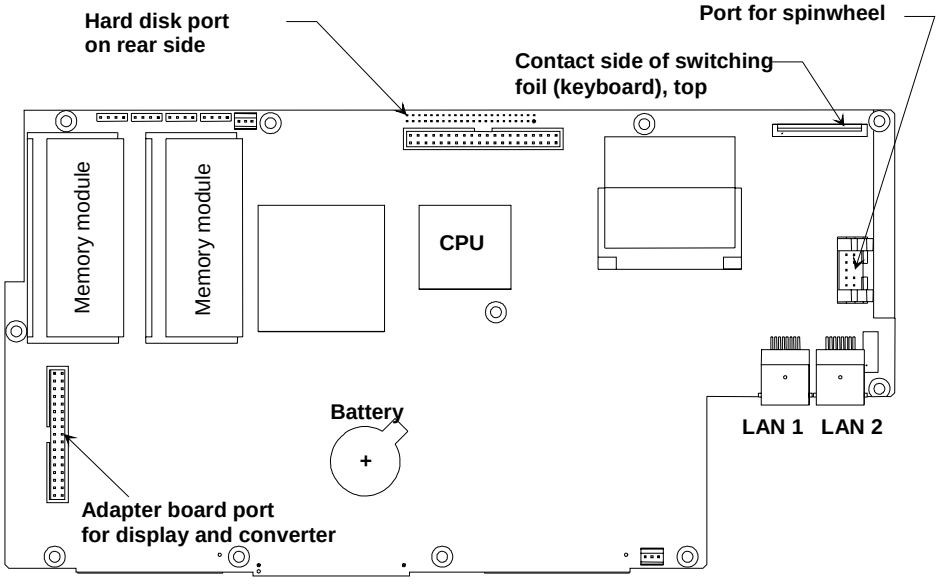


Fig. 3-10 Position of connectors on front module controller

- Rotate the front panel into the instrument and screw with four countersunk screws (610) in the front frame at the top and at the bottom.

Caution:
Make sure to route the cables properly.

- Install the labelling panel (270).
- Push the 2 front handles (420) on the instrument and mount them with the 4 screws (430).
- Replace the volume control knob (Option FSP-B3), if it was removed.
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key

Replacing the Keyboard Membrane or Mat on the Front Module

(See chapter 5, *spare parts list, items 630 and 640, and explosion drawings 1164.4391, 1164.4404.)*

The keyboard membrane is the contact film for the rubber keys (mat) behind the labelling panel and the keyboard frame. For replacement proceed as follows:

Opening the Instrument and Removing the Front Panel

- Switch off the instrument and pull the mains plug.
- Unscrew the four screws (430) of the front handles on both sides and take off the front handles.
- Remove the volume control knob (Option FSP-B3), if present, by pulling it off.
- Pull off the labelling panel (270) towards the front.
- Unscrew each two countersunk screws (610) in the front frame at the top and at the bottom.
- Remove the front panel with keyboard and display (600, 620, 630, 640, 650, 660) to the front and rotate it to the top of the instrument.



Caution:

Note the connecting cables are still connected to the controller .

- Pull off the connecting cables to the adapter board (LCD, DC/AC illumination converter), keyboard membrane and spinwheel.

  Note: *When pulling off the connecting cables be careful with the cable connecting to the keyboard. It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.*

Removing the Membrane

- Place the mounting plate onto the surface with the keyboard frame pointing upwards.
- Pull off the knob (650) of the spinwheel.
- Unscrew the 10 countersunk screws (660) and remove the keyboard frame (620).
- The keyboard membrane (640) as well as the mat (630) is now accessible.

Installing the New Membrane and Completing the Instrument

- Put the new mat (630) into the keyboard frame (620).

  Note: *The pins of the mat must be pressed in the wholes at the keyboard frame.*

- Locate the new keyboard membrane (640) on the back of the mat (630) .

  Note: *Push the foil cable of the membrane through the slit in the mounting panel.*
  The membrane must be positioned to let the pins of the mat come trough the holes in the membrane.

- Locate the mounting plate with the display (600) onto the membrane (640) .

  Note: *The mounting plate must be positioned to let the pins of the mat come trough the holes in the mounting plate (800).*

- Press the front panel together, turn the keys to the top and screw ten countersunk screws (660) into the keyboard frame.
- Place the front panel with the keys on the top of the instrument, with the cables in the right direction to the front module controller.
- Carefully plug the cable connectors to the controller board without reversing the polarities and replace the mounting plate in the reverse order.

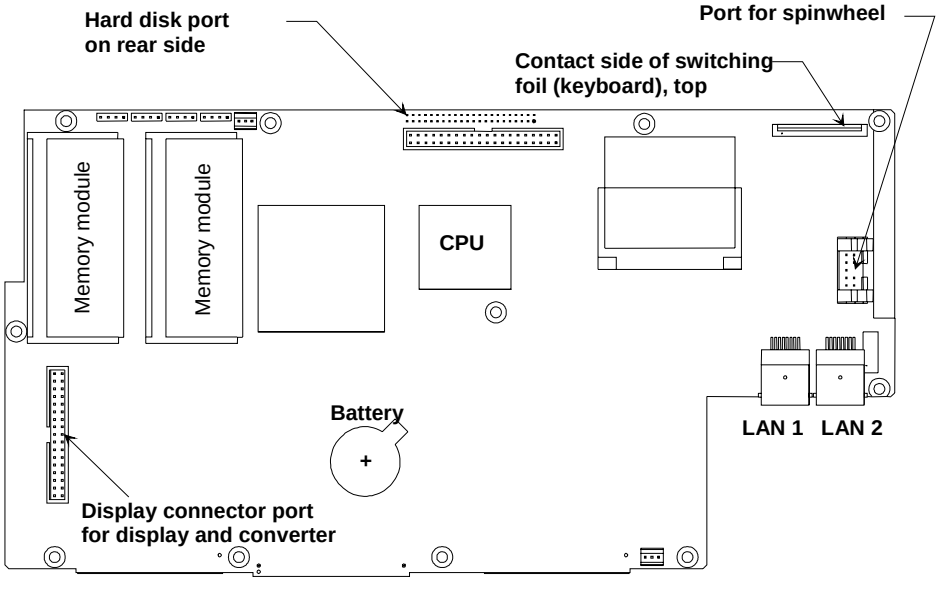


Fig. 3-11 Position of connectors on front module controller

- Rotate the front panel into the instrument and screw with four countersunk screws (610) in the front frame at the top and at the bottom.



Caution:

Make sure to route the cables properly.

- Install the labelling panel (270).
- Push the 2 front handles (420) on the instrument and mount them with the 4 screws (430).
- Replace the volume control knob (Option FSP-B3), if it was removed.
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key

Replacing the Labelling Panel on the Front Module

(See chapter 5, spare parts list, items 270 and 280, and explosion drawing 1093.4495.)

The labelling panel is the outer front panel which carries the labelling of all the parts on the front side of the FSP. Every model has its own labelling panel (270, 280, 290)

- Switch off the instrument and pull the mains plug.
- Unscrew the four screws (430) of the front handles on both sides and take off the front handles.
- Remove the volume control knob (Option FSP-B3), if present, by pulling it off.
- Pull off the labelling panel (270) towards the front.
- Install the New labelling panel and tighten all screws.
- Complete the instrument.
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key

Replacing the Floppy Disk Drive A30

(See chapter 5, spare parts list, item 670, and explosion drawings 1164.4391, 1164.4404.)

Opening the Instrument and Removing the Floppy Disk Drive

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the two countersunk screws (260) at the top of the instrument and the three countersunk screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Remove two screws (700) at the fan side of the FSP and carefully pull out the Floppy Disk Drive (670) with Floppy mounting plate (680) to the upper side.

  Note: *The connecting cable is still connected to the motherboard .*
- Disconnect the cable at the floppy disk drive .

  Note*: Please take note of the correct direction of the cable (contact side)*

Install the New Floppy Disk Drive and Completing the Instrument

- Unscrew the three screws with washers (700) and remove the floppy disk from the mounting plate (680) and mount a new disk drive (670) to the floppy mounting plate (680).
- Connect the foil cable (690) to the disk drive (Note the contact side of the cable).
- Insert the floppy mounting plate (680) and mount it to the fan side with two screws with washers (700).

  Note: *Please mount the floppy disk drive in the middle of the front panel break out.*
- Put the top cover (240) on the instrument and mount it with two countersunk screws (260) and three countersunk screws (250).
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key

Function Test

- Instrument is booting and the firmware is starting.
- Insert 3 ½ ″ disk with any files.
- Press the FILE key then the File Manager and Edit Path softkeys.
- Enter "a" and ":" and confirm with "Enter" key.
- The file structure of the inserted disk must be displayed.

Replacing the Power Supply A20

(See chapter 5, spare parts list, item 550, and explosion drawing 1164.4404).

The power supply is fitted at the rear of the instrument frame of the FSP.

Removing the Power Supply

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the ten screws (560) at the rear of the power supply.
- Pull out the power supply approx. 20 mm towards the rear, slightly tilt towards the bottom and then pull out completely.

Installing the New Power Supply

- Install the New power supply in the reverse order.
  Note: *Make sure that the 96-contact connector to the MOTHERBOARD locks in place correctly.*
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains and switch on.
- After starting the instrument check for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]

Replacing the Fan

(See chapter 5, spare parts list, item 15, and explosion drawings 1164.4391.)

The fan is fitted at the right side of the frame.

Opening the Instrument and Removing the Fan

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the two countersunk screws (260) at the top of the instrument and the three countersunk screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Disconnect the fan cable at the motherboard connector X35 (FAN) .
- Unscrew the four screws off the FAN (15) and remove the fan.

Installing the New Fan and Completing the Instrument

- Connect the fan cable at the motherboard connector X35 (FAN)
- Insert the new fan and mount it to the frame with 4 pieces fan screws.

  Note: *Please note the direction of the airflow printed on the fan. The fan must blow the cold air into the instrument.*

  Make sure to route the cables with enough space to the fan.
- Put the top cover (240) on the instrument and mount it with two countersunk screws (260) and three countersunk screws (250).
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key

Replacing the RF Input Connector (Cable W1)

(See chapter 5, spare parts list, items 295, 310, 315, 322, and explosion drawing 1164.4391.)

The RF input connector is fitted at the right lower side of the front panel.
Depending on the frequency range two different models of the connector are available.

Opening the Instrument and Removing the Cable W1

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the four screws (430) of the front handles on both sides and take off the front handles.
- Remove the volume control knob (Option FSP-B3), if present, by pulling it off.
- Pull off the labelling panel (270) towards the front.
- Remove three countersunk screws (70) at the frame and 236 countersunk screw (70) at the connector mounting plate (60).
- Unscrew the cable W1 (295) to 7 GHz, (310) to 13.6 GHz, (315) to 30 GHz or (322) to 40 GHz at the RF attenuator (20), (30) or (35).
- Remove the connector mounting plate (60) together with W1 and Probe/Key module (50) to the front.
  ***Note**: The Probe/Key module (50) is connected via a ribbon cable to the motherboard X80.*
- Unscrew the four countersunk screws (350) and remove cable W1 together with mounting plate (330) or (340).

Installing the New Cable and Completing the Instrument

- Put the mounting plate (330) or (340) onto the new cable W1 and mount the connector with four countersunk screws (350), move the mounting plate (60) back to the instrument and connect cable W1 (295) or (315) to the input of RF attenuator.
- Screw three countersunk screws (70) to the instrument frame and two countersunk screws (70) to the mounting plate (60).
- Install the labelling panel (270).
- Push the 2 front handles (420) on the instrument and mount them with the 4 screws (430).
- Replace the volume control knob (Option FSP-B3), if it was removed.
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key
- Start selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check frequency response with chapter 1 and do a correction if necessary.

Replacing the Motherboard A10

*(*See chapter 5*, spare parts list, item 515, and explosion drawings* 1164.4391, 1164.4404*.)*

The motherboard is fitted from the bottom side.

Opening the Instrument and Removing the Motherboard

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the two countersunk screws (260) at the top of the instrument and the three countersunk screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Place the instrument on the left side frame and loosen all connecting cables to the boards.
- Push out all boards to the top side of the instrument.

  Note: *The boards can be moved up by pressing carefully from the downside through the connector wholes in the motherboard against the boards.*
- Removing the power supply(550).
  Unscrew the ten screws (560) at the rear of the power supply.
  Pull out the power supply approx. 20 mm towards the rear, slightly tilt towards the bottom and then pull out completely.
- Unscrew the four screws (430) of the front handles on both sides and take off the front handles.
- Remove the volume control knob (Option FSP-B3), if present, by pulling it off.
- Pull off the labelling panel (270) towards the front.
- Unscrew each two countersunk screws (610) in the front frame at the top and at the bottom.
- Remove the front panel with keyboard and display (600, 620, 630, 640, 650, 660) to the front and rotate it to the top of the instrument.



Caution:
Note the connecting cables are still connected to the controller .

- Pull off the connecting cables to the adapter board (LCD, DC/AC illumination converter), keyboard membrane and spinwheel.

  Note: *When pulling off the connecting cables be careful with the cable connecting to the keyboard. It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.*
- Remove the front module controller (see chapter: Replacing the Front Module Controller A90)
- Remove the screws of all motherboard connectors at the rear panel . Unscrew the bolts (530) at the "COM" and "LPT" ports and (540) aa "Monitor" port. Unscrew the nuts at "Noise Source" and "Ext. Trig" connectors and the bolts at the "IEC" port.

  Note: *Do not change the bolts of the “Monitor” and the “LPT” or “COM” !*
- Pull off the connecting cables at the motherboard (RF attenuator, fan, floppy, Probe/Key, rear panel, ...).
- Unscrew five screws with washers in bottom side of the motherboard
- Move the motherboard (515) carefully to the front panel (approx. 15 mm) and lift it out of the instrument to the downside.

Installing the New Motherboard and Completing the Instrument

- Insert the motherboard into the instrument in the reverse order.

  Note: *Please move the motherboard carefully to the rear panel without causing damage to the parts on the board.*
  Connect all cables (see label on cable for position).

- Insert the front module controller, front panel, power supply, boards and cables, top cover, tube and rear panel feet in reverse order.

- A cold boot is necessary after replacing the motherboard.
  See section "Performing a Cold Boot" in this chapter.

- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key

- After starting the instrument check for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**

- Start selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]

- Start a total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]

- Store the serial number of the instrument to the EEPROM:
  - [**SETUP** : SERVICE : ENTER PASSWORD „30473035“] , then input serial number of the instrument in HW-Info table (see also Chapter 2, Section "Automatic Adjustment of Module Data").

Replacing the Module RF Attenuator A40

(See chapter 5, spare parts list, items 20, 30, 35, and explosion drawing 1164.4391.)

The RF attenuator is fitted at the bottom side behind the RF input connector.
There are different models of the attenuator for instruments up to 7 GHz (20), 30 GHz (30) and 40 GHz (35).

