R&S®FSQ
Signal Analyzer
Service Manual

1313.9681.82 – 01

Test & Measurement

Service Manual

ROHDE&SCHWARZ

The Service Manual describes the following R&S®FSQ models and options:

- R&S FSQ3 (1313.9100K03)
- R&S FSQ8 (1313.9100K08)
- R&S FSQ26 (1313.9100K26)
- R&S FSQ39 (1313.9100K39)
- R&S FSQ40 (1313.9100K40)
- R&S FSU-B9 (1142.8994.02)
- R&S FSQ-B10 (1129.7246.03)
- R&S FSP-B16 (1129.8042.03)
- R&S FSQ-B17 (1163.0063.02)
- R&S FSU-B21 (1157.1090.03)

The contents of this manual correspond to firmware 4.65 or higher.

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The following abbreviations are used throughout this manual:
R&S®FSQ is abbreviated as R&S FSQ.

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1 Performance Test

1.1 Test Instructions

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

- At least 15 minutes warm-up
- All internal adjustments must be carried out. The overall adjustment is performed in the CAL menu
  [**CAL** : CAL TOTAL].
- Unless specified otherwise, all measurements will be performed with external reference frequency.

In the following sections, the procedures for checking the rated specifications are described.

The data is given in the specification. The values 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, eg **[SPAN]**
[<SOFTKEY>]	Press a softkey, eg [MARKER -> PEAK]
[<**nn unit**>]	Enter a value and terminate by entering the unit, eg [**12 kHz**]

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

The R&S FSQ 31 is tested as R&S FSQ 40, the maximum input frequency is limited to 31 GHz.

1.2 Measuring Equipment and Accessories

Item	Type of equipment	Specifications recommended	Equipment recommended	Alternative equipment	Use
1	Frequency counter	frequency range up to 10 MHz resolution min. 9 digits accuracy < $1x10^{-9}$, < $1x10^{-9}$ with option FSU-B4	Advantest R5361B with option 23	HP 53132A with option 012 (Agilent)	Frequency accuracy of reference oscillator
2	Signal generator 2 units	R&S FSQ 3: 10 MHz to 3.6 GHz R&S FSQ 8: 10 MHz to 8 GHz R&S FSQ 26: 10 MHz to 27 GHz R&S FSQ 40: 10 MHz to 40 GHz	R&S SMP02 R&S SMP03 R&S SMR50	HP 83650 B (Agilent)	Immunity to interference; Third-Order Intercept; Absolute level accuracy at 128 MHz; Frequency response
3	Signal generator	100 kHz to 3.6 GHz -30 dBm to +10 dBm harmonics < -30 dBc SSB phase noise at 639 MHz: < -130 dBc(1 Hz) @ 100 kHz < -143 dBc(1 Hz) @ 1 MHz	R&S SMHU	HP 8664 A OPT 004 (Agilent)	2nd-Order harmonic distortion; IF Filters; Display linearity; RF attenuator accuracy; Reference level switching; Frequency response; Phase noise (only if used as alternative to item 5) B9: Frequency response of the base band input B72: SNR
4	Signal generator	10 MHz to 2.5 GHz -62 dBm to +16 dBm harmonics up to +16 dBm: <-25 dBc SSB phase noise at 639 MHz: < -100 dBc(1 Hz) @ 100 Hz < -115 dBc(1 Hz) @ 1 kHz < -127 dBc(1 Hz) @ 10 kHz	-	HP 8663 A (Agilent)	Display linearity; RF attenuator accuracy; Reference level switching accuracy (alternative measurement); Phase noise (only if used as alternative to item 5)
5	640 MHz signal source	low-noise signal source for 640 MHz from R&S FSQ with synthesizer 1166.2209.02	R&S FSU with option B5		B5 option for the FSU for testing phase noise at 640 MHz
6	Signal source	low-noise signal source for 800 MHz	REFSYN		Phase noise (alternative to item 2, 4 or item 5)
7	Power splitter 2-resistor design	DC to 3.6 GHz equivalent output SWR 10 MHz to 3.6 GHz <1.10	HP 11667 A		Frequency response <3.6 GHz; Display linearity; RF attenuator accuracy; Reference level switching accuracy;

Item	Type of equipment	Specifications recommended	Equipment recommended	Alternative equipment	Use
8	Power splitter 2-resistor design	R&S FSQ 3: 10 MHz to 3.6 GHz FSQ 8: 10 MHz to 8 GHz FSQ 26: 10 MHz to 26.5 GHz FSQ 40: 10 MHz to 50 GHz	HP 11667B (Agilent) HP 11667C + adapter to K (Agilent)		Frequency response >3.6 GHz; Third-Order Intercept
		level imbalance 3.6 GHz to 8 GHz ≤ 0.3 dB 8 GHz to 22 GHz ≤ 0.4 dB 22 GHz to 40 GHz ≤ 0.5 dB 40 GHz to 50 GHz ≤ 0.6 dB equivalent output SWR 3.6 GHz to 8 GHz ≤ 1.3 8 GHz to 22 GHz ≤ 1.4 22 GHz to 40 GHz ≤ 1.5 22 GHz to 40 GHz ≤ 1.7			
9	50 Ω termination	FSQ 3: 10 MHz to 3.6GHz FSQ 8: 10 MHz to 8 GHz FSQU 26:10 MHz to 26.5 GHz FSQ 40: 10 MHz to 50 GHz	R&S RNA Wiltron 28S50 85138A (Agilent)	85138A	Noise display
10	Power meter	Dual channel -30 dBm to +10 dBm Instrumentation uncertainty<0.5%	R&S NRVD	HP 483A (Agilent)	Frequency response Absolute level accuracy at 128 MHz; Display Linearity B21: Test LO output power
11	Power sensor 2 units	10 MHz to 3.6 GHz -30 dBm to 0 dBm RSS ≤ 0.8 % Meter noise ≤ 20 pW	R&S NRV-Z4 or R&S NRV-Z5	HP 8482 A (Agilent)	Absolute level accuracy at 128 MHz; Frequency response < 3.6 GHz; Display linearity;
12	Power sensor	FSQ 3: 10 MHz to 3.6GHz FSQ 8: 10 MHz to 8 GHz FSQ 26: 10 MHz to 26.5 GHz FSQ 40: 10 MHz to 50 GHz -30 to 0 dBm VSWR cal fact. unc. % 50 to 128 MHz 1.15 1.6 3.6 to 8 GHz 1.15 2 8 to 22 GHz 1.25 2.5 22 to 40 GHz 1.35 3 40 to 50 GHz 1.5 5 FSQ-B71: 1 MHz to 36 MHz -20 dBm to +10 dBm ≤ 1.5 %	R&S NRV-Z2 R&S NRV-Z2 R&S NRV-Z55 R&S NRV-Z55 R&S NRV-Z5	HP 8487 A (Agilent)	Frequency response > 3.6 GHz B21: Test LO output power B71: frequency response