Opening the Instrument and Removing the RF Attenuator

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Place the instrument on the left side and unscrew the RF cable or the diplexer (150, only with FSP30) at the RF output of the RF attenuator.
- Unscrew the two screws with washers (40) at the right frame.
  ***Note**: The RF attenuator will only be fixed with the RF cables at the front.*
- Disconnect RF-cable W1 (295), (315) or (322) at the input of the RF attenuator.
- Move carefully out the RF attenuator and disconnect the flexible RF-cable at the input.
- Disconnect ribbon cable at motherboard connector X40.

Installing the New RF Attenuator and Completing the Instrument

- Connect the ribbon cable of the new RF Attenuator (20), (30) or (35) at motherboard connector X40.
- Connect the flexible RF-cable at the input of new RF Attenuator (see label on cable)
- Move the new RF Attenuator in the instrument and connect cable W1 (295), (315) or (35) at the input.
- Screw the two screws with washers (40) at the right frame in the RF attenuator.
- Screw the RF cable or the diplexer (150, only with FSP30) at the RF output of the RF Attenuator.
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).

A cold boot is necessary after replacing the attenuator.
See section "Performing a Cold Boot" in this chapter.

- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key

- After starting the instrument check for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Create a backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").
- Check frequency response with chapter 1 and make a correction if necessary.

Replacing the Key/Probe Module A80 and Vol./Phone Board A191 (Option FSP-B3)

(See chapter 5, spare parts list, items 50 and 1040, and explosion drawings 1164.4391, 1129.6450.)

The boards are fitted behind the front panel connectors Keyboard, Probe, Headphone and the volume control knob.

Opening the Instrument and Removing the Boards

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the four screws (430) of the front handles on both sides and take off the front handles.
- Remove the volume control knob (Option FSP-B3), if present, by pulling it off.
- Pull off the labelling panel (270) towards the front.
- Remove three countersunk screws (70) at the frame and 1 countersunk screw (70) at the connector mounting plate (60).
- Unscrew the cable W1 (310) , W1 (315)) or (322) at the RF attenuator (20) or (30).
- Remove the mounting plate (60) completely with W1 and Probe/Key board (50) and option Vol./Phone Board (1040) to the front side.

  ***Note**:* *The Probe/Key (50) and Vol./Phone boards (1040) are connected with a ribbon cable to the motherboard X80 and X81.*
- Disconnect the ribbon cable at the motherboard connector X80 and X81.
- Unscrew the three countersunk screws (55) and remove the board Key-Probe (50).
- Undo the three countersunk screws (1060) and remove the board Vol./Phone Board (1040) from mounting plate (60) .
- Undo the screw with washers (1055) and the nut of the volume control at the mounting plate (1050) and remove Vol./Phone Board (1040) .

Installing the New Modules and Completing the Instrument

- Mount the new Key-Probe board (50) with three countersunk screws (55) to mounting plate (60).
- Mount the new Vol./Phone Board (1040) with the nut of the volume control and one countersunk screw (1055) to the mounting plate (1050). Mount Vol./Phone board (1040) with three countersunk screws (1060) to mounting plate (60).
- Connect the ribbon cable at motherboard-connector X80 and X81.
- Move the complete mounting plate (60) carefully back in the instrument.



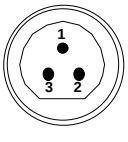
Caution

Make sure to route the cables properly.

- Connect RF-cable W1 (295) , (315)) or (322) at the input of the RF Attenuator (20) or (30).
- Screw three countersunk screws (70) to the instrument frame and two countersunk screws (70) to the mounting plate (60).
- Install the labelling panel (270).
- Push the 2 front handles (420) on the instrument and mount them with the 4 screws (430).
- Replace the volume control knob (Option FSP-B3), if it was removed.
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).

Function Test

- Connect a suitable keyboard to the keyboard jack.
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key
- Press the "Ctrl" and "Esc" keys on the keyboard simultaneously; the Windows-XP taskbar appears at the bottom of the screen.
- Measure the output voltage at the probe connector (see Fig. 3-12 Pin assignments of PROBE POWER connector).
- Connect a keyboard to the instrument and test the function.
- If the option FSP-B3 (AF demodulator) is fitted, test the function of headphone connector and volume control. Press the *MKR* key, and press the *MARKER DEMOD* softkey. Noise can be heard in the loudspeaker, the volume can be changed with the *VOLUME* knob at the front panel. Connect a headphone to the *AF OUTPUT* at the front panel, the loudspeaker must be switched off and the noise can be heard in the headphone.



Pin	Signal
1	GND
2	-12.6 V
3	+15 V

Fig. 3-12 Pin assignments of PROBE POWER connector

Replacing the RF Frontend A100

(See chapter 5, spare parts list, item 100, and explosion drawing 1164.4391.)

The RF Frontend is installed in the middle of the instrument .

Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the two countersunk screws (260) at the top of the instrument and the three countersunk screws (250)) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Place the instrument on the left side frame and loosen all connecting cables to the board.
- Push out board to the top side of the instrument.

  Note: *The board can be moved up by pressing carefully from the downside through the connector wholes in the motherboard against the board.*

Installing the New RF Frontend Module and Completing the Instrument

- Plug the new board into the instrument and reconnect all cables to the board.

  Note: *Please refer to the cable wiring drawing on the motherboard.*
- Put the top cover (240) on the instrument and mount it with two countersunk screws (260) and three countersunk screws (250).
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).

A cold boot is necessary after replacing the frontend.
See section "Performing a Cold Boot" in this chapter.

- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key
- After starting the instrument check for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check frequency response with chapter 1 and make a correction if necessary, using the correction software.
- Create a backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing the Detector A120 or A140 (Option FSP-B70)

(See chapter 5, spare parts list, item 1100 or 1900, and explosion drawing 1164.4391.)

The board is installed in the front part of the instrument.

Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the two countersunk screws (260) at the top of the instrument and three countersunk screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Place the instrument on the left side frame and loosen all connecting cables to the board.
- Push out board to the top side of the instrument.

  Note: *The board can be moved up by pressing carefully from the downside through the connector holes in the motherboard against the board.*

Installing the New Module and Completing the Instrument

- Plug the new board into the instrument and reconnect all cables to the board.

  Note: *Please refer to the cable wiring drawing on the motherboard.*
- Put the top cover (240) on the instrument and mount it with two countersunk screws (260) and three countersunk screws (250).
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).

A cold boot is necessary after replacing the detector.
See section "Performing a Cold Boot" in this chapter.

- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key

- After starting the instrument check for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Create a backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing the IF Filter A130

(See chapter 5, spare parts list, item 120, and explosion drawing 1164.4391.)

The board is installed in the middle of the instrument.

Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the two countersunk screws (260) at the top of the instrument and three countersunk screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Place the instrument on the left side frame and loosen all connecting cables to the board.
- Push out board to the top side of the instrument.

  Note: *The board can be moved up by pressing carefully from the downside through the connector holes in the motherboard against the board.*

Installing the New Module and Completing the Instrument

- Plug the new board into the instrument and reconnect all cables to the board.

  Note: *Please refer to the cable wiring drawing on the motherboard.*
- Put the top cover (240) on the instrument and mount it with two countersunk screws (260) three countersunk screws (250).
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key
- A cold boot is necessary after replacing the flash disk. See section "Performing a Cold Boot" in this chapter.
- After starting the instrument check for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check frequency accuracy and the calibration source level with chapter 1 and readjust with chapter 2 if necessary.
- Create a backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").
- Write the calibration data to the EEPROM (see chapter 2, section "Adjustment of Module Data").

Replacing the MW Converter Unit A160

(See chapter 5, spare parts list, items 130 to 141, and explosion drawing 1164.4391.)

The board is installed in the middle of the instrument.

Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the two countersunk screws (260) at the top of the instrument and three countersunk screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Place the instrument on the left side and loosen all cables at the bottom to the board.
- Push out board to the top side of the instrument.

  Note: *The board can be moved up by pressing carefully from the downside through the connector wholes in the motherboard against the board.*

Installing the New Module and Completing the Instrument

- Plug the new board into the instrument and reconnect all cables to the board.

  Note: *Please refer to the cable wiring drawing on the motherboard.*
- Put the top cover (240) on the instrument and mount it with two countersunk screws (260) and three countersunk screws (250).
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key
- After starting the instrument check for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Execute software frequency response correction FSP-FRQ.EXE
  The software is located on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference)
  - Check IEC/IEEE addresses and configuration of the instrument
  - Press Autoselect button and execute measurement with Run.
  - The frequency correction of the YIG filter is performed in the YIG section.
  - After calibration, the frequency response is corrected over the entire frequency range.
- Create a backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing Diplexer A162; FSP7

(See chapter 5, spare parts list, item 2030, and drawing 1130.2544.)
(See chapter 5, spare parts list, item 2006, and drawing 1130.2396.)
(See chapter 5, spare parts list, item 40, and drawing 1093.7994.)
The board is installed on the 8 GHz converter unit (1130.2544, 1130.2396) or the 7 GHz converter unit (1093.7994).

Removing Diplexer on MW Converter 1130.2369

- Remove the 8 GHz converter unit (130).
  Note: *See description "Replacing the MW Converter Unit A160".*
- Remove cable W1 from the diplexer (2006).
- Undo 4 screws with washers (2008) at the bottom of the printed board.
- Take off the diplexer (2006) perpendicularly to the PCB.
  Note: *The diplexer is still connected to the PCB with contact pins.*

Installing Diplexer on MW Converter 1130.2369

- Plug in new diplexer (2006) perpendicularly to the PCB.
  Note: *The diplexer is still connected to the PCB with contact pins.*
- Refasten 4 screws with washers (2008) to the bottom of the PCB.
- Fit cable W1 to diplexer (2006).

Removing Diplexer on MW Converter 1130.2544

- Remove 8 GHz converter unit (130).
  Note: *See description "Replacing 8 GHz Converter Unit A160"*
- Disconnect cable W1 from diplexer (2030).
- Undo 4 screws with washers (2035) from the bottom of the PCB.
- Remove diplexer (2006) perpendicularly to the PCB.
  Note: *The diplexer is still connected to the PCB with contact pins.*

Installing Diplexer on MW Converter 1130.2544

- Plug in new diplexer (2030) perpendicularly to the PCB.
  Note: *The diplexer is connected to the PCB with contact pins.*
- Refasten 4 screws with washers (2035) to the bottom of the PCB.
- Fit cable W1 to diplexer (2030).

Completing the Instrument and Frequency Response Correction

- Insert 7/8 GHz converter unit (130) back into the instrument.

  Note: *See description "Replacing MW Converter Unit A160".*

- Execute frequency response correction software FSP-FRQ.EXE.
  The software is located on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press Autoselect button and perform the measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.

Replacing 7/8 GHz YIG Unit A161; FSP7

(See chapter 5, spare parts list, items 2005, 2010, and drawing 1130.2544.)

The board is installed on the 8 GHz converter unit (1130.2544, 1130.2396.

Note: *Only the YIG units (with YIG filter, cable, sheet metal part) are replaced. The interface is thus always the same when using other YIG filters.*

Removing 8 GHz YIG Unit on MW Converter 1130.2396

- Remove 8 GHz converter unit (130).

  Note: *See description "Replacing MW Converter Unit A160".*

- Remove the two module covers by undoing the screws from the bottom of the module.
- Disconnect cable W1 from the diplexer (2006) and cable W2 from the 8 GHz converter circuit (2000).
- Depending on the YIG unit used, disconnect cable from YIG filter to X4.
- Undo 2 countersunk screws (2004).
- Remove the complete YIG unit (2002 or 2003).

  Note: *YIG Unit 1130.2744.02 (2002) is connected to the PCB via contacts. Remove the YIG unit towards the top perpendicularly to the PCB.*

Installing 8 GHz YIG Unit on MW Converter 1130.2396

- Put the new YIG unit (2002 or 2003) onto the PCB.

  Note: *YIG Unit 1130.2744.02 (2002) is connected to the PCB via contacts. Plug YIG unit to connector contacts from the top perpendicularly to the PCB.*

- Fasten YIG unit with 2 countersunk screws (2004).
- Screw on cable W1 to the diplexer (2006) and connect cable W2 to 8 GHz converter circuit (2000).
- Depending on the YIG unit used, connect cable from YIG filter at X4.
- Fit the module cover onto the top of the converter unit (positioning by means of adjusting pins). Turn 8 GHz converter unit upside down, fit module cover to the bottom side and refasten all screws.

Removing 8 GHz YIG Unit on MW Converter 1130.2544

- Remove 8 GHz converter unit (130).

  Note *See description "Replacing MW Converter Unit A160."*

- Remove the two module covers by undoing the screws from the bottom of the module.
- Disconnect cable W1 from the diplexer (2030) and cable W2 from the 8 GHz converter circuit (2000).
- Depending on the YIG unit used, disconnect cable from YIG filter at X4.
- Undo 2 countersunk screws (2025).
- Remove the complete YIG unit (2005 or 2010).

  Note: *YIG Unit 1130.2944.02 (2005) is connected to the PCB via contacts. Remove the YIG unit towards the top perpendicularly to the PCB.*

Installing 8 GHz YIG Unit on MW Converter 1130.2544

- Put the new YIG unit (2005 or 2010) onto the PCB.

  Note: *YIG Unit 1130.2944.02 (2002) is connected to the PCB via contacts. Plug YIG unit into connector contacts from the top perpendicularly to the PCB.*

- Fasten YIG unit with 2 countersunk screws (2025).
- Screw on cable W1 to the diplexer (2030) and connect cable W2 to 8 GHz converter circuit (2000).
- Depending on the YIG unit used, connect cable from YIG filter at X4.
- Fit the module cover onto the top of the converter unit (positioning by means of adjusting pins). Turn 8 GHz converter unit upside down, fit module cover to the bottom side and refasten all screws.

Completing the Instrument and Frequency Response Correction

- Put 8 GHz converter unit (130) back into the instrument.
  Note: *See description "Replacing MW Converter Unit A160".*
- Execute frequency response correction software FSP-FRQ.EXE.
  The software is located on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform the measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.

Temperature Adjustment and Test of the YIG Filter

- A digital temperature adjustment is to be performed for the following MW converters:
  - MW converter unit 8: 1130.2544 Mod: XX Rev: ≥ 05 Subrev: ≥ 01
  - All other MW converters should undergo analog adjustment.
- Analog adjustment for converter unit 1130.2396 and for converter unit 1130.2544 with HWC = 00:
  - Connect the RF output of the signal generator to the RF input of the FSP
  - Activate the YIG filter sweep with the service function:
    Password 30473035
    Service funct. 2.16.10.1
  - Span on FSP7: 200 MHz
  - Set the signal generator frequency an the center frequency to 5 GHz
    Nominal value: Temperature drift (0 to 50 C) < 8 MHz
  - If X21 is used for temperature compensation, the temperature drift can be adapted via trimming resistor R232 or trimming value R374.
- Digital adjustment:
  - Place FSP7 into a climatic chamber for 2 hours at 50°C.
  - Execute frequency response correction software FSP-FRQ.EXE.
    The software is located on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference)
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the TK adjustment button.
  - Place FSP7 into a climatic chamber for 2 hours at 0°C in the switched-off state.
  - Switch on the instrument and repeat the coldness adjustment

Adjustment of Module Data

- Create a backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing Diplexer (30 GHz) A230; FSP13/30

(See chapter 5, spare parts list, item 150, and drawing 1093.4495.01.)
In FSP13/30, the module is behind the attenuator on the right-hand side.

Removing Diplexer

- Disconnect cable X71 from motherboard (515).
- Disconnect cables W2 and W30 from diplexer (150).
- Disconnect diplexer (150) from attenuator (30).
- Remove diplexer (150).

Installing Diplexer

- Screw on diplexer (150) to attenuator (30).
- Fasten cables W2 and W30 to diplexer (150).
- Connect cable X71 to motherboard (510).

Completing the Instrument and Frequency Response Correction

- Execute frequency response correction software FSP-FRQ.EXE.
  The software is located on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform the measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.
- Create a backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing 13/30 GHz YIG Unit A161; FSP13/30

(See chapter 5, spare parts list, items 2115, 2120, 2125, 2130, and drawing 1093.8249.)
The board is installed on the 13/30 GHz converter unit (1093.8249).

Note: *Only the YIG units (with YIG filter, cable, sheet metal part) are replaced. The interface is thus always the same when using other YIG filters.*

Removing 13 GHz YIG Unit on MW Converter 1093.8249

- Remove 13 GHz converter unit (135).
  Note: *See description "Replacing MW Converter Unit A160".*
- Remove the two module covers by undoing the screws from the bottom of the module.
- Disconnect cable W2 from the RF extension (2140)
- Disconnect the cable from the YIG filter at X4.
- Undo 4 countersunk screws (2135).
- Remove the complete YIG unit (2115 or 2120).

Installing 13 GHz YIG Unit on MW Converter 1093.8249

- Put the new YIG unit (2115 or 2120) onto the PCB.
- Fasten YIG unit with 4 countersunk screws (2135).
- Screw on cable W2 to the RF extension (2140).
- Connect the cable from the YIG filter at X4.
- Fit the module cover onto the top of the converter unit (positioning by means of adjusting pins). Turn 13 GHz converter unit upside down, fit module cover to the bottom side and refasten all screws.

Removing 30 GHz YIG Unit on MW Converter 1093.8249

- Remove 30 GHz converter unit (140).
  Note: *See description "Replacing MW Converter Unit A160".*
- Remove the two module covers by undoing the screws from the bottom of the module.
- Disconnect cable W2 from the RF extension (2145).
- Disconnect the cable from the YIG filter at X4.
- Undo 4 countersunk screws (2135).
- Remove the complete YIG unit (2125 or 2130).

Installing 30 GHz YIG Unit on MW Converter 1093.8249

- Place the new YIG unit (2125 or 2130) on the circuit board.
- Fasten YIG unit with four countersunk screws (2135).
- Screw cable W2 to RF extension (2145).
- Plug cable from YIG filter onto X4.
- Fit the module cover onto the top of the converter unit (positioning by means of adjusting pins). Turn the 30 GHz converter unit upside down, fit module cover to the bottom side and refasten all screws.

Completing the Instrument and Frequency Response Correction

- Put the 13/30 GHz MW converter unit (135/140) back into the instrument.
  Note: *See description "Replacing MW Converter Unit A160".*
- Execute frequency response correction software FSP-FRQ.EXE.
  The software is located on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC addresses and configuration of instruments.
  - Press the Autoselect button and perform the measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.

Temperature Adjustment and Test of the YIG Filter

- A digital temperature adjustment is to be performed for the following MW converters:
  - MW converter unit 13/30: 1093.8249 Mod: XX Rev: ≥ 10 SubRev: ≥ 01
  - All other MW converters should undergo analog adjustment.
- Analog adjustment:
  - Connect the RF output of the signal generator to the RF input of the FSP.
  - Activate the YIG filter sweep with the service function:
    Password 30473035
    Service funct. 2.16.10.1
  - Span on FSP30: 200 MHz
  - Set the frequency of the signal generator and the center frequency to 15 GHz.
    Nominal value: Temperature drift (0 to 50°C) < 8 MHz
  - Adjust temperature drift with jumpers X21, X22, X23, trimming values R403, R119, R402 and potentiometer R232.
- Digital adjustment:
  - Place FSP30 into a climatic chamber for 2 hours at 50°C.
  - Execute frequency response correction FSP-FRQ.EXE.
    The software is located on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the TK adjustment button.
  - Place FSP30 into a climatic chamber for 2 hours at 0°C in the switched-off state.
  - Switch on the instrument and repeat the coldness adjustment.

Adjustment of Module Data

- Create a backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing RF Extension 13/30 A162; FSP13/30

(See chapter 5, spare parts list, items 2140, 2145, and drawing 1093.8249.)
The board is installed on the 13/30 GHz converter unit.

Removing RF Extension 13

- Remove 13 GHz MW converter unit (135).
  Note: *See description "Replacing MW Converter Unit A160."*
- Disconnect all cables from the extension (2140).
- Undo 6 screws with washers (2150) from the bottom side of the extension (2140).
  Caution: *The extension (2140) may fall out.*
- Remove extension 13 (2140) perpendicularly to the PCB.
  Note: *The extension is still connected to the PCB with contact pins.*

Installing RF Extension 13

- Plug extension 13 (2140) perpendicularly into the PCB.
  Note: *The extension is still connected to the PCB with contact pins.*
- Refasten 6 screws with washers (2150) to the bottom side of the extension (2140).
- Reconnect all cables to the extension (2140).

Removing RF Extension 30

- Remove 30 GHz MW converter unit (140).
  Note: *See description "Replacing MW Converter Unit A160".*
- Disconnect all cables from the extension (2145).
- Undo 6 screws with washers (2150) from the bottom side of the extension (2145).
  Caution*: The extension (2145) may fall out.*
- Remove extension 30 (2145) perpendicularly to the circuit board.
  Note: *The extension is still connected to the PCB with contact pins.*

Installing RF Extension 30

- Plug extension 30 (2145) perpendicularly into the PCB.
  Note: *The extension is still connected to the PCB with contact pins.*
- Refasten 6 screws with washers (2150) to the bottom side of the extension (2145).
- Reconnect all cables to the extension (2145).

Completing the Instrument and Frequency Response Correction

- Put the 13/30 GHz MW converter unit (135/140) back into the instrument.
  Note: *See description "Replacing MW Converter Unit A160".*
- Execute frequency response correction software FSP-FRQ.EXE.
  The software is located on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform the measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.
- Create a backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing Diplexer A163; FSP40

(See chapter 5, spare parts list, item 2225, and drawing 1093.8584.)
The board is installed on the 40 GHz converter unit (141).

Removing the Diplexers on the 40 GHz MW Converter

- Remove 8 GHz converter unit (130).
  Note: *See description "Replacing MW Converter Unit A160".*
- Disconnect cable W5 from diplexer (2225).
- Undo 4 screws with washers (2230) from the bottom side of the PCB.
- Remove diplexer (2006) perpendicularly to the PCB.
  Note: The diplexer is still connected to the PCB with contact pins.

Installing the Diplexer on the 40 GHz MW Converter

- Plug diplexer (2225) perpendicularly into the PCB.
  Note: *The diplexer is connected to the PCB with contact pins.*
- Refasten 4 screws with washers (2230) to the bottom side of the PCB.
- Connect cable W5 to diplexer (2225)

Completing the Instrument and Frequency Response Correction

- Put the 40 GHz MW converter unit (141) back into the instrument.
  Note: *See description "Replacing MW Converter Unit A160".*
- Execute frequency response correction software FSP-FRQ.EXE.
  The software is located on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform the measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.
- Create a backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing 40 GHz YIG Unit A161; FSP40

(See chapter 5, spare parts list, item 2215, and drawing 1093.8584.)
The board is installed on the 40 GHz converter unit (141).

Note: *Only the YIG units (with YIG filter, cable, sheet metal part) are replaced. The interface is thus always the same when using other YIG filters.*

Removing 40 GHz YIG Unit on MW Converter

- Remove 40 GHz converter unit (141).
  Note: *See description "Replacing MW Converter Unit A160".*
- Remove the two module covers by undoing the screws from the bottom of the module.
- Disconnect cable W2 from RF extension (2235) and cable W5 from diplexer (2225).
- Disconnect cable from YIG filter at X4.
- Undo 4 countersunk screws (2220).
- Remove complete YIG unit (2215).

Installing 40 GHz YIG Unit on MW Converter

- Put the new YIG unit (2215) onto the PCB.
- Fasten YIG unit with 4 countersunk screws (2220).
- Screw on cable W2 to RF extension (2235) and cable W5 to diplexer (2225).
- Connect cable from YIG filter at X4.
- Fit the module cover onto the top of the converter unit (positioning by means of adjusting pins). Turn 40 GHz converter unit upside down, fit module cover to the bottom side and refasten all screws.

Completing the Instrument and Frequency Response Correction

- Put the 40 GHz MW converter unit (141) back into the instrument.
  Note: *See description "Replacing MW Converter Unit A160".*
- Execute frequency response correction software FSP-FRQ.EXE.
  The software is located on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform the measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.

Temperature Adjustment and Test of the YIG Filter

- The MW converter 40 should undergo digital temperature compensation.
- Digital adjustment:
  - Place FSP40 into a climatic chamber for 2 hours at 50°C.
  - Execute frequency response correction software FSP-FRQ.EXE.
    The software is located on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the TK adjustment button.
  - Place FSP40 into a climatic chamber for 2 hours at 0°C in the switched-off state.
  - Switch on the instrument and repeat the coldness adjustment.
- Create a backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing RF Extension 40 A162; FSP40

(See chapter 5, spare parts list, item 2235, and drawing 1093.8584.)
The board is installed on the 40 GHz converter unit.

Removing RF Extension 40

- Remove 40 GHz MW converter unit (141).
  Note: *See description "Replacing MW Converter Unit A160".*
- Disconnect all cables from the extension (2235).
- Remove the two module covers by undoing the screws from the bottom of the module.
- Undo 8 screws with washers (2240) from the bottom side of the extension (2235).
  Caution: The extension (2235) may fall out.
- Remove extension 40 (2235) perpendicularly to the PCB.
  Note: *The extension is still connected to the PCB with contact pins.*

Installing RF Extension 40

- Plug extension 40 (2235) perpendicularly into the PCB.
  Note: *The extension is still connected to the PCB with contact pins.*
- Refasten 8 screws with washers (2240) to the bottom side of the extension (2235).
- Fit the module cover onto the top of the converter unit (positioning by means of adjusting pins). Turn 40 GHz converter unit upside down, fit module cover to the bottom side and refasten all screws.
- Refasten all cables to the extension (2235).

Completing the Instrument and Frequency Response Correction

- Put the 40 GHz MW converter unit (141) back into the instrument.
  Note: *See description "Replacing MW Converter Unit A160".*
- Execute frequency response correction software FSP-FRQ.EXE.
  The software is located on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform the measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.
- Create a backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing AF Demodulator A190 (Option FSP-B3)

(See chapter 5, spare parts list, item 1000, and drawing 1164.4391.)
The board is fitted the front part of the instrument.

Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the two countersunk screws (260) at the top of the instrument and the three countersunk screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Place the instrument on the left side frame and loosen all connecting cables to the board.
- Push out board to the top side of the instrument.

  Note: *The board can be moved up by pressing carefully from the downside through the connector wholes in the motherboard against the board.*

Installing the New Module and Completing the Instrument

- Plug the new board into the instrument and reconnect all cables to the board.

  Note: *Please refer to the cable wiring drawing on the motherboard.*
- Put the top cover (240) on the instrument and mount it with 3 countersunk screws (260) and 2 screws with washer (250).
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key
- After starting the instrument check for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Test the function of headphone connector and volume control.
- Create a backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing the OCXO A200 (Option FSP-B4)

(See chapter 5, spare parts list, item 1100, and drawings 1164.4391 and 1129.6791.)
The board is fitted in the front part behind the front module .

Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the two countersunk screws (260) at the top of the instrument and the three countersunk screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Place the instrument on the left side frame and loosen all connecting cables to board.
- Push out board to the top side of the instrument.

  Note: *The board can be moved up by pressing carefully from the downside through the connector wholes in the motherboard against the board.*

Installing the New Module and Completing the Instrument

- Plug the new board into the instrument and reconnect all cables to the board.

  Note: *Please refer to the cable wiring drawing on the motherboard.*
- Put the top cover (240) on the instrument and mount it with two countersunk screws (260) and 2 screws with washer (250).
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key
- After starting the instrument check for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check frequency accuracy with chapter 1 and readjust with chapter 2 if necessary.
- Create a backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing Trigger A230 (Option FSP-B6)

(See chapter 5, spare parts list, item 1800, and drawings 1164.4391 and 1129.8613.)

The board is installed at the rear of the instrument in front of the power supply.

Opening the Instrument and Removing the Board

- Switch off unit, disconnect it from power supply, unscrew 4 rear-panel feet (450) and pull off enclosure (410) towards rear.
- Undo the two countersunk screws (260) at the top of the instrument and the three countersunk screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Place the instrument onto its side and remove all connecting RF cables to board on the bottom of the instrument.
- Pull out the board towards the top of the instrument.

  Note: *The board can be disconnected from the motherboard connector by carefully pressing through the motherboard slots from the bottom.*

Installing the New Module and Completing the Instrument

- Plug the new board into the instrument and reconnect all RF cables.

  Note: *Please observe the labelling on the motherboard.*
- Mount top cover (240) and fasten it in place by 2 countersunk screws (260) and three countersunk screws (250).
- Slide on enclosure (410) and screw on 4 rear-panel feet (450).

A cold boot is necessary after replacing the TRIGGER module.
See section "Performing a Cold Boot" in this chapter.

- Connect power cable, switch on power switch and press ON key.
- After starting the instrument check for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]
- Start selftest and check results to ensure that no errors occurred:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start system error correction and check the result to ensure that no errors occurred:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check trigger level according to chapter 1 and adjust if required.
- Create a backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing the Tracking Generator A170 (Option FSP-B9)

(See chapter 5, spare parts list, item 1500, and drawings 1164.4391 and 1129.7069.)
The board is fitted in the back part of the instrument in front of the power supply.

Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the two countersunk screws (260) at the top of the instrument and the three countersunk screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Place the instrument on the left side frame and loosen all connecting cables to the board.
- Push out board to the top side of the instrument.

  Note: *The board can be moved up by pressing carefully from the downside through the connector wholes in the motherboard against the board.*

Installing the New Module and Completing the Instrument

- Plug the new board into the instrument and reconnect all cables to the board.

  Note: *Please refer to the cable wiring drawing on the motherboard.*
- Put the top cover (240) on the instrument and mount it with two countersunk screws (260) and three countersunk screws (250).
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).

A cold boot is necessary after replacing the TRIGGER module.
See section "Performing a Cold Boot" in this chapter.

- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key

- After starting the instrument check for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Connect the output of the Tracking Generator with the RF-Input (use short low attenuation cable) and switch on the Generator : [**NETWORK**]. A continuous signal is displayed on the screen.

Replacing the External Generator Control A210 (Option FSP-B10)

(See chapter 5, spare parts list, item 1600, and drawings 1093.4495 and 1129.7298.)
The board is fitted in the front part of the instrument .

Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the two countersunk screws (260) at the top of the instrument and the three countersunk screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Push out board to the top side of the instrument.

Installing the New Module and Completing the Instrument

- Plug the new board into the instrument.
- Put the top cover (240) on the instrument and mount it with two countersunk screws (260) and three countersunk screws (250).
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key
- After starting the instrument check for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Create a backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").
- Check function as described in chapter 1.

Replacing Wideband Calibrator A190 (Option FSP-B15)

(See chapter 5, spare parts list, item 1160, and drawing 1155.1012.)

The board is installed in the front part of the instrument.

Opening the Instrument and Removing the Board

- Switch off unit, disconnect it from power supply, unscrew 4 rear-panel feet (450) and pull off enclosure (410) towards rear.
- Undo the two countersunk screws (260) at the top of the instrument and the three countersunk screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Place the instrument onto its side and remove all connecting cables to board at the rear of the instrument.
- Pull out the board towards the top of the instrument.

  Note: *The board can be disconnected from the motherboard connector by carefully pressing from the bottom through the motherboard slots.*

Installing the New Module and Completing the Instrument

- Plug the new board into the instrument and reconnect all RF cables.

  Note: *Please observe the labelling on the motherboard.*

- Mount top cover (240) and fix it by 2 countersunk screws (260) and three countersunk screws (250).
- Slide on enclosure (410) and screw on 4 rear-panel feet (450).

A cold boot is necessary after replacing the attenuator.
See section "Performing a Cold Boot" in this chapter. Connect power cable, switch on power switch and press ON key.

- After starting the instrument, check for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]
- Create a backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").
- Check the function according to chapter 1.

Replacing the LAN Adapter (Option FSP-B16)

(See chapter 5, spare parts list, item 1270, and drawings 1164.4391 and 1129.8071.)
The adapter is located at the rear of the instrument.

Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Unscrew the two countersunk screws (260) at the top of the instrument and the three countersunk screws (250) at the fan side, lift the cover at the top (240) of the instrument to the left side and take off.
- Disconnect LAN interface cable W32 (1250)) on the LAN adapter (1270).
- Undo the barrier and remove the adapter (1270) inward.
- .

Installing the New Module and Completing the Instrument

- Hook the new adapter (1270) into the opening in the rear panel from the inside of the instrument and engage it.
  Note: For alignment, see drawing, view B.
- Reconnect the LAN cable (1250) to the adapter (1270).
- Mount the instrument cover at the top (240) and refasten it with two countersunk screws (260) and three countersunk screws (250).
-
- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key

Replacing the Electronic Attenuator A50 (Option FSP-B25)

(See chapter 5, spare parts list, item 1400, and drawings 1164.4391 and 1129.7800.)
The electronic attenuator is fitted behind the RF attenuator under the fan.

Opening the Instrument and Removing the Electronic Attenuator

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- Place the instrument on the left side frame and loosen RF cable W28 (1430/1440) at the electronic Attenuator output 1400).
- Unscrew 4 countersunk screws (1460) at the right frame.

  ***Note**: The electronic attenuator will only be fixed with the RF cables at the front.*
- Fix the electronic attenuator and disconnect RF cable W29 (1420) at the output of the attenuator (20).
- Move carefully out the RF attenuator and disconnect the ribbon cable at the electronic attenuator.

Installing the New Electronic Attenuator

- Connect (only loose) cable W29 (1420) at the new electronic attenuator.
  Note: Label X3 shows to the electronic attenuator.
- Connect the ribbon cable (W50) at the new attenuator.
- Move the new electronic attenuator in the instrument and connect cable W29 (1420) to the output of the attenuator (20).
- Screw the four screws with washers (1460) at the right frame in the electronic attenuator.
- Fix the RF cable (1420) at the output of the attenuator (20) and the electronic attenuator.

3 GHz Model (1164.4391.03)

- Connect cable W28 (1430) between electronic attenuator and the frontend (100) .

7 GHz Model (1164.4391)

- Connect cable W28 (1440) between electronic attenuator and the MW converter (130).

Completing the Instrument

- Push the tube (410) on the instrument and mount the 4 rear-panel feet (450).

A cold boot is necessary after replacing the attenuator.
See section "Performing a Cold Boot" in this chapter.

- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key
- After starting the instrument check for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start a total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Create a backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").
- Check frequency response with chapter 1 and make a correction if necessary.

Replacing the DC/DC Converter (Option FSP-B30)

(See chapter 5, spare parts list, item 3000.)
The DC/DC converter (3000) is mounted on the rear panel of the instrument.

See also DC Power Supply FSP-B30 operating manual.

Caution:

The DC/DC converter in an unmounted state is a module in "open frame" design. Therefore make sure that it is mounted only by skilled electricians (see operating manual, safety instructions, item 9).

Make sure that the DC/DC converter is separated from the supply source.

Removing the DC/DC Converter

- Unplug the supply cable on the DC/DC converter.
- Unscrew the three captive screws on the converter.
- Pull off the converter to the rear.

Installing the new DC/DC Converter

- Plug the DC/DC converter (3000) onto the rear-panel power plug.

Note: The power switch is automatically actuated when the DC/DC converter is connected.
Fasten the converter to the rear panel with three fixing screws.

Note:

Rear-panel foot with Options FSP-B30 (DC/DC converter) and FSP-B1 (housing with shock protection):
If Option FSP-B1 is present, the right rear-panel foot (3020) is modified in order to ensure sufficient ventilation of the power pack.

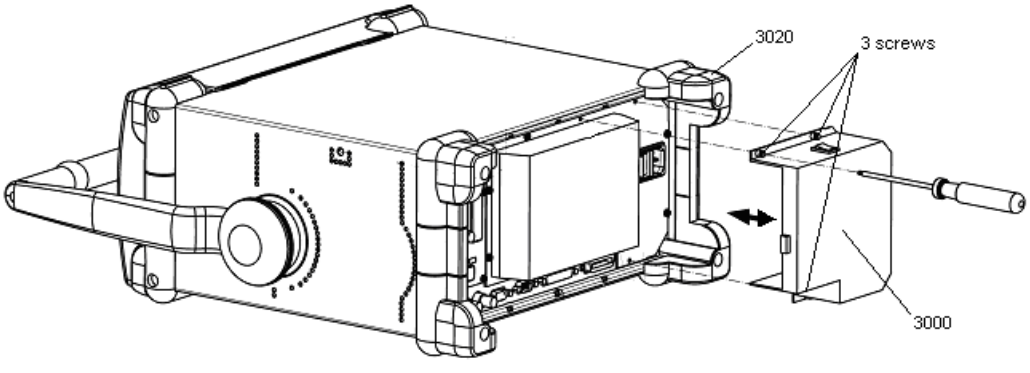


Fig. 3-1 Removing and installing the DC/DC converter, FSP-B30

Replacing the Battery Charger Module (Option FSP-B31/32)

Opening the Battery Pack and Removing the Module

- Remove the battery pack from the instrument.
- Undo the three screws (1) on the bottom.
- Pull out the cover (2) to the rear.
- Unplug all cables.
- Undo the two screws on the jack (5) and pull out the jack (5).
- Undo six screws (6) and remove the battery charger module (3030).

Installing the Battery Charger Module and Completing the Instrument

- Install new battery charger module (3030) and refasten with six screws (6).
- Install jack (5), fasten with two screws and reconnect all cables.
- Replace the cover (2), pressing the batteries down and making sure that no cables are trapped.
- Refasten the cover with three screws (1).

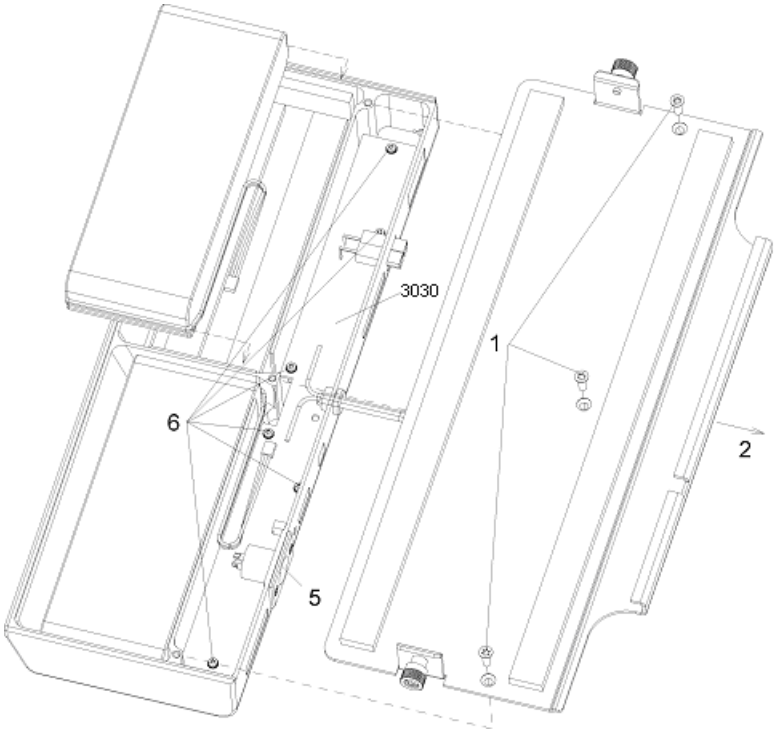


Fig. 3-2 Removing and installing the battery charger module, FSP-B31/32

Replacing the Batteries (Option FSP-B31/32)

Opening the Battery Pack and Removing the Batteries

- Remove the battery pack from the instrument.
- Undo the three screws (1) on the bottom.
- Pull out the cover (2) to the rear.
- Disconnect the batteries (3).
- Take out the batteries (3040).

Installing the Batteries and Completing the Instrument

- Insert new batteries (3040) and connect them (3).
- Replace the cover, pressing the batteries down and making sure that no cables are trapped.
- Refasten the cover (1).
- Charge the battery pack.

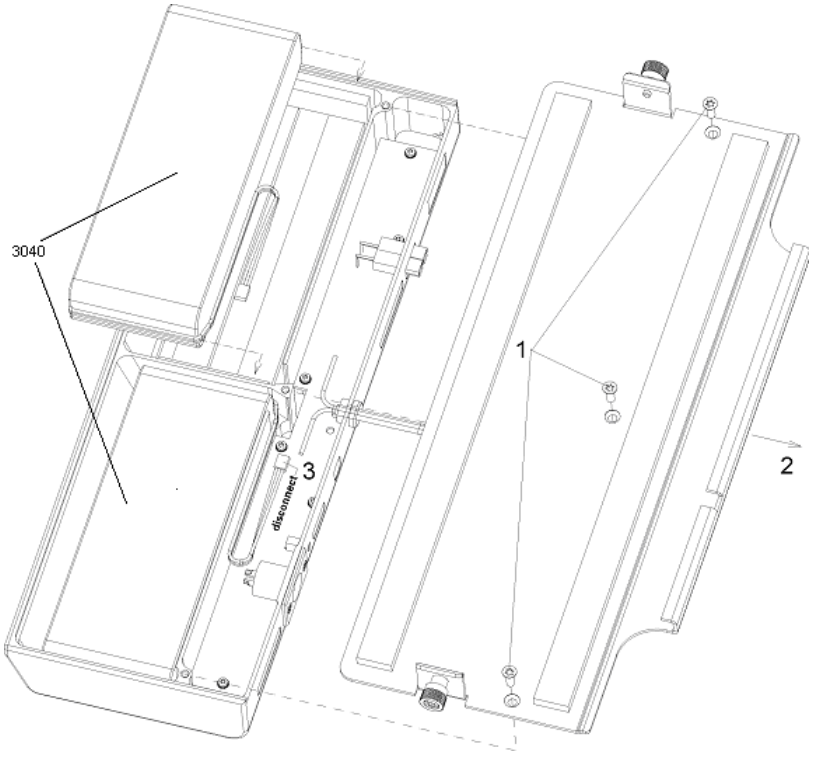


Fig. 3-3 Removing and installing the batties, FSP-B31/B32

FVREFSEQARABISCHFVREFSEQARABISCH

Troubleshooting

Malfunctions may have simple causes but also may be caused by faulty components.

These troubleshooting instructions allow for locating the error causes down to board level and make the instrument ready for use again by means of board replacement.

We recommend that the instrument be shipped to our experts in the service centers (cf. address list) for module replacement and further error elimination.



Warning!

Do not plug or unplug boards prior to disconnecting them from ac supply!

Be careful not to cause short-circuits when measuring voltages!

The following utilities are provided in the FSP for diagnostic purposes:

- Permanent monitoring of levels and frequencies in the instrument
- Selftest
- System error correction

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

Measuring Equipment and Accessories

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S-Order No.	Use
1	DC meter		URE	0350.5315.02	Troubleshooting
2	Spectrum analyzer	Frequency range 0 to 7 GHz	FSEB 20	1066.3010.20	Troubleshooting
3	Adapting cable	1 m long SMP- to SMA connection	-	1129.8259.00	Troubleshooting
4	Adapting cable	0.5 m long SMP-to SMP-connection	-	1129.8265.00	Troubleshooting
5	Adapter board	Extension 150 mm high 48-contact, 2 mm spacing	-	1100.3542.02	Troubleshooting

Troubleshooting Start-up Problems

- **Error: FSP cannot be switched on.**

Action	Possible error causes and further steps
Check power-on switch on the rear ⇓	Power switch OFF: Switch on power supply..
Check yellow LED (Stand-by). ⇓	LED remains dark: ➢ Measure voltage at X20.D24 (power supply unit) Rated value: +12 V ± 1V Voltage o.k.: Keyboard or controller faulty. No voltage: Remove IF-Filter or OCXO modules. ➢ Measure voltage at X20.D24 (power supply unit): Rated value: +12 V ± 1V Correct voltage: Removed module faulty No voltage: Power supply faulty or short-circuit at 12V standby.
Switch on instrument. Check green LED ⇓	LED remains dark: Measure PWR-ON signal on the power supply X20.B1: < 1V for ON Voltage > 1V: Keyboard membrane or controller faulty.
Power supply starts, screen remains dark?	Measure voltages on the motherboard, see "Short-circuit of one or more operating voltages".

- **Error: Short-circuit of one or more operating voltages**

Action	Possible error causes and further steps
Check on the bottom of the motherboard which of the voltages is short-circuited: Computer, hard disk, EEPROMs : X20.A7 to A10: rated value: +5 V2 Detector board : X20.A5 and X20.A6: rated value +3 V3 Analog boards: X130.A10: rated value +12 V X130.A9: rated value +8 V X130.A8: rated value +6 V X130.A12: rated value –12 V	No voltage or considerably low voltage: Remove the respective boards from the instrument one by one and repeat the measurement. If the voltage is supplied, then, the error is probably located on the module removed. ***Note:*** *The power supply switches off all voltages after a short time in case of a short-circuit. Restart by pressing the Standby/On key.*

- **Error: Fan does not work.**

Action	Possible error causes and further steps
Check voltage at connector: X35 pins 1+ 3 : rated value 12V	Voltage o.k.: fan is defective Voltage too low: fan is blocked or power consumption too high

Troubleshooting Problems with Boot Process

- **Error: FSP does not start the measurement application.**

Following switch-on, the FSP first boots the computer BIOS. After successful initialization of the computer the Windows XP operating system starts up. Subsequently, the test application is loaded as start-up program. Simultaneously, selftests are performed at various locations and error messages, if any, are output. It is advisable for troubleshooting to connect a keyboard to the keyboard socket.