Item	Type of equipment	Specifications recommended	Equipment recommended	Alternative equipment	Use
13	Step attenuator	variable attenuation 0 dB to 100 dB, 1-dB steps attenuation accuracy < 0.1 dB (f = 5 MHz)	R&S RSP		Reference level switching, Display linearity, RF attenuator
14	Step attenuator	variable attenuation 0 dB to 30 dB in 10 dB steps 30 MHz VSWR <1.5	R&S RSP	HP 8496B/H (Agilent)	Display Linearity (alternative measurement);
15	Precision Step Attenuator	0 dB to 30 dB, 10 dB steps insertion loss at 0dB 20 dB nominal Accuracy at 30 MHzcharted Limit of uncertainty: ±(0.005 dB + 0.005 dB / 10 dB step)	R&S FSMR-Z2	Verification Kit Attenuator HP 11812 A (Agilent)	Display Linearity (alternative measurement)
16	Fixed Attenuator (2 units)	fixed attenuation 10 dB	43KC-10 (Anritsu)	8490D-010 (Agilent)	Third-Order Intercept B21: Test LO output power
17	Fixed Attenuator	fixed attenuation 3 dB	43KC-3 (Anritsu)	HP 8491B (Agilent)	RF attenuator accuracy; Reference level switching accuracy (alternative measurement);
18	Low pass filter set [1]	Filter 1 cut-off >40 MHz rejection >35 dB at 80 MHz Filter 2 cut-off >290 MHz rejection >35 dB at 580 MHz Filter 3 cut-off >1800 MHz rejection >35 dB at 3600 MHz		HP 0955-0306 HP 0955-0455 HP 0955-0491 (Agilent)	2nd--order harmonic distortion.
19	Measuring Receiver	Range -68 to +2 dBm / 128 MHz Relative Accuracy (RSS): ±0.09 dB within -10 dB to +60 dB from set reference at -58 dBm *TAR = 2.2 : 1* ±0.075 dB within -50 dB to +10 dB from set reference at -8 dBm *TAR = 2.0 : 1*	R&S FSMR 3	HP 8902 (Agilent)	RF Attenuator Accuracy; Reference Level Switching Accuracy (alternative measurement);
20	VSWR-Bridge	directivity >30 dB 9 kHz to 20 (50) MHz	R&S ZRC		VSWR < 20 (50) MHz

[1] If the harmonic suppression of the signal generator is sufficient, the low pass is not needed.

Item	Type of equipment	Specifications recommended	Equipment recommended	Alternative equipment	Use
21	Power sensor	100 kHz to 3.6 GHz -70 dBm to 0 dBm RSS ≤ 0.8 % Meter noise ≤ 20 pW	R&S NRV-Z4		VSWR < 20 (50) MHz
22	Network Analyzer	9 kHz to 20 (50) MHz	R&S ZVR	HP 3577 A (Agilent)	VSWR < 20 (50) MHz (alternative to item 20, 21)
23	Network Analyzer	FSQ 3: 20(50) MHz to 3.6GHz FSQ 8: 20 (50) MHz to 8 GHz FSQ 26: 20 (50) MHz to 26.5 GHz FSQ 40: 20 (50) MHz to 40 GHz	R&S ZVK	HP 8722C E8363B (Agilent)	VSWR > 20 (50) MHz
24		Not used			
25	4 x 50 Ω termination	BNC, 50 Ω ± 0.1 %	RAD 50		B71: all 1kΩ measurements and noise disolay via FSQ-B71 (base band inputs)
26	Arbitrary waveform / function generator	Frequency range up to 10 MHz 2 sinusoidal signals with 90 deg phase difference,	R&S ADS	33220A with option 001 (Agilent) (2 units)	B9: test of modulation
27	Volt meter (2 units)	DC and AC voltage	R&S URE02/03	34401A (Agilent)	B9: test of modulation
28	N cable	attenuation< 0.2 dB up to 3.6 GHz			B9/B12: test of output level
29	Spectrum Analyzer	Frequency range up to 3,6 GHz	R&S FSU see also item 5	E4404B ESA-E (Agilent)	B9: test of modulation
30	IQ-Base Band Generator	Frequency range up to 10 MHz 2 sinusoidal signals with 90 deg phase difference	AMIQ	Alternative item 26	B9: test of modulation
31	WinIQSIM	PC test program for AMIQ		Alternative item 26	B9: Generation of data for modulation test.
32	Software: Modulation test 100 kHz	Setup files for AMIQ with modulated signal 100 kHz		Alternative item 26	B9: test FM
33	Software modulation test 1 MHz + 90 degrees	AMIQ setup file to generate 2 base band signals of 1 MHz with + 90 deg phase shift between I- and Q- channel		Alternative item 26	B9: test AM; Test of I/Q-modulation with + 90 deg phase shift
34	Software modulation test 1 MHz - 90 degrees	AMIQ setup file to generate 2 base band signals of 1 MHz with - 90 deg phase shift between I- and Q- channel		Alternative item 26	B9: test AM; Test of I/Q-modulation with – 90 deg phase shift
35	PC	Windows, LAN and RSIB SW or GPIB interface		Alternative item 26	frequency response of IQ-path B9, B71
36	DC-current meter	max. current 50 mA uncertainty +/- 0.01 mA			B21: mixer bias current source

1.3 Performance Test R&S FSQ

1.3.1 Checking the Reference Frequency Accuracy

Preparation:

The measurement can be performed either with a signal generator on the RF INPUT connector (front panel) at 1 GHz or on the EXT REF OUT connector (rear panel) at 10 MHz with a frequency counter.

For adjustment, the FSQmust be switched to an internal reference source.

To speed up the measurements, a lower frequency counter resolution can be used for the measurement at 3 GHz.

1.3.1.1 Measurement with Generator:

Test equipment:

► Signal generator (chapter "Measuring Equipment and Accessories", item. 2):
- Frequencye.g. 3000 MHz
- Level -20 dBm
- Frequency accuracy $<1x10^{-9}$

If the frequency accuracy of the test transmitter is insufficient, the transmitter can be set to the correct frequency with the aid of the frequency counter prior to the measurement.

Test setup:

► Connect RF output of the signal generator to RF input.of the R&S FSQ.

R&S FSQ settings:

- [**PRESET**]
- [**FREQ** : CENTER : **3 GHz**]
- [**SPAN** : **1 MHz**]
- [**BW** : RES BW MANUAL : **300 kHz]**
- [**AMPT** : REF LEVEL : **-8 dBm**]
- [**AMPT** : RF ATTEN AUTO]
- [**SETUP** : REFERENCE INT / EXT]

► Switch to an internal reference source (INT)

Before the following measurement, the R&S FSQ must be on for at least ten minutes with an internal reference, so that the reference oscillator is warmed up

Measurement:

- ► Switch marker frequency count:
  - [**MKR** : SIGNAL COUNT]
- ► Set the appropriate resolution:
  - [**MKR : NEXT** : CNT RESOL 1 HZ

Model without B4	3 GHz ± 30 Hz (corresponds to 1E-7)
Model with B4	3 GHz ± 10 Hz (corresponds 0.35E-7)

1.3.1.2 Measurement with Frequency Counter

Test equipment:

- ► Frequency counter (Section "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 R&SFSQ (rear panel)

R&S FSQ settings:

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

Measurement:

Measure frequency with frequency counter
Nominal frequency:

Model without option B4	10 MHz ± 1 Hz
Model with option B4	10 MHz ± 0.3Hz

The frequency of the reference oscillator can be adjusted by means of a service function (see chapter "Adjustment")

1.3.2 Checking Immunity to Interference

Test equipment:

► Signal generator (Section "Measurement Equipment", item 2):

Frequency range	R&SFSQ 3, 8:	10 MHz to 13 GHz
	R&S FSQ 26:	10 MHz to 27 GHz
	R&S FSQ 43:	10 MHz to 43 GHz
Maximum level		≥ 0 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 0 dBm

R&S FSQ settings:

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

1.3.2.1 1st IF Image Frequency Rejection

Additional signal generator settings:

- Frequency f_{in} + 9256.8 MHz

Additional R&S FSQ settings:

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

See table of performance test report 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 = 0dBm – L_{dis}

1.3.2.2 2nd IF Image Frequency Rejection

Additional Signal generator settings:

- Frequency f_{in} + 808.8 MHz

Additional R&S FSQ settings:

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

See table of performance test report 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 = 0dBm – L_{dis}

1.3.2.3 3rd IF Image Frequency Rejection

Additional signal generator settings:

- Frequency f_{in} + 40.8 MHz

Additional R&S FSQ settings:

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

  See table of performance test report 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 = 0dBm – L_{dis}

1.3.2.4 1st IF Rejection

Additional Signal generator settings:

- Frequency 4628.4 MHz

Additional R&S FSQ settings:

- [**FREQ** : CENTER : {f_{in}}]
  See table of performance test report 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 = 0dBm – L_{dis}

1.3.2.5 2nd IF Rejection

Additional Signal generator settings:

- Frequency +/- 404.4 MHz
  see table "performance test report" for explanation of “+/-“

Additional R&S FSQ settings:

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

  See table of performance test report 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 = 0dBm – L_{dis}

1.3.3 Checking Nonlinearities

1.3.3.1 Third-Order Intercept Point

Test equipment:

► 2 signal generators (Section "Measurement Equipment", item 2)
- Frequency range:
R&S FSQ 3: 10 MHz to 3.6 GHz
R&S FSQ 8: 10 MHz to 8 GHz
R&S FSQ 26: 10 MHz to 27 GHz
R&S FSQ 40: 10 MHz to 40 GHz

► 2 attenuators (Section "Measurement Equipment", item 16)

► Attenuation a_{ATT} = 10 dB
- Frequency range:
R&S FSQ 3: 10 MHz to 3.6 GHz
R&S FSQ 8: 10 MHz to 8 GHz
R&S FSQ 26: 10 MHz to 26.5 GHz
R&S FSQ 40: 10 MHz to 40 GHz

► Power splitter/combiner (Section "Measurement Equipment", item 8)
- Frequency range:
R&S FSQ3: 10 MHz to 3.6 GHz
R&S FSQ 8: 10 MHz to 8 GHz
R&S FSQ 26: 10 MHz to 26.5 GHz
R&S FSQ 40: 10 MHz to 40 GHz

Test setup:

► Connect RF outputs of the signal generators via 10 dB attenuators to the inputs of the combiner

► Connect output of the combiner to the RF input of the R&S FSQ.

Signal generator settings:

(both generators)

- Frequency: generator 1 $f_{g1} = f_{in} – 50$ kHz
  generator 2 $f_{g2} = f_{in} + 50$ kHz
  See table of performance test report for values of f_{in}

► Adjust the output level of the signal generators for an input level at the R&S FSQ of –10 dBm.

► Switch off the ALC of the generators to reduce the interference between the generators

R&S FSQ settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **500 kHz**]
- [**BW** : RES BW MANUAL : **3 kHz**]
- [**FREQ** : CENTER : {f_{in}}]
  See table of performance test report for values of f_{in}

Measurement

- [**MKR FCTN** : TOI]

Evaluation:

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

If the input signal is exactly known, you can also measure the spurious products in a span of 20 kHz, for example. The TOI is then calculated from the average values of the two interference signals and the average value of the two useful signals.

1.3.3.2 Second-Order Harmonic Distortion

Test equipment:

► Signal generator (Section "Measurement Equipment", item 3)
- Frequency range: 9 kHz to 1.8 GHz
- Recommended harmonic suppression:
  f <100 MHz : >35 dBc
  100 MHz < f < 1 GHz : >45 dBc
  f >1 GHz : >35 dBc

In order to improve the harmonic suppression of the generator it is recommended to insert a lowpass filter with a suitable cut-off frequency (Section "Measurement Equipment", item 13) after the generator.

Test setup:

► Connect RF output of signal generator to the input of the lowpass

► Connect the output of the lowpass to the RF input of the R&S FSQ

If the harmonic suppression of the signal generator is sufficient, the lowpass can be left out.

B88 option IP2:
For instruments equipped with the RF converter model 06, increased limit values are valid in the range from 800 MHz to 1000 MHz.

Signal generator settings:

- Level: 0 dBm
- Frequency: f_{in}
see table of performance test report for values of f_{in}

R&S FSQ settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **3 kHz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**FREQ :** CENTER : { f_{in} }]
  See table of performance test report for values of f_{in}

Measurement:

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

  The level of the input signal L_{IN} is displayed by the marker reading for marker 1.

► Set center frequency of the R&S FSQ to the frequency of the 2nd harmonic
  - [**FREQ** : CENTER : {2 x f_{in}}]

Measurement:

► Set marker to peak of the 2nd harmonic
  - [**MKR** ⇒ : PEAK]

  The level of the harmonic signal L_{K2} is displayed by the marker reading for marker 1.

Evaluation:

The second order harmonic distortion can be calculated as

$$IP_{k2} / \text{dBm} = (L_{IN} - L_{K2}) + L_{IN}$$

1.3.4 Checking IF Filters

Test equipment:

► Signal generator (Section "Measurement Equipment", item 3):
- Frequency 128 MHz
- Level ≥ 0 dBm

Test setup:

► Connect RF output of the signal generator to the RF input of the R&S FSQ.

1.3.4.1 Checking the bandwidth switching level accuracy

Reference measurement (RBW 10 kHz)

Signal generator settings:

- Frequency: 128 MHz
- Level: -20 dBm

R&S FSQ settings:

- [**PRESET**]
- [**AMPT** : **-15 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 the level accuracy

R&S FSQ settings:

- [**SPAN** : {0.5 x RBW}], 0 Hz for RBW > 3 MHz
- [**BW** : RBW MANUAL : {RBW} : **ENTER**]

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´.

1.3.4.2 Checking Bandwidth

Signal generator settings:

- Frequency: 128 MHz
- Level: -10 dBm

R&S FSQ 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-Bandwith

- [**MKR FCTN** : N DB DOWN : **3 dB**]
- [**SPAN** : {3 x RBW}]
  See table of performance test report for values of RBW.

To check the filters > 3 MHz, the resolution bandwidth has to be set manually to X MHz. All other bandwidths will be set automatically by changing the span.

*- [**BW** : RES BW MANUAL : **X MHz**] , with X = 5, 10, 20 or 50 MHz*

► Additional signal generator setting for RBW = 50 MHz:
- Frequency: 999 MHz

► Additional FSQ setting for RBW = 50 MHz:
- [**FREQ** : CENTER : **999 MHz**]

Measurement:

- [**MKR** ⇒ : PEAK]

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

1.3.4.3 Checking the Shape Factor

To check the shape factor the values of the 3 dB bandwith will be needed. Please check before this measurement.

Signal generator settings:

- Frequency: 128 MHz
- Level: 0 dBm

R&S FSQ 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}]

See table of performance test report for values of RBW.

To check the filters > 3 MHz, the resolution bandwidth has to be set manually to X MHz. All other bandwidths will be set automatically by changing the span.

- [**BW** : RES BW MANUAL : **X MHz**] , with X = 5, 10, 20 or 50 MHz

1.3.5 Checking Noise Display

Test equipment:

► 50 Ω termination (Section "Measurement Equipment", item 7)
- Frequency range: R&S FSQ 3: DC to 3.6 GHz
R&S FSQ 8: DC to 8 GHz
R&S FSQ 26: DC to 26.5 GHz
R&S FSQ 40: DC to 40 GHz

Test setup:

Terminate the RF input of the R&S FSQ with 50 Ω

R&S FSQ settings:

Measurement for $f_{n \leq}$ 1 kHz:

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

See table below for values of RefLev.

Measurement for f_n >1 kHz:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [SPAN : 0 Hz]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**BW** : SWEEP TIME MANUAL : **50 ms**]
- [**TRACE 1** : AVERAGE]
- [**TRACE 1** : SWEEP COUNT : **30 ENTER**]
- [**AMPT** : {RefLev}]
- [**FREQ** : CENTER : {f_n}]
- [**MEAS** : Time Dom Power : **Mean**]

See table of performance test report for values of f_n.

Measurement:

► Set the marker to the center frequency for the value below or equal 1 kHz.

► Read out the marker for frequencies below 1 kHz and correct the measurement value by –10 dB for the ratio of 1 Hz / 10 Hz .

► Read out the mean marker for frequencies above 1 kHz and correct the measurement value by –30 dB for the ratio of 1 Hz / 1 kHz .

As both filter designs are digitally and using the same hardware setting, the DANL can be measured also with 1 kHz bandwidth to reduce measurement time.