Normal action

➢ Start FSP

Subsequent to switching on the FSP, the following BIOS message is displayed:

```
Award Modular BIOS v6.00PG, An Energy Star Ally
Copyright (C) 1984-2000, Award Software, Inc.

R&S ANALYZER BIOS V2.1-20-1
Main Processor      :  Intel Pentium III 700 MHz
(100x7.0)
Memory Testing      :


01/17/03-i815E-LPC47B2-6A69REF2C-00
```

After the first beep, the computer starts the hardware test and the message:

```
, ESC to skip Memory test...
```

The test results are displayed on the screen. If errors occur during the boot procedure, these messages may indicate defects.

Error and error cause

If no result of the memory test is indicated, the memory is defective.

```
Award Modular BIOS v6.00PG, An Energy Star Ally
Copyright (C) 1984-2000, Award Software, Inc.

R&S ANALYZER BIOS V1.1-20-1
Main Processor      : Intel Pentium III 700MHz (100x7.0)
Memory Testing      : 261120K OK + 1024K Shared
Memory

01/17/03-i815E-LPC47B2-6A69REF2C-00
```

The memory test issues the memory capacity of the front module controller. The basic version of the FSP provides 256 Mbytes. Subsequently, BIOS starts the hardware check and displays all PC boards found.

Normal action

- This procedure may be interrupted using the "BREAK" key on the connected external keyboard, any other key continues the boot process.

```
Award Modular BIOS v6.00PG, An Energy Star Ally
Copyright (C) 1984-2000, Award Software, Inc.

R&S ANALYZER BIOS V2.1-20-1
Main Processor      :  Intel Pentium III 700MHz
(100x7.0)
Memory Testing      :  261120K OK + 1024K Shared
Memory

   Main Memory Clock is 100 MHz
   Primary Master   : IBM-DJSA-205 JS10ABOA  *)
   Primary Slave    : None
Secondary Master    : None
Secondary Slave     : None


01/17/03-i815E-LPC47B2-6A69REF2C-00
```

*) *depending on the hard disk installed*

Then, the SETUP is displayed.

- This procedure may also be interrupted using the BREAK key.

The contents partly depend on the hardware provided:

Error and error cause

If this hard disk entry is missing, the hard disk may be faulty

Award Software, Inc.
System Configurations

CPU Type	: Intel Pentium III		Base Memory	:	640K
CPU ID/ucode	: 068A/00		Extended Memory	:	260096K
CPU Clock	: 700 MHz		Cache Memory	:	256K
Diskette Drive A	: 1.44M, 3.5 in.		Display Type	:	EGA/VGA
Diskette Drive B	: None		Serial Port(s)	:	3F8
Pri. Master Disk	: LBA, ATA 66 , 5001MB		Parallel Port(s)	:	378
Pri. Slave Disk	: None		SDRAM at Row(s)	:	2 3
Sec. Master Disk	: None		Display Cache Size	:	None
Sec. Slave Disk	: None				

PCI device listing.....

Bus No.	Device No.	Funct No.	Vendor	/Device	Class	Device Class	IRQ
0	2	0	8086	1132	0300	Display Cntrlr	10
0	31	1	8086	244B	0101	DIE Cntrlr	14
0	31	2	8086	2442	0C03	Serial Bus Cntrlr	11
0	31	3	8086	2443	0C05	SMBus Cntrlr	NA
0	31	4	8086	2444	0C03	Serial Bus Cntrlr	9
1	8	0	8086	2449	0200	Network Cntrlr	11
1	13	0	162F	4013	FF00	Unknown PCI Device	11

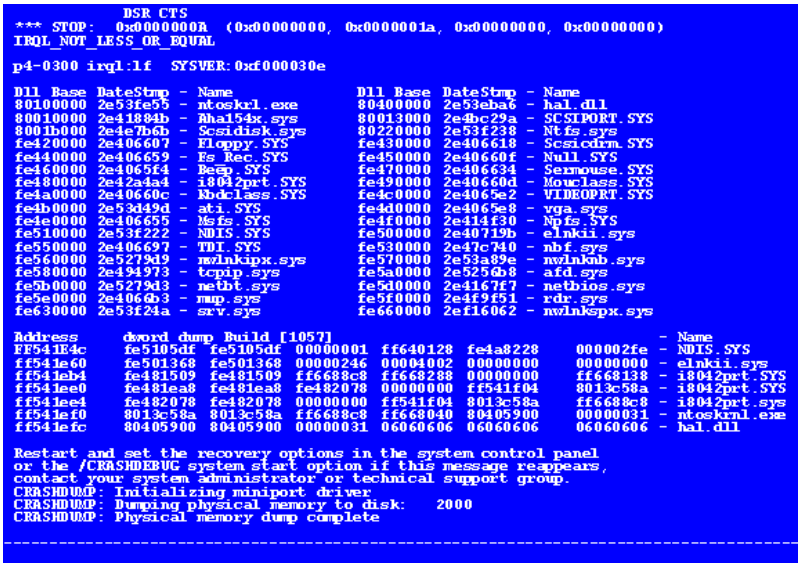
Verifying DMI Pool Data ..... Update Success

Normal action	**Error and error cause**
The PCI hardware test is displayed in the lower half of the screen. All modules found during the test are displayed with their names and PCI device IDs. The Device Class column lists the types of PCI device. The detector board of the FSP is indicated as „Unknown PCI Device".	If the line "Unknown PCI Device" is missing, the detector board was not identified and the measuring application cannot be started. If the remaining PCI devices have all been identified, the detector board will probably contain the error, which is why the board must then be replaced
After this test, the BIOS has been loaded and the operating system is started.	The message „No System Disk or Disk error ..." at this point indicates that the contents of the hard disk are not correct. Replace the hard disk.
After Windows XP was installed correctly, the following selection menu is displayed:	
Please select the operating system to start: **Analyzer Firmware** **Analyzer Firmware Backup** **Use the up and down arrow keys to move the highlight to your choice.** **Press ENTER to choose.** **Seconds until highlighted choice will be started automatically: 0** **For troubleshooting and advanced startup options for Windows, press F8.**	After Windows XP was installed correctly, the following selection menu is displayed:

Normal action

Error and error cause

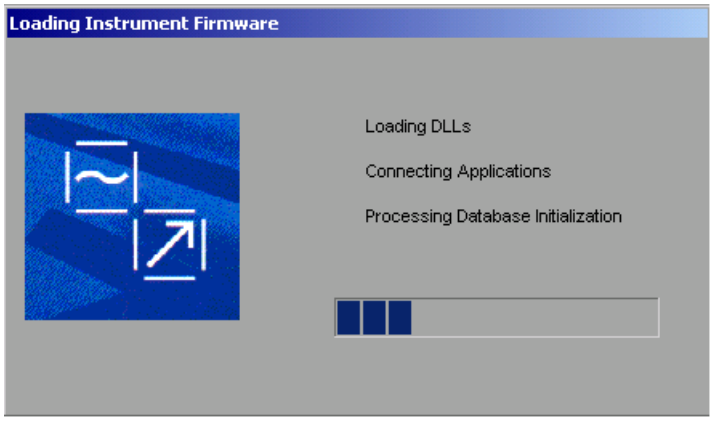
If the operating system on the hard disk has been destroyed and cannot be loaded correctly, Windows XP reacts by displaying a "bluescreen". This bluescreen contains all essential information on the internal states of the computer which are displayed as follows (by way of example):



Windows XP and the instrument firmware must then be updated from the back-up partition (cf. Chapter 4, Section "Initial Setup/ Update of the Instrument Firmware").

Subsequent to starting the operation system, the application for the FSP is loaded in a start-up program. The program start is initiated automatically and generates a window , which displays information on the start-up procedure.

Normal action



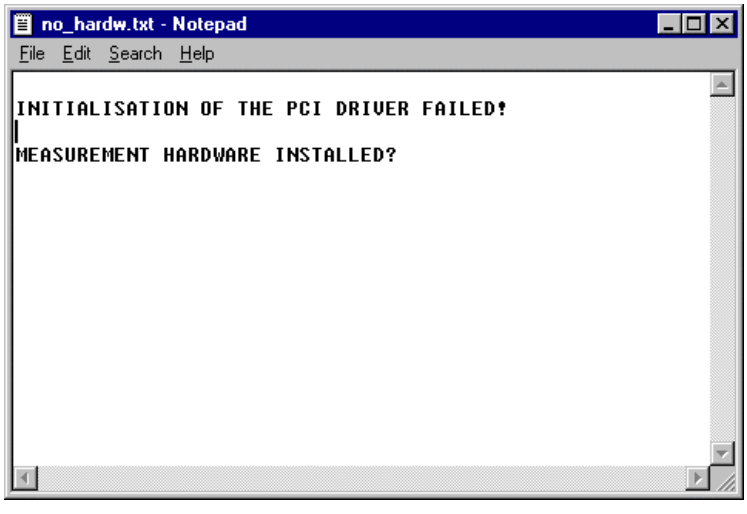
While booting, the detector board is identified again.

Error and error cause

If a "bluescreen" is displayed with loading, a cold start may be necessary. Proceed as follows in such a case:
Cold boot (see section "Performing a Cold Boot" in this chapter)

- Firmware update from the backup partition, if a cold boot does not succeed.
  (see chapter 4 "Software Update/Installing Options")

If the detector board is not identified, the following message is issued:



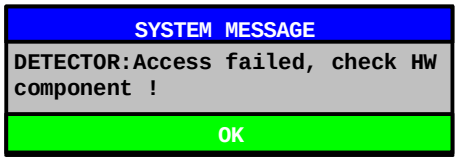
Normal action

When the program has been loaded, the measurement hardware is initialized first. A timer which is controlled by a 32-MHz clock signal is set on the detector board. This test reveals proper functioning of the detector board and the clock oscillator in the FSP (frontend).

After passing the function tests, the analog boards are initialized and the correction data EEPROMs are loaded.

Error and error cause

If an error occurred on the detector board or the clock is missing, the following message is displayed:



In this case, first check the clock generation in the instrument.

The reference is generated on the frontend module. The 128-MHz reference supplied by the frontend is decoupled in the IF filter and distributed to the detector board and the options.

The following measurements are appropriate to check the reference supply:

Measurement:	**Result:**
RF frontend A100, X114: rated value 128 MHz, 0 dBm ⇓	No signal: replace frontend.
IF filter A130, X135: rated value 128 MHz, 0 dBm ⇓	No signal: replace IF filter.
IF filter A130, X141: rated value 32 MHz, 0 dBm ⇓	No signal: replace IF filter.

If no error occurs with the clock generation, booting can be continued by acknowledging the error message entering "OK“

If no error message or any other information on the error source was issued with booting, the error can only be determined by replacement of the detector board or the front-module controller.

Troubleshooting - Loading Module EEPROMs

- **Error: Data of modules cannot be read.**

Normal action	Error and error cause
On booting the instrument all calibration data required must be written into the RAM of the computer. The calibration data of a module is read from the EEPROM in the case of a cold start, otherwise from the associated binary file. In the case of a cold start, it is checked for each module identified by the software whether the EEPROM can be read.	
If reading at the desired address is not possible, the software assumes that the module is not available.	For modules that must always be available (e.g. IF filter) an error message will be output: Error reading EEPROM of IF Filter
The calibration data are then read from the file pertaining to the module (e.g. iffilt.bin).	If error-free reading of the binary file is not possible either, an error message is output again. Error reading file of IF Filter
If reading at the address of an optional module is not possible, this module is marked as not available in the module array for storage of the module information. If the file pertaining to the non-available module does exist, it is assumed that upon the last successful booting the module was available but has been removed meanwhile. The file with the calibration data of the module is erased. Moreover the data collected during the last calibration are invalid and only saved as a backup copy on the hard disk	
	If reading at the address of a module is possible but the contents of the data block faulty (e.g. check sum of header block incorrect), the calibration data of the respective module are read from the associated file. The firmware assumes that the module is available. Error reading EEPROM of IF Filter

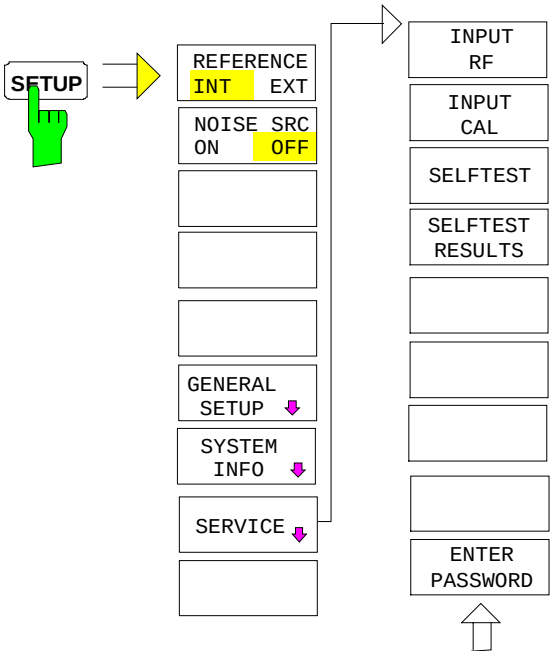
Normal action	Error and error cause
Upon successful reading of the module header from the EEPROM the contents of the module header is entered into the array for storing the module information. The module header read from the EEPROM is compared with the module header of the associated binary file. If the module header can be read from the file and agrees with the header read from the EEPROM it is assumed that the contents of the module EEPROM has already been mapped in the binary file. The calibration data can thus be written from the file to the RAM.	If however the associated file cannot be found or if the module header of the EEPROM differs from that of the file, the total EEPROM contents must be written to the RAM and then saved in the binary file. Error finding file of IF Filter
After loading the calibration data from the EEPROMs, the calibration data are loaded from the calibration data files (e.g. DDC settings for various filters). First the relevant calibration data file is written to the calibration data memory.	If an error occurs upon loading the file into the memory, an error message is output: Error reading file of DDC Filter
Upon successful loading of the calibration data file the latter is compared with its backup copy on the hard disk.	
After loading the calibration data from the EEPROMs and files, the data collected during the last calibration are loaded from the ‘rdf_cal.bin’ file into the calibration data memory. This process takes only place if valid calibration data (and the ‘rdf_cal.bin’ file) are available.	If there are no valid calibration data, the status message "UNCAL " is output informing the user that the instrument is uncalibrated.

Troubleshooting via Selftest

The selftest is provided for identification of instrument errors and tolerance violations which can not be corrected with self-calibration of the instrument.
All signal paths are connected and the signal is traced via test points. The selftest checks all possible hardware settings which are used for the self-calibration with regard to sufficient setting range including reserves.

Service Level - Test Following the Entry of a Password
When entering the password, the test result is recorded in detail and in case of a fatal error (such as a failure of the operating voltage), the selftest is *not* aborted..