Evaluation:

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

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

1.3.6 Checking the Level accuracy and the Frequency Response

Test equipment:

- Signal Generator (Section "Measurement Equipment", item 3)
  - Frequency range 100 kHz to 3.6 GHz
  - Maximum level ≥ 0 dBm
- Signal Generator (Section "Measurement Equipment", item 2)
  - Frequency range: R&S FSQ 3: 10 MHz to 3.6 GHz
    R&S FSQ 8: 10 MHz to 8 GHz
    R&S FSQ 26: 10 MHz to 27 GHz
    R&S FSQ 40: 10 MHz to 40 GHz
  - Maximum level ≥ 0 dBm
- Power meter (Section "Measurement Equipment", item 10)
  - Dual Channel
  - Power range -30 to 0 dBm
  - Instrumentation uncertainty <0.5%
  - Uncertainty of power reference <1.2%
  - VSWR of power reference <1.10
- Power Sensor (Section "Measurement Equipment", item 11 (2x))
  - Frequency range 100 kHz to 3.6 GHz
  - Power range -30 to 0 dBm
  - Cal factor uncertainty 1 MHz to 3.6 GHz <1.6 %
  - VSWR 1 MHz to 3.6 GHz <1.30
    50 MHz to 128 MHz <1.10
- Power Sensor (Section "Measurement Equipment", item 12)
  - Frequency range:
    R&S FSQ 8: DC to 8 GHz
    R&S FSQ 26: DC to 26.5 GHz
    R&S FSQ 40: DC to 40 GHz
  - Power range -30 to 0 dBm
  - Cal factor uncertainty
    50 to 128 MHz <1.6 %
    3.6 to 8 GHz <2 %
    8 to 22 GHz <2.5 %
    22 to 40 GHz <3 %
    40 to 50 GHz <5 %
  - VSWR
    50 to 128 MHz <1.15
    3.6 to 8 GHz <1.15
    8 to 22 GHz <1.25
    22 to 40 GHz <1.35
- 6 dB Power Splitter (Section "Measurement Equipment", item 7)
  - Frequency range DC to 3.6 GHz
  - Level imbalance 10 MHz to 3.6 GHz n/a
  - Equivalent output VSWR 10 MHz to 3.6 GHz ≤ 1.1

- ► 6 dB divider (Section "Measurement Equipment", item 8)
  - Frequency range:
    - R&S FSQ 8: DC to 8 GHz
    - R&S FSQ 26: DC to 26.5 GHz
    - R&S FSQ 40: DC to 40 GHz
  - Level imbalance
    - 3.6 to 8 GHz ≤ 0.3 dB
    - 8 to 22 GHz ≤ 0.4 dB
    - 22 to 40 GHz ≤ 0.5 dB
    - 40 to 50 GHz ≤ 0.6 dB
  - Equivalent output VSWR
    - 3.6 to 8 GHz ≤ 1.3
    - 8 to 22 GHz ≤ 1.4
    - 22 to 40 GHz ≤ 1.5

Determining the level accuracy at 128 MHz

Test setup:

- ► Standardize the Power Meter and Power Sensor (item 10, 11).
- ► Set the Power Meter Cal Factor to the appropriate value for the Power Sensor for 128 MHz.
- ► Connect Power Sensor through a cable to RF output of Signal Generator.

Signal generator settings:

- Frequency 128 MHz
- Level -30 dBm

Measurement:

- ► Adjust level to -10 dBm ± 0.1 dB as viewed on the Power Meter.
- ► Record the Power Meter indication.
- ► Disconnect Power Sensor from the cable.

R&S FSQ settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : RF INPUT DC] (R&S FSQ3 / 8 / 26 only)
- [**AMPT** : **-10 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 R&S FSQ (level reading of marker 1) reflects the absolute level accuracy of the R&S FSQ . It can be calculated as:

Level accuracy$_{128MHz}$ = L_{FSQ} - $L_{powermeter}$

Frequency response < 3.6 GHz

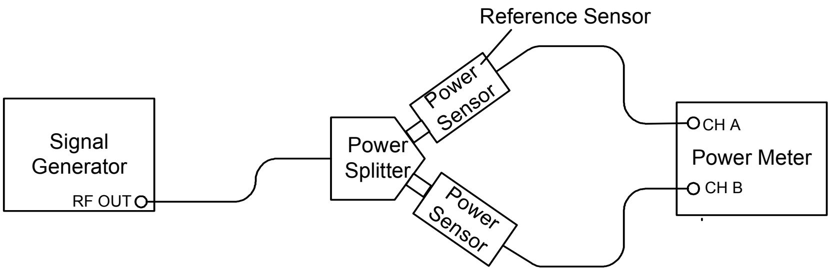
Power splitter calibration

This section can be skipped, if a power splitter with a level imbalance <0.1 dB is available.

Test setup:

► Standardize the Power Meter and both Power Sensors (item 10, 11).

► Use Power Splitter (item) and connect equipment as shown below.



Signal generator settings:

- Level 0 dBm

Measurement:

1. Set the Signal Generator frequency to the first value listed in the table below.
2. Set the Power Meter Channel A Cal Factor to the appropriate value for the Power Sensor for the first frequency listed in the table below (Reference Sensor).
3. Set the Power Meter Channel B CAL Factor to 100%.
4. Calculate the Power Splitter imbalance as
   Imbalance / dB = L_{CHA} / dBm - L_{CHB} / dBm
   (L_{CHA} = Reference Sensor)
5. Record the calculated value in the table below.

Repeat steps 1, 1, 4), 5 for the remaining frequencies listed in the table below.

Table 1 Power Splitter calibration data

Applied frequency (f_{fresp})	Imbalance / dB
100 kHz	_______
1 MHz	_______
10 MHz	_______
50 MHz	_______
100 MHz	_______
128 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	_______
3000 MHz	_______
3599 MHz	_______

Checking the frequency response

Test setup:

► Disconnect the Power Sensor (CHA, Reference Sensor) from the Power Splitter.

► Connect the open port of the Power Splitter directly to the RF input of the R&S FSQ.

Signal generator settings:

- Level 0 dBm
- Frequency 128 MHz

R&S FSQ settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : RF INPUT DC] (R&S FSQ3 / 8 / 26 only)
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

Reference measurement

Measurement:

► Determine signal level $L_{powermeter}$.

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

► Read level indication from R&S FSQ (reading of marker 1): L_{FSQ}

► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

► Calculate
ΔRef / dB = L_{FSQ} / dBm - $L_{PowerMeter}$ / dBm - Imbalance(128 MHz) / dB
Take value of Imbalance(128 MHz) from the table above.

► Record ΔRef / dB

Frequency Response Measurement:

Signal generator settings:

- Frequency f_{fresp}
See table of performance test report for values of f_{fresp}

R&S FSQ settings:

- [**FREQ** : CENTER : {f_{fresp}}]
See table of performance test report for values of f_{fresp}

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

► Read level indication from R&S FSQ (reading of marker 1): L_{FSQ}

Power Meter:

► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

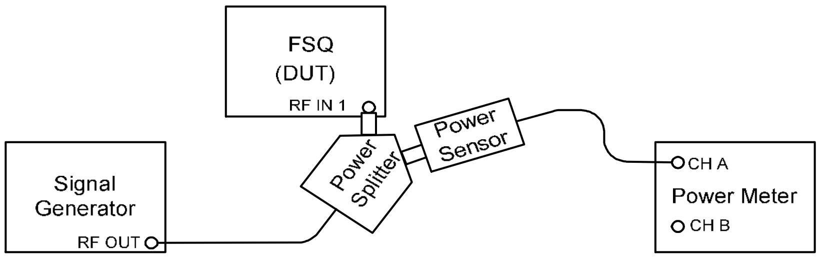
► The frequency response can be calculated as:

- Freq. response / dB = L_{FSQ} - $L_{PowerMeter}$ - Imbalance(f_{fresp}) / dB - ΔRef / dB
- Take the value of Imbalance(f_{fresp}) from the table above and ΔRef as ascertained before.

1.3.6.1 Frequency response > 3.6 GHz

Test setup:

- Standardize the Power Meter and Power Sensor (item 10, 12).
- Use Power Splitter/Combiner (item 8) and connect equipment as shown below.
- Connect the power splitter directly to the R&S FSQ RF input



NOTICE

Throughout the remaining steps set the Power Meter Cal Factor as appropriate!