All operating functions required in connection with the selftest are offered in the *SETUP - SERVICE* menu:



- Enter the password 894129 for service level 1 with *ENTER PASSWORD*.
- Initiate the selftest of the instrument modules using the SELFTEST softkey

While the selftest is running, a message box is displayed, which shows the current test and test result.

- Pressing ENTER ABORT aborts the test run.

All modules are tested one by one and the test result (selftest PASSED or FAILED) is output in the message box



The *SELFTEST RESULTS* softkey calls a complete list of all test results.
If an error occurs, a brief description of the failed test, the module concerned, the valid range and the measurement value are displayed.

```
Total Selftest Status: ***FAILED***
Date (dd/mm/yyyy): 10/06/1999 Time: 16:34:47
Runtime: 05:59

Supply voltages detector
test description    min       max       result    state
+6V                   5.88      6.42      6.06   PASSED
+8V                   7.84      8.96      8.56   PASSED
+12V                 11.76     12.83     12.42   PASSED
-12V                -11.33    -13.28    -11.85   PASSED
+28V                 26.62     29.39     28.34   PASSED
```

If the result is ***FAILED***, the service technician should pay attention not only to the entries marked with FAILED** but also to those marked with SKIPPED. These entries indicate that a test item was not performed because the preconditions were not observed. In that case, it is an error only if it was also not possible to calibrate the instrument.
The selftest with a password yields FAILED as the overall status, as it will relatively soon no longer be possible to calibrate the instrument due to a temperature drift or aging.
The selftest without a password yields PASSED as the overall status; here too, however, the skipped test items are marked with SKIPPED as an indication for the service technician.

Selftest Design and Error Messages

Overview

The calibration source on the IF-filter module is used as signal source for testing the signal path.

1. Measurement of the operating voltages

   a) of the power supply
   b) regulated operating voltages on the detector and IF-filter modules
2. Temperature measurement on the IF-filter board
3. Testing the fourfold D/A converter on the detector
4. Test of the reference signals on the Standard Frontend (modules 1 and 2) and on the IF filter modules
5. Synthesizer test on the frontend module
6. Testing of the signal paths on all boards
7. Test of optional modules

All measurements on the analog boards are independent of the gate arrays on the detector board, since individual A/D converters are provided for them on the analog boards. The interface section in the FPGA of the detector board must function properly to read these A/D converters. This is always tested with switching on the instrument.
The signal path via the gate arrays on the detector board is tested using a known, analog signal at the input of the A/D converter on the detector board. The analog test signal is provided by the preceding analog tests.
Since the operating voltages are measured first, it is ensured that the selftest can be performed correctly. If an operating voltage failed which is not required by the selftest this is correctly signalled in the error list. If, however, all operating voltages are indicated to be faulty, it may well be assumed that the operating voltage for the selftest has failed or the selftest A/D-converter itself is defective.

Operating Voltages

When an operating voltage fails, the selftest is aborted to avoid subsequent error.
The test is not aborted under service level 1. All subsequent errors are then listed in the result record. Errors which occurred independent of the voltage failure can then be detected, still.
The error message indicates the error source (power supply, IF filter, detector board) and the voltage which failed.

Normal action	Error and error cause
Power Supply The voltages of the power supply and the –6 V regulator (dc-dc converter from –12 V to –6 V on the motherboard) are measured at the board connector by means of the selftest A/D-converter on the detector board.	
Channel: 1 — Nominal voltage: +6V Channel: 2 — Nominal voltage: +8V Channel: 3 — Nominal voltage: +12V Channel: 4 — Nominal voltage: -12V Channel: 5 — Nominal voltage: +28V Channel: 7 — Nominal voltage: -6V	FATAL ERROR! Power supply: DC FAIL +6V. Selftest aborted. ➢ If error messages occur, the voltages on the motherboard should be checked. The tolerances given in the column "Tolerance range power supply / voltage regulator" apply in this case. If the voltages adhere to the tolerance limits, the error must be located in the selftest: ➢ Replace the detector board.
Regulated Voltages on the Boards **Detector Board**	
Channel: 6 — Nominal voltage: -5V	FATAL ERROR! Detector: DC FAIL -5V. Selftest aborted. ➢ If the preceding tests passed, the detector board has to be replaced.

Temperature Measurement on IF Filter

Normal action	Error and error cause
The **temperature** is measured, first. If the temperature violates the permitted range from 0° to 70°C, the following warning is output:	WARNING! IF-FILTER: Operating Temperature xx °C - out of range
	➢ Check the temperature data to plausibility. The fan might be defective or the ventilation slots might be covered. If the temperature data indicated are not reasonable, e.g., if the temperature of the instrument is indicated to be 120° C, the temperature sensor or the selftest may be faulty. If , in the following, the *first* operating voltage (or all operating voltages under service level 1) is measured incorrectly, the selftest will obviously be defective.

Channel	Nominal voltage	Designation, name which occurs in the error message
74	- 5 V	UREF-5
77	+2.5 V	UREF+2.5
76	+3.3 V	+3.3V
73	+5 V	+5V
72	+10.6 V	+10V
71	-5 V	-5V
70	-10.6 V	-10V
75	+5 V	+5VR

	➢ The IF filter board must be replaced in any case, if an error message occurs which refers to these operating voltages or the temperature (if not plausible). The voltage of the temperature sensor is used for temperature compensation of the filters. Thus, a faulty temperature sensor may detune the filters such that subsequent errors are likely to occur.

Checking the 4-fold D/A Converter on the Detector Board.

Normal action	Error and error cause
Detector Board Pretune-DAC Test The 4-fold D/A-converter on the detector board is checked. One D/A converter controls the frequency-dependant IF gain on the IF filter for frequency response correction. The other ones are provided for options (microwave converter, tracking generator). The first output voltage of the 4-fold D/A converter is measured, thus checking the basic function of the control interface (in DCON gate array), also.	

Channel	Nominal voltage
8	666 mV

FATAL ERROR!
Detector: Pretune DAC FAIL - check DCON and pretune DAC
Selftest aborted.

➢ Replace the detector board

Testing the Reference Signals on Standard Frontend (Modules 1 and 2) and on the IF Filter Module

Errors detected do not cause abortion of the test. However, the subsequent checking of the signal path in the IF filter and detector boards is skipped, since there is no local oscillator provided to convert the 128-MHz calibration signal to the 20.4-MHz IF required for the tests.

Normal action	Error and error cause
Reference Signals on the IF Filter Board Figure 3-5 illustrates the reference signals on the IF-filter board. The selftest points are emphasized by color. The levels are measured at these points with a permitted tolerance of ±5 dB. In addition, the level control loop of the calibration signal generator is monitored. If the loop unlocks, the level of the calibration signal is not accurate, even if no error occurs at the other test points.	
128 MHZ Input level: The transfer level should be > –5dBm. It can be rechecked at the output X114 of the frontend.	FATAL ERROR! IF Board: 128 MHz Reference input level low. Selftest aborted ➢ If this signal is missing, the clock for the detector board is missing, too. If the level is too low, proper functioning cannot be assured. ➢ Replace Frontend Module 2, if any error occurs.
10 MHZ Output level: This is the reference frequency for synchronizing all oscillators	ERROR! IF Board: 10 MHz Reference output level low, TCXO / OCXO. If the signal fails, the instrument continues functioning properly, however, the frequency accuracy is violating the tolerance limits. Option OCXO fitted: ➢ Check output level of option (10 MHz, > -5 dBm). If the level is o.k., the IF-filter board is faulty. ➢ Replace IF-filter board Option OCXO not fitted: ➢ Replace IF-filter board

Channel	Test
1	128-MHz input level
2	10-MHz output level
3	Calibration signal level
4	Control voltage of calibration signal

Normal action	Error and error cause
Calibration signal level:	FATAL ERROR! IF Board: CAL Signal level out of range for selftest Selftest aborted. The selftest of the signal path can not be performed with failure of the calibration signal. ➢ Switch on measurement via the *INPUT CAL* softkey in the *SETUP - SERVICE* menu. While attending this menu, the level can be switched over between -30 dBm and 0 dBm using the step keys ⇧ ⇩. ➢ Measure the calibration signal at X142 of the IF-filter board. Option W-CDMA Demod. Hardware installed ➢ Measure the calibration signal at X192 of the W-CDMA Demodulation Hardware.
Control voltage of calibration signal:	ERROR! IF Board: CAL Signal level control loop unlocked As soon as the control voltage violates the tolerance, the level control loop unlocks and the level becomes inaccurate. If the level error is small, the selftest of the signal path can be performed. However, following the calibration of the instrument, the level measuring accuracy will be out of tolerance. ➢ Prior to replacing the IF-filter board, check, whether the level applied in X134 is between -4 and +6 dBm. The typical level range of the CAL generator is -5 dBm to +8 dBm. ➢ If the level is outside this range, the Frontend Module 2 must be replaced.

Testing the Signal Paths

Overview of the test sequence

- The internal source for the test signal (CAL signal) has already been tested with testing the reference signals.
- Testing all attenuators.
- Testing the output level of the standard frontend using a level detector at the IF-filter input.
- Testing all signal paths inside the IF filter.
- Testing all (digital) signal paths and the signal processing incl. RAM on the detector board.

Normal action	Error and error cause
Signal Path via RF Attenuator It is assumed that the signal path is continuous; an absolute level error of up to 20 dB is permitted. The attenuators are measured in relation to the calibration source, by switching over the latter between 0 dBm and -30 dBm. The 10-dB, 20-dB, 40-dB attenuators are checked to ±3 dB.	

RF-Att	CAL level	Tested attenuator
0	-30	Reference measurement
30	0	10 dB + 20 dB
10	-30	Reference measurement
40	0	40 dB

➢ If there is no measured value in the ±20-dB range, the error is likely to be located in the subsequent signal path. The test does not reveal any information on the RF attenuator. The selftest is continued.

FATAL ERROR!

RF-Attenuator FAIL.

Selftest aborted.

➢ If individual measurements, only, violate the tolerances, the RF attenuator is clearly faulty: error message

Important: *Since a faulty RF attenuator causes many subsequent errors to occur with the IF-filter test, proper functioning of the attenuator is a must.*

Signal Paths on the IF Filter Board

The RF attenuator is used to provide an appropriate test level. Therefore, a fault in the RF attenuator will entail subsequent errors with the IF filter test.

Normal action	Error and error cause
Input Level of IF Filter / Calibration Amplifier (CAL-Amps 1 + 2) **Selftest detector A (see block diagram)** The level applied to the RF input is referred to as mixer level in the following. The RF attenuation is to be set to 0 dB. The input frequency is always 128 MHz. The input level at X131 is 8 dB ±3 dB higher than the mixer level. With maximum mixer level of -10 dBm the level at X131 is -2 dBm ± 3 dB. CAL_Amp2 is provided for frequency response correction. With the input frequency of 128 MHz, the gain of CAL_Amp2 is set to 0 dB. The frequency for the selftest is 128 MHz. The nominal gain between X131 and X132 is +2 dB. The level at X132 is 0 dBm with a mixer level of -10 dBm. The selftest (A) checks the level to ±5 dB (User) or ±3 dB (Service Level 1) after passing the CAL_Amps.	FATAL ERROR! IF Board: IF input level / CALAMP Selftest aborted Possible error causes: • Signal path interrupted in the frontend. • Erroneous EEPROM data in the frontend leading to incorrect setting of CAL_Amp1. • CAL_Amp1 or 2 faulty. Troubleshooting ➢ Check the level applied at X131 with mixer level -10 dBm: -2 dBm, production tolerance ± 3 dB, maximum tolerance permitted ± 4.5 dB; ➢ Replace the frontend, if the deviation exceeds this value

Normal action	Error and error cause
	If the level adheres to the tolerance, a defective CAL_Amp may have caused the error. The setting ranges of the CAL_Amps are tested during the selftest, later. The selftest passes under service level 1. ➢ Note, whether the result file contains any error messages concerning the CAL_Amps. If no CAL_Amp error occurred, the CAL_Amps will be set incorrectly. The EEPROM data in the frontend are obviously incorrect (cf. troubleshooting instructions for the frontend)
LC Filter I and XTAL Filter **Selftest Detector B (see block diagram)** The level measurement is performed with wide and narrow bandwidths of the LC filter. Subsequently, it is additionally measured via the crystal filter. If the LC filter does not work properly, the measurement of the crystal filter is not performed.	ERROR! IF Board: LC Filter-1/2 wide XTAL Filter not tested ERROR! IF Board: LC Filter-1/2 narrow XTAL Filter not tested ERROR! IF Board: XTAL Filter ➢ The IF filter board must be replaced in all cases.

Normal action	Error and error cause
Step Gain (IF Amplifier) **Selftest Detector C (see block diagram)** The 10-dB Step Gain (Step Gain Coarse) and the 0.1 dB Step Gain (Step Gain Fine) are tested. The input level is attenuated in steps of 10 dB by the RF attenuator and amplified by means of the Step Gain by the same amount, simultaneously. The level detector C checks to ±6 dB (user) or ±4 dB (service level 1).	FATAL ERROR! IF Board: Step Gain Fine Selftest aborted ➢ Test with Step Gain Coarse by-passed (0 dB) and Step Gain Fine set to 0 dB If an error occurs, Step Gain Fine does not work correctly or the signal path is interrupted. ➢ Replace the IF-filter board. ERROR! IF Board: Step Gain Coarse ➢ Testing the amplifier stages. ERROR! IF Board: Step Gain Fine ➢ Testing the amplifier stages. ***Attention:*** *If the RF attenuator test caused output of an error message, Step Gain cannot be tested and an error message must be ignored* ➢ If the RF attenuator test passed without any error, Step Gain is defective. ➢ Replace the IF-filter board. However, the selftest can be continued, since it does not require the IF gain.

Troubleshooting Frontend 1

Depending on the kind of error a few measurements should be performed on the frontend prior to replacing the module:

- **IP3 too high**
- **Signal level too low**
- **LO feedthrough too high**
- **Spurious signals**

Depending on the kind of error a few measurements should be performed on the frontend prior to replacing the module.
Very high values with input frequency 0, > -10 dBm with an input attenuation of 0 dB indicate that the mixer does not work properly.

Action	**Error and error cause**
Measure with diode tester at X101: rated value: 0.35 V voltage in the forward and reverse directions with a current of 1 mA.	Different values in both directions, high-impedance or very low-impedance: mixer defective : replace frontend1

- **Signal missing or displayed with incorrect frequency**

If the signal is missing or the instrument signals "LOUNL", the conditioning of the 1st LO is probably not correct. The function of this oscillator requires both, the EEPROM data and the reference frequency of the second module.

Action	**Error and error cause**
Measure function of the 1st LO in zero span. check signal at X102: rated value: 3476.4 MHz above the current input frequency (between 0 Hz and 3 GHz) and the signal level is approx. –5 dBm.	The frequency is considerably higher or lower or the signal is not stable frontend 1 defective replace Frontend 1

Troubleshooting – MW Converter

The most frequent error occurring on MW converters is that the signal level displayed on the spectrum analyzer >3 GHz is too low or missing.