Reference Measurement

Signal generator settings:

- Level 0 dBm
- Frequency 128 MHz

R&S FSQ settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : RF INPUT DC] (R&S FSQ3 / 8 / 26 only)
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

R&S FSQ settings:

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

► Read level indication from R&S FSQ (reading of marker 1): L_{FSQ}

Power Meter:

► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

► Calculate
ΔRef / dB = L_{FSQ} / dBm - $L_{PowerMeter}$ / dBm

► Record ΔRef / dB

Frequency Response Measurement (YIG filter = ON)

Signal generator settings:

- Frequency f_{fresp}
See table in performance test report for values of f_{fresp}

R&S FSQ settings:

- [**FREQ** : CENTER : {f_{fresp}}]
See table in performance test report for values of f_{fresp}

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

► Read level indication from R&S FSQ (reading of marker 1): L_{FSQ}

Power Meter:

► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

► The frequency response can be calculated as:
Freq. response / dB = L_{FSQ} - $L_{PowerMeter}$ - ΔRef / dB

► Take the value of ΔRef as ascertained before.

Frequency Response Measurement (YIG filter = OFF)

Signal generator settings:

- Frequency f_{fresp}
See table in performance test report for values of f_{fresp}

R&S FSQ settings:

- [**SETUP** : SIGNAL SOURCE : YIG FILTER OFF]
- [**FREQ** : CENTER : {f_{fresp}}]
See table in performance test report for values of f_{fresp}

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

► Read level indication from R&S FSQ (reading of marker 1): L_{FSQ}

Power Meter:

► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

► The frequency response can be calculated as:
Freq. response / dB = $L_{FSQ} - L_{PowerMeter} - \Delta Ref$ / dB

► Take the value of ∆Ref as ascertained before.

1.3.7 Checking the Display Linearity

Test equipment:

► Signal generator (Section "Measurement Equipment", item 3)
- Frequency 128 MHz [1)]
- Maximum level ≥ 10 dBm

► Step attenuator (Section "Measurement Equipment", item 13)
- Frequency 128 MHz [1)]
- 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 R&S FSQ

Signal generator settings:

- Frequency 128 MHz [1)]
- Level +10 dBm

Step attenuator settings:

- Attenuation 20 dB

[1)] A frequency between 5 MHz and 1 GHz may be used. It is recommended to use correction values for the uncertainty of the attenuator.

R&S FSQ 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 : **200 ms**]
- [**MEAS** : TIME DOM POWER : MEAN]

1. Measurement:
- [**BW** : RES BW MANUAL : **500 Hz**]

2. Measurement:
- [**BW** : RES BW MANUAL : **300 kHz**]

3. Measurement:
- [**BW** : RES BW MANUAL : **20 MHz**]

Reference Measurement:

► Read out the mean marker

► Set reference
- [**MEAS** : TIME DOM POWER : **NEXT** : SET REFERENCE]
- [**MEAS** : TIME DOM POWER : **NEXT** : POWER REL]

Measurement

► Step attenuator settings:
Attenuation {a_{ATT}}
See table of performance test report for values of a_{ATT}.

Sweep time settings:

- [**SWEEP** : SWEEP TIME MANUAL : {sweep time}]

a_{ATT}	≤ 50 dB	50 dB < aATT ≤ 70 dB	> 70 dB
Sweep time	200 ms	600 ms	2 s

Evaluation:

The difference between the level of the input signal of the R&S FSQ and the reference (about 10 dB below the reference level) is displayed in the marker field by the reading `POWER [T1] MEAN ´.

1.3.8 Checking the Display Linearity (alternative Measurement)

Test equipment:

► Signal Generator (Section "Measurement Equipment", item 4)
- Frequency 30 MHz
- Maximum level 16 dBm
- Harmonics < -25 dBc

► Power Meter (Section "Measurement Equipment", item 10)
- Dual Channel
- Power range -30 to 0 dBm
- Power Splitter (Section "Measurement Equipment", item 7)
- Power Sensor (Section "Measurement Equipment", item 11)
- Frequency 30 MHz
- Power -15 to +10 dBm

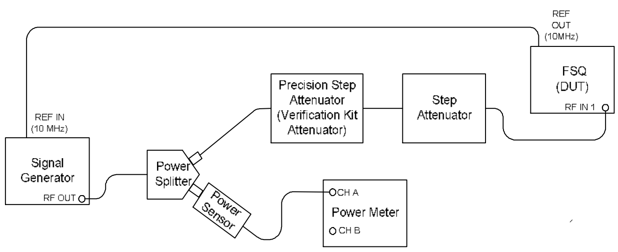
► Precision Step Attenuator (Verification Kit Attenuator, Section "Measurement Equipment", item 15)
- Frequency 30 MHz
- Uncertainty of charted attenuation values: ±(0.005 dB + 0.005 dB / 10dB step)
- Attenuation 0 to 30 dB in 10 dB steps
- Insertion loss 20 dB nominal (two 10 dB pads permanently attached one on each side).

► Step Attenuator (Section "Measurement Equipment", item 14) 0 dB / 30 dB

Test setup:

► Standardize the Power Meter and Power Sensor.

► Connect equipment as shown below:



Signal generator settings:

- Frequency 30 MHz
- Reference Frequency (10 MHz) External

R&S FSQ settings:

- [**PRESET**]
- [**FREQ** : **30 MHz**]
- [**SPAN** : **0 Hz**]
- [**AMPT** : **-10 dBm:** RF ATTEN MANUAL : **10 dB**]
- [**BW** : **500 Hz**]
- [**TRACE** : DETECTOR : DETECTOR AVERAGE]
- [**SWEEP** : **500 ms**]
- [**MEAS** : TIME DOM POWER : MEAN]
- [**NEXT** : POWER REL]

Measurement - RBW 500 Hz

Signal Generator Power dBm	Verification Kit Attenuation dB	Power Meterindication dB (relativ)		Signal Generator Level Error ∆GEN dB (relativ)
16	0	0.00		0.00
10	0	_____	+6 =	_____
14	10	_____	+2 =	_____
8	10	_____	+8 =	_____
12	20	_____	+4 =	_____
6	20	_____	+10 =	_____
10	30	_____	+6 =	_____
4	30	_____	+12 =	_____
-2	30	_____	+18 =	_____
-8	30	_____	+24 =	_____

Step 1

► Set the power of the Signal Generator and the attenuation of the Verification Kit to the first value listed in the table above.

► Set the Step Attenuator to 0 dB.

► R&S FSQ setting
- [**MEAS** : TIME DOM POWER]
- [**NEXT** : SET REFERENCE]

► Set Power Meter to relative indication (dB) and store actual value as reference value.

Step 2

► Set the power of the Signal Generator and the attenuation of the Verification Kit to the second value listed in the table above.

► Record the power meter indication in column 3 of the table above.
Add the figure given in the table above and record the result in column 4 (= ∆GEN).

- Read the R&S FSQ relative power indication, subtract the appropriate value ΔGEN and add the appropriate value V-Kit-Error [2].
- Record the result in the Performance Test Report, item "Display linearity, RBW 500 Hz".
- Repeat step 2 for the remaining values listed in the table above.
- Record the corrected R&S FSQ relative power indication (same value as recorded in the Performance Test Report) appendant to the last setting of the table above:
  L_{-54a} = _________ dB

Signal Generator Power dBm	Verification Kit Attenuation dB	Power Meter indication dB (relativ)		Signal Generator Level Error ΔGEN dB (relativ)
-8	0	0.00		0.00
-4	10	_____	-4 =	_____
0	20	_____	-8 =	_____
4	30	_____	-12 =	_____
-2	30	_____	-6 =	_____
-8	30	_____	-0 =	_____

Step 3

- Set the power of the Signal Generator and the attenuation of the Verification Kit to the first value listed in the table above.
- Set the Step Attenuator to 30 dB.
- Record the R&S FSU relative power indication: L_{-54b} = _________ dB
- Calculate $\Delta L = L_{-54b} - L_{-54a}$ = _________ dB
- Set Power Meter to relative indication (dB) and store actual value as reference value.