- **Level conditions on the MW converter**

Action	**Error and error cause**
Apply a high-frequency signal (f >3 GHz) at the MW converter input with a level of –20 dBm and measure the converted level at the output connector. If the instrument is operated on an adapter the LO (connector X102 standard frontend) should be taken out to the MW converter (connector X167). FSP7: - Input connector diplexer X169 - Output connector X161 FSP13/30: - Input connector YIG filter X169 - Output connector X161 FSP40: - Input connector diplexer X168 - Output connector X163 Output level at 404.4 MHz: > -20 dBm	If the level is missing or too low, a module is defective on the MW converter. Check levels of the modules on the MW converter unit. (see the following items) If the measured level is within tolerances, the attenuator (or the diplexer with FSP13/30) or a subsequent module in the signal path is defective.

- **Level conditions on the diplexer**

Action	**Error and error cause**
Apply a high-frequency signal (f >3 GHz) at the diplexer input with a level of –20 dBm and measure at the output connector. FSP7: - Input connector diplexer X169 - Output connector diplexer X8 FSP13/30: - Input connector X231 - Output connector X233 *- Note: The diplexer is not installed on the MW converter unit (see chapter 5 item 150).* FSP40: - Input connector diplexer X168 - Output connector diplexer X5 Output level >-27 dBm	If the level is missing or too low, replace the diplexer. (Refer to "Replacing Diplexer".) If the measured level is within tolerances, one of the subsequent modules on the MW converter is defective.

- **Level conditions on the YIG filter unit**

Action	**Error and error cause**
Apply a high-frequency signal (f >3 GHz) at the YIG filter input with a level of –25 dBm and measure at the output connector. Set the spectrum analyzer to the center frequency of the signal generator and a span of 0 Hz. - Input connector J1 - Output connector J2 Output level >-33 dBm	If the level is missing or too low, replace the YIG filter unit. (Refer to "Replacing YIG Filter Unit".) If the measured level is within tolerances, one of the subsequent modules on the MW converter is defective.

- **Level conditions on the RF extension**

Action	**Error and error cause**
Apply a high-frequency signal (f >3 GHz) at the RF extension input with a level of -10 dBm and measure at the output connector. Set the spectrum analyzer to the center frequency of the signal generator and a span of 0 Hz. In addition, the LO (connector X102 standard frontend) should be taken out to the MW converter (connector X167). <u>FSP13/30/40:</u> - Input connector X1 - Output connector X3 *- Note concerning the LO: The solid-sheath cable between X2 and X7 should be connected.* <u>Output level at 404.4 MHz:</u> f = 3 GHz to 13.6 GHz: >-26 dBm f = 13.6 GHz to 30 GHz: >-38 dBm f = 30 GHz to 40 GHz: >-40 dBm	If the level is missing or too low, replace the RF extension. (Refer to "Replacing RF Extension".)

Contents - Chapter 4 "Software Update/Installing Options"

4 Software Update / Installing Options 4.1

Installation of new FSP Software 4.1

Restoring the Operating-System Installation 4.2

Installing the Options 4.3

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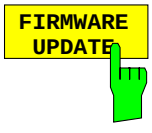
4 Software Update / Installing Options

This chapter contains information on updating software, restoring the operating-system installation and installing options to the FSP. Additional manuals obtained together with a software/firmware update or with subsequently acquired options can be filed here.

Installation of new FSP Software

The installation of a new firmware version can be performed using the built-in diskette drive. The firmware update kit contains several diskettes.
The installation program is called up in the *SETUP* menu.

SETUP side menu:



The *FIRMWARE UPDATE* softkey starts the installation program and leads the user through the remaining steps of the update

IEC/IEEE-bus command: --

Performing the update:

Insert diskette 1 into the drive.
Call *SETUP* side menu *[**SETUP**][**NEXT**]*

Start update *[FIRMWARE UPDATE]*



The *RESTORE FIRMWARE* softkey restores the previous firmware version

IEC/IEEE-bus command: --

Restoring the Operating-System Installation

If the operating system can no longer be booted, it is possible to boot the analyzer in the boot menu from the backup partition, and to restore the operating-system installation. The function is not available for instruments equipped with option B20.

Please select the operating system to start:

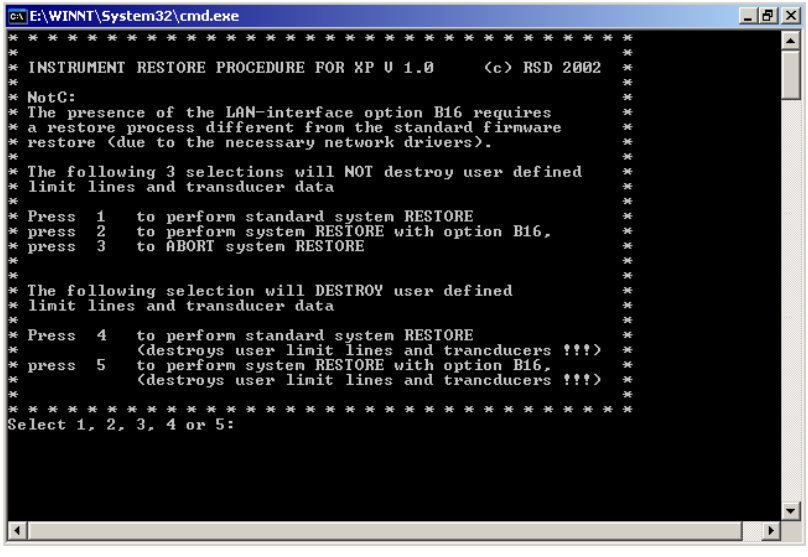
Analyzer Firmware
Analyzer Firmware Backup

Use the up and down arrow keys to move the highlight to your choice.
Press ENTER to choose.

Seconds until highlighted choice will be started automatically: 5

For troubleshooting and advanced startup options for Windows, press F8.

The boot of the backup partition is selected in the boot menu (*Analyzer Firmware Backup*) using the cursor keys and confirmed with ENTER.



After the operating system has been started from the backup partition, a window appears containing the different restore functions.

The selected operation is started by entering the corresponding number, and the operating-system files are copied from the backup partition to the analyzer partition.

After the files have been copied, the instrument starts up and the firmware is reinstalled. This is automatically followed by a cold for recognizing the analyzer hardware.

Installing the Options

The following options are available with the FSP:

AF Demodulator	FSP-B3	1129.6491.02
OCXO Reference	FSP-B4	1129.6740.02
TV Trigger / RF Power Trigger	FSP-B6	1129.8594.02
Tracking Generator	FSP-B9	1129.6991.02
External Generator Control	FSP-B10	1129.7246.02
WCDMA Demodulation Hardware	FSP-B15	1155.1006.02
LAN Interface	FSP-B16	1129.8042.02
Flash Disk	FSP-B20	1155.3557.02
Elektronic Attenuator	FSP-B25	1129.7746.02
Trigger Port	FSP-B28	1162.9915.02
DC Power Supply	FSP-B30	1155.1158.02
Battery Pack	FSP-B31	1155.1258.02
Additional Battery Pack	FSP-B32	1155.1506.02
Demodulation Hardware	FSP-B70	1157.0559.02

For retrofitting, please note the mounting instructions enclosed with the options.
These mounting instructions can be filed at this place in the service manual and are thus easily available whenever they are required.



Caution!

Disconnect the instrument from the mains before opening the casing. Also note the safety instructions at the beginning of this manual.

The components used in the instrument are sensitive to electrostatic discharges which is why they are to be dealt with according to the ESD regulations.

When installing hardware options note the following:

- Switch off instrument and pull the mains plug.
- Unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- After installing the option replace the tube and fasten the rear panel feet again.



Caution!

When replacing the tube take care not to damage or pull off cables.

- Switch on FSP (cold boot).
- Install additional software, if supplied, according to the instructions enclosed with the option.
- If an adjustment is required for this option, the appropriate hints are to be found in the installation instructions for the option.

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5 Documents

This chapter provides information on the ordering of spare parts and contains the spare parts list and the documents for the complete FSP unit.

Shipping of Instrument and Ordering of Spare Parts

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

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

We require the following information in order to answer your inquiry fast and correctly and to decide whether the warranty still applies for your instrument:

- Instrument model
- Stock No.
- Serial number
- Firmware version
- Detailed error description in case of repair
- Contact partner for checkbacks

Shipping of Instrument

When shipping the instrument, be careful to provide for sufficient mechanical and antistatic protection

- Repack the instrument as it was originally packed when transporting or shipping. The two protective caps for the front and rear panels prevent the control elements and connectors from being damaged. The antistatic packing foil avoids any undesired electrostatic charging to occur.
- If you do not use the original packaging, provide for sufficient padding to prevent the instrument from slipping inside the package. Wrap antistatic packing foil around the instrument to protect it from electrostatic charging.

Shipping of a Module

When shipping a module, then, also be also careful to provide for sufficient mechanical and antistatical protection

- Ship the module in a sturdy, padded box.
- Wrap the board into antistatic foil.
  If the packaging is only antistatic but not conductive, additional conductive packaging is required. The additional packaging is not required if the enclosed packaging is conductive.
  Exception: If the module contains a battery, the tightly fitting packaging must always consist of antistatic, non-chargeable material to protect the battery from being discharged.

Ordering Spare Parts

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

- Stock number (see component lists in this chapter)
- Designation
- Component number according to component list
- Number of pieces
- Instrument type the replacement part belongs to
- Stock No.
- Contact person for possible questions

The stock numbers necessary for ordering replacement parts and modules as well as power cables can be found further down.

Refurbished Modules

Refurbished modules are an economic alternative for original modules. It should be kept in mind that refurbished modules are not new, but repaired and fully tested parts. They may have traces from use but they are electrically and mechanically equivalent to new modules.

To find out which refurbished modules are available, please refer to your Rohde & Schwarz representative (or to the central service division, Rohde & Schwarz Munich).

Return of Defective Replaced Modules

Defective modules of the replacement program that can be repaired can be returned within **3 months** after delivery of the replaced module. A repurchasing value is credited.

Excluded are parts which can not be repaired, e.g. PCBs that are burnt, broken or damaged by repair attempts, incomplete modules, parts which are heavily damaged mechanically.

The defective parts must be sent back with a **returned accompanying document** containing the following information:

- Stock number, serial number and designation of the dismounted part,
- **Precise** description of the error,
- Stock number, serial number and designation of the instrument the part was dismounted from,
- Date of dismounting,
- Name of the technician who exchanged the part.

A returned accompanying document is provided with each replacement module.

Spare Parts

The stock numbers necessary for ordering replacement parts and modules can be found in the component lists further down.



Important Note!

When replacing a module please note the safety instructions and the repair instructions given in chapter 3 and at the beginning of this service manual

When shipping a module be careful to provide for sufficient mechanical and antistatical protection.

Available Power Cables

Table 5-1 List of power cables available

Stock No.	Earthed-contact connector	Preferably used in
DS 0006.7013	BS1363: 1967' complying with IEC 83: 1975 standard B2	Great Britain
DS 0006.7020	Type 12 complying with SEV-regulation 1011.1059, standard sheet S 24 507	Switzerland
DS 0006.7036	Type 498/13 complying with US-regulation UL 498, or with IEC 83	USA/Canada
DS 0006.7107	Type SAA3 10 A, 250 V, complying with AS C112-1964 Ap.	Australia
DS 0025.2365 DS 0099.1456	DIN 49 441, 10 A, 250 V, angular DIN 49 441, 10 A, 250 V, straight	Europe (except Switzerland)

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Spare Parts List

Mechanical Drawings

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List of FSP parts including spare parts

The FSP is constructed in accordance with R&S design 2000.

Overall dimension: W x H x L, 372.75 x 176.50 x 395.00

Rack mount: 4E 7/8 T350

Accessories: 19" Adapter ZZA-411, Stock No. 1096.3283.00

Note: *The recommended spare parts are marked with an x in the last column.*

Table 5-2 List of all FSP part and spare parts

Position	Designation	Stock No.	Number	Electrical designation	Recommended spare parts
Document 1164.4391.01 (FSP Basic Unit)					
10	Basic Unit	1164.4404.02	1 S		
15	Fan	1093.4614.00	1 S	E1	x
20	Attenuator (FSP-3/7)	1067.7684.03	1 S	A40	x
30	Attenuator (FSP-13/30)	1046.5024.05	1 S	A40	x
35	Attenuator (FSP 40)	1046.5099.03	1 S	A 40	x
40	Screw with washer assembly M2.5X6	1148.3059.00	2 S		x
42	Screw with washer assembly M3X6	0041.1682.00	2 S		
50	Key probe board	1093.7742.02	1 S	A80	x
55	DIN965-M2.5X6-A4-PA	1148.3288.00	3 S		
60	Subassembly plate	1164.4456.00	1 S		
70	DIN965-M2.5X6-A4-PA	1148.3288.00	4 S		
80	Adhesive foil 30X20 SW	1093.9051.00	3 S		
90	Cover RD15,9	0009.9200.00	1 S		
92	Frontend	1093.5491.06	1 S	A100	x
100	FRONTEND	1093.5491.07	1 S	A100	x
110	DETECTOR BOARD	1093.6998.06	1 S	A120	x
120	IF-FILTER	1093.7242.04	1 S	A130	x
130	Converter Unit (7 GHz) replaced by 1130.2544.02	1093.7994.02	1 S	A160	x
130	Converter Unit (8 GHZ)	1130.2544.02	1 S	A160	x
135	MW Converter Unit (13 GHz)	1093.8249.13	1 S	A160	x