Step 4

- Set the power of the Signal Generator and the attenuation of the Verification Kit to the second value listed in the table above.
- Record the power meter indication in column 3 of the table above.
  Subtract the figure given in the table above and record the result in column 4 (= ΔGEN).
- Read the R&S FSQ relative power indication and subtract both the appropriate value ΔGEN and ΔL. Then add the appropriate value V-Kit-Error.
- Record the result in the Performance Test Report, item "Display linearity, RBW 500 Hz".

[2] Refer to charted attenuation accuracy of the Verfication Kit.
V-Kit-Error = actual attenuation (charted) – nominal attenuation (10, 20 or 30 dB).
V-Kit-Error is referenced to the 0 dB setting, i.e. V-Kit-Error = 0 with the 0 dB setting.

► Repeat step 4 for the remaining values listed in the table above.

Table 2 Measurement - RBW 300 kHz

Signal Generator Power dBm	Verification Kit Attenuation dB	Power Meter indication dB (relativ)		Signal Generator Level Error ∆GEN dB (relativ)
16	0	0.00		0.00
10	0	_____	+6 =	_____
14	10	_____	+2 =	_____
8	10	_____	+8 =	_____
12	20	_____	+4 =	_____
6	20	_____	+10 =	_____
10	30	_____	+6 =	_____
4	30	_____	+12 =	_____
-4	30	_____	+20 =	_____
-10	30	_____	+26 =	_____
-16	30	_____	+32 =	_____

Step 1

► Set the power of the Signal Generator and the attenuation of the Verification Kit to the first value listed in the table above.

► Set the Step Attenuator to 0 dB.

► R&S FSQ setting
- [**BW** : **300 kHz**]
- [**MEAS** : TIME DOM POWER]
- [**NEXT** : SET REFERENCE]

► Set Power Meter to relative indication (dB) and store actual value as reference value.

Step 2

► Set the power of the Signal Generator and the attenuation of the Verification Kit to the second value listed in the table above.

► Record the power meter indication in column 3 of the table above.
Add the figure given in the table above and record the result in column 4 (= ∆GEN).

► Read the R&S FSQ relative power indication, subtract the appropriate value ∆GEN and add the appropriate value V-Kit-Error.

► Record the result in the Performance Test Report, item "Display linearity, RBW 300 kHz".

► Repeat step 2 for the remaining values listed in the table above.

1.3.9 Checking the RF Attenuator

Test equipment:

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

► - Step attenuator (Section "Measurement Equipment", item 13)
- 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 R&S FSQ

Signal generator settings:

- Frequency 128 MHz
- Level 0 dBm

Step attenuator settings:

Attenuation 70 dB

R&S FSQ 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 { 80dB - a_{FSQ}}

See table below for values of a_{ATT}.

R&S FSQ settings:

- [**AMPT** : RF ATTEN MANUAL : { a $_{FSQ}$}]
- [**AMPT** : {-40dBm + a$_{FSQ}$ } **dBm**]
- [**MKR** ⇒ : PEAK]

See table below for values of a $_{FSQ}$, a $_{ATT}$ and reference level.

Evaluation:

The difference between the level of the input signal of the R&S FSQ and the reference (at 10 dB RF-Attenuation) is displayed in the marker field by the reading Delta [T1 FXD].

a_{ATT}	70 dB	75 dB	65 dB	60 dB	55 dB	50 dB	40dB	30 dB	20 dB	10 dB
a_{FSQ}	10 dB	5 dB	15 dB	20 dB	25 dB	30 dB	40dB	50 dB	60 dB	70 dB
reference level	-35 dBm	-40 dBm	-30 dBm	-25 dBm	-20 dBm	-15 dBm	-5 dBm	5 dBm	+15 dBm	+25 dBm

1.3.10 Checking the RF Attenuator Accuracy (alternative Measurement)

Test equipment:

► Signal Generator (Section "Measurement Equipment", item 4)
Frequency 128 MHz
Level range -62 to +8 dBm

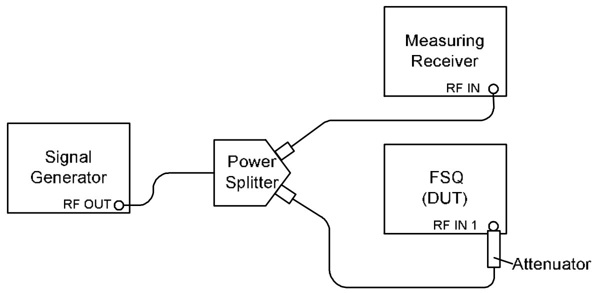
► Power Splitter (Section "Measurement Equipment", item 7)

► Fixed Attenuator (Section "Measurement Equipment", item 17)
3 dB / 128 MHz

► Measuring Receiver (Section "Measurement Equipment", item 19)
- Range +2 to -68dBm / 128 MHz
- Relative Accuracy (RSS): ±0.09 dB within -10 dB to +60 dB from set reference at -58 dBm

Test setup:

► Connect equipment as shown below:



R&S FSQ settings:

- [**PRESET**]
- [**FREQ** : **128 MHz**]
- [**SPAN** : **500 Hz**]
- [**TRACE** : DETECTOR : DETECTOR AVERAGE]
- [**BW** : RES BW MANUAL: **1 kHz**: VIDEO BW MANUAL : **100 Hz**]

R&S FSU RF Attenuation dB	**R&S FSU Ref Level dBm**	**Signal Generator Power dBm**
10	-60	-52
5	-65	-57
15	-55	-47
20	-50	-42
25	-45	-37
30	-40	-32
40	-30	-22
50	-20	-12
60	-10	-2
70	0	+8

Step 1

► Set the power of the Signal Generator to the first value listed in the table above.

► Set RF Attenuation and Reference Level of the R&S FSU to the first value listed in the table above:
- [**AMPT** : RF ATTEN MANUAL : **xx dB :** REF LEVEL **xx dBm**]

► Set R&S FSU Delta Marker Reference
- [**MKR** : REFERENCE FIXED]

► Set Measuring Receiver Reference (SET REF)

Step 2

► Set the power of the Signal Generator to the second value listed in the table above.

► Set RF Attenuation and Reference Level of the R&S FSU to the second value listed in the table above.

► Record the difference
R&S FSU Delta Marker indication [3] - Measuring Receiver indication
in the Performance Test Report.

► Repeat step 2 for the remaining values of the table above.

[3] Delta 2 [T1 FXD] xx.xx dB

1.3.11 Checking the Reference Level Switching (IF-Gain)

Test principle:

The IF gain of the R&S FSQ can be switched from 0 to 50 dB by changing the reference level at fixed RF attenuation. To prevent the IF gain accuracies to be mixed up with the log amplifier accuracy it is determined by comparison using an external precision attenuator.

Test equipment:

► Signal generator (Section "Measurement Equipment", item 3)
- Frequency 5 MHz
- Maximum level ≥ -10 dBm

► Step attenuator (Section "Measurement Equipment", item 13)
- Frequency 5 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 R&S FSQ.

Signal generator settings:

- Frequency 5 MHz
- Level -10 dBm

Step attenuator settings:

Attenuation 20 dB

R&S FSQ settings:

- [**PRESET**]
- [**FREQ** : CENTER : **5 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}}
See table below for values of a_{ATT}.

FSQ settings:

- [**AMPT** : {reference level} **dBm**]
  See table below for values of reference level.
- [**MKR** ⇒ : PEAK]

Evaluation:

The difference between the level of the input signal of the R&S FSQ and the reference (at 10 dB IF-Gain) is displayed in the marker field by the reading ´Delta [T1 FXD]´.

Table 3 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

Table 4 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

1.3.12 Checking the Reference Level Switching Accuracy (alternative Measurement)

Test equipment:

► Signal Generator (Section "Measurement Equipment", item 4)
  - Frequency 128 MHz
  - Level range -52 to +8 dBm

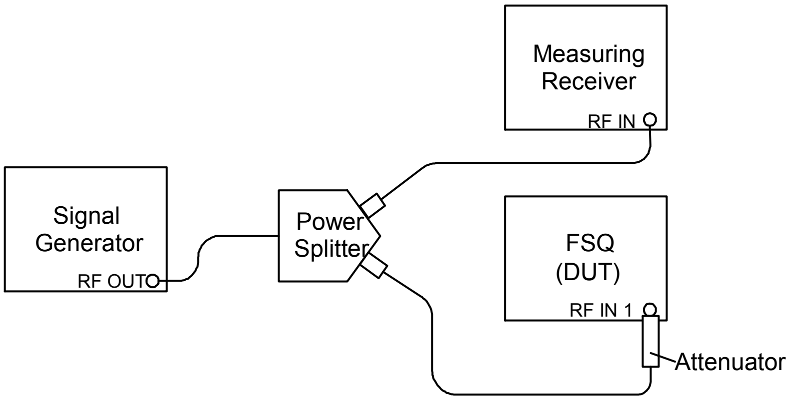
► Power Splitter (Section "Measurement Equipment", item 7)

► Fixed Attenuator (Section "Measurement Equipment", item 17)
  3 dB / 128 MHz

► Measuring Receiver (Section "Measurement Equipment", item 19)
  Range -58 to +2 dBm / 128 MHz
  Relative Accuracy (RSS): ±0.075 dB
  within +10 dB to -50 dB from set reference at -8 dBm

Test setup:

► Connect equipment as shown below:



R&S FSQ settings:

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

R&S FSQ Ref Level dBm	Signal Generator Power dBm
-10	-2
0	+8
-11	-3
-12	-4
-13	-5
-14	-6
-15	-7
-16	-8
-18	-10
-20	-12
-30	-22
-40	-32
-50	-42
-60	-52

Step 1

▶ Set the power of the Signal Generator to the first value listed in the table above.

▶ Set the Reference Level of the R&S FSU to the first value listed in the table above:
- [**AMPT** : REF LEVEL **xx dBm**]

▶ Set R&S FSU Delta Marker Reference
- [**MKR** : REFERENCE FIXED]

► Set Measuring Receiver Reference (SET REF)

Step 2

► Set the power of the Signal Generator to the second value listed in the table above.

► Set the Reference Level of the R&S FSU to the second value listed in the table above.

► Record the difference
R&S FSQ Delta Marker indication [4] - Measuring Receiver indication
in the Performance Test Report.

► Repeat step 2 for the remaining values of the table above.

1.3.13 Checking the Phase Noise for Instruments with serial numbers smaller than 200000

Test equipment:

► Signal Generator (Section "Measurement Equipment", item 4 or R&S equipment item 3)
- Frequency 639 MHz
- Level 5 dBm
- Phase Noise at 639 MHz: < -100 dBc(1 Hz) @ 100 Hz
< -115 dBc(1 Hz) @ 1 kHz
< -127 dBc(1 Hz) @ 10 kHz

► Signal Generator (Section "Measurement Equipment", item 3)
- Frequency 639 MHz
- Level 5 dBm
- Phase Noise at 639 MHz: < -130 dBc(1 Hz) @ 100 kHz
< -142 dBc(1 Hz) @ 1 MHz

Test setup:

► Connect RF output of the signal generator to RF input of the R&S FSQ

► The external reference of the two instruments should be disconnected to avoid correlation of the synthesizer phase noise.

Signal generator settings:

- Frequency 639 MHz
- Level 5 dBm

Fine-adjust the frequency of the generator so that the R&S FSQ shows exactly 639 MHz .

[4] Delta 2 [T1 FXD] xx.xx dB

R&S FSQ settings:

- [**PRESET**]
- [**FREQ** : CENTER : **639 MHz**]
- [**AMPT** : **0 dBm**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**SPAN** : {span}]
- [**Ext Ref** : **INT**]
  Depending on offset, see table below for values of span.
- [**BW** : COUPLING RATIO : RBW/VBW NOISE[10]]
- [**BW** : RBW MANUAL : {RBW}]
  Depending on offset, see table below for values of RBW.
- [**TRACE 1** : AVERAGE]
- [**SWEEP** : SWEEP COUNT : **20** : **ENTER**]

Activate phase noise marker
- [**MKR FCTN**: PHASE NOISE]
- [**FREQ** : CENTER : {640 MHz + offset}]
  See table below for values of offset.
- [**AMPT** : {reference level}]
  Depending on offset, see table below for values of reference level.
- [**AMPT** : RF ATTEN MANUAL : {a_{FSQ}}]
  Depending on offset, see table below for values of a_{FSQ}.

► Set phase noise marker
  - [**MKR :** MARKER 2 : {offset}]
  See table below for values of offset.

Please make sure not to 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**	**$a_{R\&S FSQ}$**
100 Hz	20 Hz	30 Hz	0 dBm	10 dB
1 kHz	200 Hz	100 Hz	0 dBm	10 dB
10 kHz	2 kHz	300 Hz	0 dBm	10 dB
100 kHz	10 kHz	3 kHz	-10 dBm	0 dB
1 MHz	100 kHz	30 kHz	-30 dBm	0 dB

To obtain a precise measurement of the phase noise at high offsets, the level used at the R&S FSQ input is 10 dB to 30 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 R&S FSQ from being overloaded.

1.3.14 Testing the phase noise at 639 MHz or 640 MHz for instruments with serial number larger than 200000

Measuring equipment:

► Tester (section “measuring instruments and accessories”, pos. 30)
- Frequency 640 MHz
- Level 5 dBm to 9 dBm (on the R&S FSQ)
- Phase noise at 640 MHz: < -103 dBc (1 Hz) at 100 Hz
  < -123 dBc (1 Hz) at 1 kHz
  < -130 dBc (1 Hz) at 10 kHz
  < -143 dBc (1 Hz) at 100 kHz
  < -143 dBc (1 Hz) at 1 MHz

or

► Signal Generator (Section "Measurement Equipment", item 4)
- Frequency 639 MHz
- Level 5 dBm
- Phase Noise at 639 MHz: < -103 dBc(1 Hz) @ 100 Hz
  < -123 dBc(1 Hz) @ 1 kHz
  < -130 dBc(1 Hz) @ 10 kHz

Test setup:

► Connect the RF output of the signal generator or the 640 MHz reference output (rear panel of the R&S FSQ generator) to the RF input of the R&S FSQ.

► The external reference of the two instruments should be disconnected to avoid correlation of the synthesizer phase noise.

R&S FSQ generator settings:

- [**PRESET**]
- [**SETUP** : SERVICE : INPUT CAL : NEXT : CALGEN COMB 640 MHZ]
- [**SWEEP** : SINGLE SWEEP]

or

Signal Generator settings:

- Frequency 639 MHz
- Level 5 dBm

R&S FSQ settings:

- [**PRESET**]
- [**SETUP** : REFERENCE INT]

- [**FREQ** : CENTER : **640** or **639 MHz**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**SPAN** : 1 kHz]

► Correct frequency deviation f_{dev} between signal generator or R&S FSU (generator) and R&S FSQ:
- [**FREQ** : FREQUENCY OFFSET {f_{dev}}]
- [**FREQ** : CENTER **640** or **639 MHz**]

► Continue with R&S FSQ settings:
- [**BW** : COUPLING RATIO : RBW/VBW NOISE[10]]
- [**TRACE 1** : AVERAGE]
- [**SWEEP** : SWEEP COUNT : **20** : **ENTER**]
- [**MKR FCTN**: PHASE NOISE]

► See table below for the values of the following parameters:
- [**FREQ** : CENTER : **{640** or **639 MHz +** f_{Offset}**}**]
- [**SPAN** : {Span}]
- [**SWEEP** : SWEEP TIME MANUAL {s_{FSQ}}]
- [**BW** : RES BW MANUAL : {RES BW}]
- [**AMPT** : RF ATTEN MANUAL : {a_{FSQ}}]
- [**AMPT** : REF LEVEL : {Reference level}]
- [**MKR :** MARKER 2 : {Offset}]

Please make sure not to measure on a spurious signal.

Evaluation:

The phase noise is displayed in the marker information field by delta 2 [T1 PHN].