Position	Designation	Stock No.	Number	Electrical designation	Recommended spare parts
140	MW Converter Unit (30 GHz)	1093.8249.30	1 S	A160	x
141	MW Converter Unit (40 GHz)	1093.8584.40	1 S	A 160	x
142	Screw with washer assembly M2.5X6	1148.3059.00	4 S		
150	Diplexer (30 GHz)	1108.8508.30	1 S	A230	x
160	Air cover	1093.5285.00	1 S		
170	Rear panel labelling	1093.4650.00	1 S		
180	Screw with washer assembly M2.5X6	1148.3059.00	5 S		
190	Cover 9-pin SUB-D	1093.8990.00	1 S		
200	Cover 25-pin SUB-D	1093.9000.00	3 S		
210	Cover RD11,1/9,9	0009.9217.00	4 S		
220	Cover f. IEC Bus (metal)	1050.9272.00	1 S		
225	Cover f. IEC Bus	0852.0450.00	1 S		
230	Screw with washer assembly M3X6	0041.1682.00	2 S		
235	Cover f.. LAN-connector	0852.0467.00	1 S		
240	Instrument top cover	1093.4637.00	1 S		
250	Screw with washer assembly M2.5X6	1148.3288.00	2 S		
260	DIN965-M2.5X6-A4-PA	1148.3288.00	2 S		
270	Printed front panel 3 GHz	1164.4462.00	1 S		
280	Printed front panel 7 GHz	1164.4479.00	1 S		
285	Printed front panel 13 GHz	1164.4485.00	1 S		
290	Printed front panel 30 GHz	1164.4491.00	1 S		
292	FRONT COVER DESCR. 40 GHz	1164.4504.00	1 S		
295	RF cable W1 7GHz	1093.4872.00	1 S	W1	x
305	Cable clamp RD4 BR6	0080.3660.00	1 S		
312	RF-cable W1 13 GHz	1093.5010.00	1 S	W1	x
315	RF-cable W1 30GHz	1093.5027.00	1 S	W1	x
316	TESTPORT ADAPTER	1021.0493.00	1 S		
322	CABLE W1 40 GHz	1093.5162.00	1 S	W1	
324	TEST PORT RACK ADAPTER	1036.4702.00	1 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended spare parts
330	Assembly plate	1093.4750.00	1 S		
340	Assembly plate	1093.4772.00	1 S		
350	DIN965-M2.5X6-A4-PA	0852.3614.00	4 S		
400	Adhesive foil DRM50 grey	1093.9068.00	1 S		
401	Adhesive foil DRM50 grey	1093.9068.00	1 S		
410	tube with foots	1164.4662.00	1 S		
420	BW2-front panel handle 4E	1096.1480.00	2 S		
430	BW2- M4X14	1096.4909.00	4 S		
450	BW2-rear panel foot 50MM	1096.2493.00	4 S		
455	BW2-foil f. rear panel foot	1096.2435.00	4 S		
Drawing 1164.4404.01 (Digital Unit)					
500	Instrument frame	1093.4543.00	1 S		
510	DIN965-M2,5X6-A4-PA	1148.3288.00	1 S		
515	Motherboard	1142.8228.02	1 S	A10	x
520	Screw with washer assembly M2.5X6	1148.3059.00	5 S		
530	Locking bolt M3	0009.6501.00	4 S		
540	Spacer for D-Submin.	1093.9180.00	2 S		
550	Power supply unit 230W UL/CSA	1091.2320.00	1 S	A20	x
560	Screw with washer assembly M2.5X6	1148.3059.00	10 S		
575	Front module controller 6/5	1091.2520.00	1 S	A90	x
590	Screw with washer assembly M2.5X6	0071.5040.00	10 S		
600	Display unit	1093.4708.04	1 S		
610	DIN965-M2.5X6-A4-PA	1148.3288.00	1 S		
620	Keyboard frame FSP	1093.5127.00	1 S		
630	Keyboard mat FSP	1093.5133.00	1 S		x
640	Keyboard membrane FSP	1093.5140.00	1 S		x
650	Rotary knob RD28 ACHS-RD6	0852.1086.00	1 S		
660	DIN965-M2X6-A4-PA	0041.1599.00	10		
670	3,5" Floppy drive slim	0048.6638.00	1 S	A30	x

Position	Designation	Stock No.	Number	Electrical designation	Recommended spare parts
680	Floppy bracket	1093.4620.00	1 S		
690	Fley strip conn.26P.R=1	1091.2066.00	1 S	W300	
700	Screw with washer assembly M2.5X6	1148.3059.00	5 S		
702	DIN7985-M2,5X4-A4-PA	1148.2717.00	3		
704	DIN127-B2,5-A4	0082.4786.00	3		
710	Hard disk with firmware	1164.4579.02	1 S	A60	x
720	Ribbon cable	1093.5156.00	1 S	W11	
730	Disk bracket	1093.4837.00	1 S		
740	DIN965-M2.5X6-A4-PA	1148.3288.00	2 S		
750	DIN965-M3X5-A4-PA	1148.2775.00	4 S		
775	Lithium batterie CR2032	0858.2049.00	1		
Drawing 1093.4708.01 (Display Unit) page 3					
800	Assembly tray	1093.4795.00	1 S		
810	Shielded filter plate	1091.2014.00	1 S		x
820	RF spring (177)	1069.3011.00	2 S		
830	RF spring (137)	1069.3105.00	2 S		
840	Plate holder	0852.0844.00	4 S		
850	DIN965-M2X4-A4-PA	1148.3259.00	4 S		
860	Dust sealing	1093.5279.00	1 S		
870	CXA-L0605-VJL DC-AC converter	0048.6996.00	1 S	T10	x
880	DIN7985-M2X10-A4-PA	1148.2917.00	2 S		
890	DIN125-A2,2-HP	0049.7396.00	2 S		
906	Converter cable L=350	1091.2650.00	1 S	W100	x
910	Spin wheel	0852.1170.00	1 S	B10	x
915	SCHRAUBE 1,8X4,4	1066.2066.00	3 S		
920	TFT 640x480x3 Color-LCD	0048.6980.00	1 S	A80	x
930	Screw with washer assembly M2.5X6	1148.3059.00	4 S		
947	Display connector	1091.0911.00	1 S	W80	x
950	Screw with washer assembly M2.5X6	0071.5040.00	2 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended spare parts
Drawing 1093.7994.01 (7 GHz converter unit) page 3					
2000	7 GHz CONVERTER	1093.8003.02	1 S	A160	
2000	7 GHz YIG UNIT	1093.8090.02	1 S	A161	
2000	DIN965-M2.5X6-A4-PA	0852.3614.00	2 S		
2000	7 GHz DIPLEXER	1108.7001.02	1 S	A162	
2000	DIN6900-M2.5X5 -A2	0071.6830.00	4 S		
2000	8 GHz CONVERTER	1130.2409.02	1 S	A160	
2002	8 GHz YIG UNIT (MICRO LAMBDA)	1130.2744.02	1 S	A161	
2003	8 GHz YIG UNIT (FILTRONIC)	1130.2744.03	1 S	A161	
2004	DIN965-M2.5X6-A4-PA	1148.3288.00	2 S		
2006	8 GHz DIPLEXER	1132.6501.02	1 S	A162	
2008	DIN6900-M2.5X5 -A2	0071.6830.00	4 S		
Drawing 1130.2544.01 (8 GHz converter unit)					
2000	8 GHz CONVERTER	1130.2550.02	1 S	A160	x
2005	8 GHz YIG UNIT (MICRO LAMBDA)	1130.2944.02	1 S	A161	x
2010	8 GHz YIG UNIT (FILTRONIC)	1130.2944.03	1 S	A161	x
2025	DIN965-M2.5X6-A4-PA	1148.3288.00	2 S		
2030	8 GHz DIPLEXER	1132.6501.02	1 S	A162	x
2035	DIN6900-M2.5X5 -A2	0071.6830.00	4 S		
Drawing 1093.8249.01 (MW CONVERTER UNIT 13 / 30 GHz)					
2110	MW CONVERTER	1093.8255.02	1 S	A160	x
2115	YIG UNIT (13 GHz , MICRO LAMBDA)	1093.8278.13	1 S	A161	x
2120	YIG UNIT (13 GHz, FILTRONIC)	1093.8278.14	1 S	A161	x
2125	YIG UNIT (30 GHz, MICRO LAMBDA)	1093.8278.30	1 S	A161	x
2130	YIG UNIT (30 GHz, FILTRONIC)	1093.8278.31	1 S	A161	x
2135	DIN965-M2.5X8-A4	0825.3620.00	4 S		
2140	RF EXTENSION 13	1108.6505.13	1 S	A162	x
2145	RF EXTENSION 30	1108.6505.30	1 S	A162	x
2150	SCREW WITH WAHSER M2.5X5-A2	0071.6830.00	6 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended spare parts
Drawing 1093.8584.01 (UNIT MW CONVERTER 40 GHz)					
2210	40 GHz CONVERTER	1093.8610.02	1 S	A160	x
2215	YIG UNIT (40 GHz, MICRO LAMBDA)	1093.8655.40	1 S	A161	
2217	YIG UNIT (40 GHz, FILTRONIC)	1093.8655.41	1 S	A161	
2220	DIN965-M2.5X6-A4-PA	0852.3614.00	2 S		
2225	DIPLEXER 44	1132.9500.02	1 S	A163	
2230	SCREW WITH WASHER M2.5X6-A2	1148.3059.00	4 S		
2235	RF EXTENSION 40	1151.2508.02	1 S	A162	x
2240	SCREW WITH WASHER M2.5X6-A2	1148.3059.00	8 S		
2245	50 OHM TERMINATION SMA	0249.7823.00	1 S		
Drawing 1096.6224.00 (Option FSP-B1 1129.7998.02)					
	Swivel handle	1096.6118.00	1 S		x
	Front protector left	1096.6001.00	1 S		x
	Front protector right	1096.6018.00	1 S		x
	Rear protector	1096.6076.00	2 S		x
	Protctive cover	1096.6182:00	1 S		x
	BW2-TUBE FSP 4E 7/8	1129.8007.00	1 S		
	DIN934-M4-A4	0016.4400.00	2 S		
	DIN6797-A4,3-A2	0016.2837.00	2 S		
Drawing 1129.6491.02 (Option FSP-B3)					
1000	Demodulator	1093.7620.02	1 S	A190	x
1010	RF cable W13	1129.6504.00	1 S	W13	
1020	Loudspeaker	1129.6510.00	1 S	B1	x
1025	CABLE HOLDER 6X7	1093.9045.00	1 S		
1030	Loudspeaker support spring	1096.2512.00	1 S		
1040	Vol./phones board	1093.7094.02	1 S	A191	x
1050	Retaining bracket probe/code	1093.4766.00	1 S		
1055	Screw with washer assembly M2.5X6	1148.3059.00	1 S		
1060	DIN965-M2.5X6-A4-PA	1148.3288.00	3 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended spare parts
1070	Rotary knob RD9.5ACHS-RD4T-GR	0852.1111.00	1 S		
1086	MASSEFEDER	1142:8242:00	1 S		
1090	Mounting instruction / drawing	1129.6540.00	1 S		
Drawing 1129.6791.00 (Option FSP-B4)					
1100	OCXO	1093.7871.02	1 S	A200	x
1120	RF-cable W14	1129.6756.00	1 S	W14	
1140	Mounting instruction / drawing	1129.6791.00	1 S		
Drawing 1129.8613.00 (Option FSP-B6 1129.8594.02)					
1800	TRIGGER	1129.8642.04	1 S	A230	x
1810	RF CABLE W33	1129.8636.00	1 S	W33	
1850	CCVS-SCHILD	1129.8707.00	1 S		
1870	NUMMERN-SCHILD	1129.8713.00	1 S		
1890	MOUNTING INSTRUCTION / DRAWING	1129.8613.00	1 S		
Drawing 1129.7069.00 (Option FSP-B9 1129.6991.02)					
1500	TRACKING GENERATOR	1093.7371.02	1 S	A170	x
1510	RF cable L W16 (FSP-3/7/13/30)	1129.7000.00	1 S	W16	
1520	RF cable W17	1129.7017.00	1 S	W17	
1530	RF cable W18	1129.7023.00	1 S	W18	
1540	RF cable W19 (FSP-3)	1129.7030.00	1 S	W19	
1550	RF cable W19 (FSP-7/13/30/40)	1129.7075.00	1 S	W19	
1560	RF cable W20	1129.7046.00	1 S	W20	x
1561	Bracket RD 4 BR 6	0080.3660.00	1 S		
1565	Assembly plate	1093.4750.00	1 S		
1566	DIN965-M2.5X6-A4-PA	1148.3288.00	4 S		
1568	RF CABLE W35 (FSP 40)	1129.7117.00	1 S	W35	
1590	Mounting instruction / drawing	1129.7069.00	1 S		
Drawing 1129.7298.00 (Option FSP-B10 1129.7246.02)					
1600	EXT. GEN. CONTROL	1093.8590.02	1 S	A210	x
1610	IEC-BUS cable W21	1129.7252.00	1 S	W21	x

Position	Designation	Stock No.	Number	Electrical designation	Recommended spare parts
1612	DIN125-A3.2-A4	0082.4670.00	2 S		
1614	DIN137-A3-A2	0005.0296.00	2 S		
1620	Aux control cable W22	1129.7269.00	1 S	W22	x
1622	Locking bolt M3	0009.6501.00	2 S		
1624	DIN137-A3-A2	0005.0296.00	2 S		
1626	DIN934-M3-A4	0016.4398.00	2 S		
1690	Mounting instruction / drawing	1129.7298.00	1 S		
Drawing 1155.1012.00 (Option FSP-B15 1155.1006.02)					
1160	WIDEBAND CALIBRATOR	1154.7100.02	1 S	A190	x
1170	RF CABLE W34	1155.1029.00	1 S	W34	
1180	MOUNTING INSTRUCTION / DRAWING	1155.1012.00	1 S		
Drawing 1129.8107.00 (Option FSP-B16 1129.8042.03)					
1250	Cable 2XRJ45 ST/ST 8P	1138.9677.00	1 S	W32	
1270	Adapter 8P.GER	1093.9122.00	1 S	X220	x
1290	Assembly plate	1129.8065.00	1 S		
1300	Screw with washer assembly M2.5X6	0071.5040.00	2 S		
1310	Cable clamp BI.RD 1 BIS 25 B2	0015.9038.00	2 S		
1340	Mounting instruction / drawing	1129.8107.00	1 S		
Drawing 1155.1712.00(Option FSP-B20 1155.1606.06)					
1700	COMPACT FLASH BOARD	1130.3557.02	1 S	A60	x
1713	FLASH MEM with software	1155.1641.06	1 S	A61	x
1730	CF-CARD HOLDER CLAMP	1130.1260.00	2 S		
1770	MOUNTING INSTRUCTION / DRAWING	1155.1612.00	1 S		
Drawing 1129.7800.00 (Option FSP-B25 1129.7746.02)					
1400	Attenuator (electronic)	1108.7230.02	1 S	A50	x
1410	Ribbon cable 10POL	1129.7823.00	1 S	W50	
1420	RF cable W29	1129.7752.00	1 S	W27	
1430	RF cable W28 (FSP-3)	1129.7769.00	1 S	W28	
1440	RF cable W28 (FSP-7/13/30)	1129.7775.00	1 S	W28	

Position	Designation	Stock No.	Number	Electrical designation	Recommended spare parts
1460	Screw with washer assembly M2.5X6	0071.5040.00	4 S		
1490	Mounting instruction / drawing	1129.7800.00	1 S		
Drawing 1162.9921.00 (Option FSP-B28 1162.9915.02)					
1360	USER-PORT cable W67	1142.8094.00	1 S	W67	x
1365	Locking bolt M3	0009.6501.00	2 S		
1370	DIN137-A3-A2	0005.0296.00	2 S		
1375	DIN934-M3-A4	0016.4398.00	2 S		
1380	Adhesive shield	1162.9938.00	1 S		
1385	MOUNTING INSTRUCTION / DRAWING	1162.9921.00	1 S		
Drawing in chapter 3 (Option FSP-B30 1155.1158.02)					
3000	DC/DC Konverter f. SN230	1155.1164.00	1 S		x
3010	Cable EXT. DC	1155.1170.00	1 S		
3020	Rear panel feet FSP-B30	1155.1193.00	1 S		
Drawing chapter 3 (Option FSP-B31/B32 1155.1258.02/1155.1506.02)					
3030	BATTERY CHARGER	1155.1358.02	1 S	A1	x
3040	13,2 V 7,6AH AKKU PACK	1102.5607.00	2 S	G1, G2	x
3050	Table power supply 70 W	4055.3471.00	1 S		x
3060	Cable	1155.1487.00	1 S	W2	
Drawing 1157.0607.00 (Option FSP-B70 1157.0559.02)					
1900	DETECTOR BOARD 1	1130.2196.07	1 S	A140	x
1950	MOUNTING INSTRUCTION / DRAWING	1157.0607.00	1 S		

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Block Circuit Diagram