To avoid correlation during the phase noise measurement, (especially at 100 Hz), the FSQ and generator references should not be connected.

Setting for phase noise measurement s				
Offset	**Span**	**RES BW / SWEEPTIME**	**Reference level l**	a_{FSQ}
100 Hz	0 Hz	10 Hz / 10s	+ 8 dBm	10 dB
1 kHz	0 Hz	100 Hz / 10s	+8 dBm	10 dB
10 kHz	0 Hz	500Hz / 5s	-5 dBm	10 dB
100 kHz	0 Hz	10 kHz / 2s	-2 dBm	5 dB
1 MHz	0 Hz	30 kHz / 2s	-20 dBm	5 dB

Measurement at 640 MHz is the standard measurement case. If there is no FSQ with a 640 MHz output available, you can alternatively measure the phase noise at 800 MHz

To obtain an accurate phase noise measurement at high offsets, the level at the R&S FSQ input is 10 dB to 30 dB higher than the reference level. An analog filter located before the AD converter prevents the ADC from being overdriven.

1.3.15 Alternative phase-noise testing at 800 MHz for instruments with a serial number larger than 200000

Alternative measuring at 800 MHz

► (Section measuring instruments and accessories pos. 31)
This measurement can be performed , if no R&S FSQ with a 640 MHz output is available.
- Frequency 800 MHz
- Level 5 dBm to 9 dBm (at the R&S FSU)
- Phase noise at 800 MHz: < -103 dBc (1 Hz) at 100 Hz
< -123 dBc (1 Hz) at 1 kHz
< -130 dBc (1 Hz) at 10 kHz
< -143 dBc (1 Hz) at 100 kHz
< -143 dBc (1 Hz) at 1 MHz

Test setup:

► Connect the 800 MHz RF output of the REFSYN to the RF input of the R&S FSQ.

R&S FSQ settings:

- [**PRESET**]Switch to internal reference (INT).
- [**SETUP** : REFERENCE INT / EXT]
- [**FREQ** : CENTER : **800 MHz**]

► Correct offset frequency f_{Offset}between REFSYN and R&S FSQ with: f
- [**FREQ** : FREQUENCY OFFSET : {f_{Offset}}]
- [**FREQ** : CENTER : **800 MHz**]

► Set resolution filter.
- [**BW** : COUPLING RATIO : RBW/VBW NOISE[10]]
- [**BW** : RES BW MANUAL : {RES BW}]
RES BW depends on the offset, refer to the table below.

► Form the average value.
- [**TRACE** : AVERAGE]
- [**SWEEP** : SWEEP COUNT : **20** : **ENTER**]
Record reference (carrier).
- [**AMPT** : Make the setting so that the signal is at the reference level]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**SPAN** : {Span}]

► Activate the phase noise marker.
- [**MKR FCTN**: PHASE NOISE]
- [**SPAN** : ZERO SPAN]
- [**FREQ** : CENTER : **{800 MHz + Offset}**]
- [**SWEEP** : SWEEP TIME MANUAL : {s_{FSQ}}]
- [**TRACE** : DETECTOR RMS]
- [**AMPT** : {Reference level}]
Depends on the offset, regarding the reference level values, refer to the table below.
- [**AMPT** : RF ATTEN MANUAL : {a $_{FSQ}$}]
Depends on the offset, regarding the values of a, refer to the table below $_{FSQ}$.

► Set the phase noise marker.
- [**MKR :** MARKER 2 : {Offset}]
Regarding offset values, see the following table.

Please make sure not to measure on a spurious signal.

Evaluation:

The phase noise is displayed in the marker information field by Delta 2 [T1 PHN].

To avoid correlation during the phase noise measurement (especially at 100 Hz), the R&S FSQ and generator references should not be connected.

Setting for phase noise measurement

Offset	Span	RES BW / SWEEP TIME	Reference level	a_{FSQ}
100 Hz	0 Hz	10 Hz/10s	+ 8 dBm	10 dB
1 kHz	0 Hz	100 Hz/10s	+8 dBm	10 dB
10 kHz	0 Hz	500Hz/5s	-5 dBm	10 dB
100 kHz	0 Hz	10 kHz/2s	-2 dBm	5 dB
1 MHz	0 Hz	30 kHz/2s	-20 dBm	5 dB

To obtain a precise phase noise measurement at high offsets, the level used at the R&S FSQ input is 10 dB to 30 dB higher than the reference level. An analog filter located before the AD converter prevents the ADC from being overdriven.

1.3.16 Checking the Return Loss at the RF Input

For R&S FSQ 3 or R&S FSQ 8 as alternative to the VSWR bridge a network analyzer (item 14a) can be used also. For R&S FSQ 26, 40 it is recommended to use a network analyzer for better accuracy.

Test equipment:

► Signal generator (Section "Measurement Equipment", item 3)
- Frequency range: 100 kHz to 20 MHz
- Level range: ≥ -10 dBm

► Power meter (Section "Measurement Equipment", item 10)

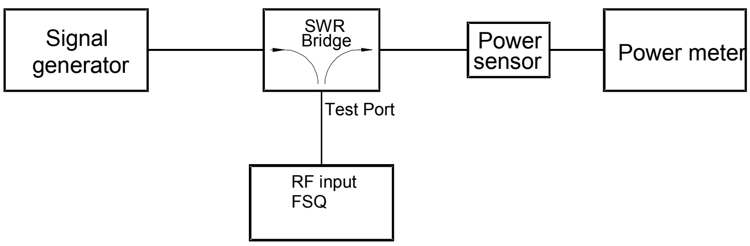
► Power sensor (Section "Measurement Equipment", item 21)
- Frequency range 100 kHz to 20 MHz

► SWR bridge (Section "Measurement Equipment", item 20)
- Frequency range 100 kHz to 20 MHz

As alternative to the VSWR bridge a network analyzer (item 22) can be used network analyzer (Section "Measurement Equipment", item 23)

► Network analyzer (Section "Measurement Equipment", item 23)

Test setup (f_{in} < 20 MHz):



► Signal generator settings:
- Level -10 dBm
- Frequency {f_{in}}
See performance test report for values of f_{in}.

R&S FSQ settings:

- [PRESET]
- [INPUT : RF ATTEN MANUAL : 10 dB]

Calibration:

- Use total reflection (OPEN or SHORT) at the test port of the SWR bridge as a reference:
- Remove cable from RF input of the R&S FSQ and connect precision short or open to the cable. Determine reflected power with the power meter and store measured level L_{Ref} as reference. Repeat this procedure for every measurement over the whole frequency range.

Measurement:

- Connect the RF input of the R&S FSQ to the test port of the SWR bridge.
- Measure reflected power L_r with the power meter. The return loss a_r of the RF input of the R&S FSQ can be calculated as:
  $a_r = L_{Ref} - L_r$.

  The VSWR can be calculated as:

$$\boxed{s = \frac{10^{0.05a_r} + 1}{10^{0.05a_r} - 1}}$$

Test setup (f_{in} > 20 MHz):

- Connect the test port of the network analyzer to the RF input 1 of the R&S FSQ.

Measurement:

- Determine S11 of the R&S FSQ at the frequencies shown in the performance test report. See operating manual of the network analyzer for detailed information about S11 measurement.

1.3.17 Checking the frequency response of the IQ compensation filter

As IQ-data are not available in manual mode, checking the compensation of IQ-data path is only possible running a little program on an external PC. Instead of manual settings, GPIB commands for the FSQ are shown in the following table.

Test equipment:

- - Signal generator (Section "Measurement Equipment", Item 3)
  - Frequency 128 MHz
  - Max. level ≥0 dBm

Test setup:

- Connect RF output of signal generator to RF input of the R&S FSQ.

Signal generator settings:

- Frequency 128 MHz
- Power level 0 dBm at the FSQ

FSQ settings:

- *RST
- FREQ:CENT 128 MHz
- INP:ATT 5 dB
- DISP:WIND:TRAC:Y:RLEV +3
- TRAC:IQ ON
- TRAC:IQ:SET NORM, 20 MHz, 40 MHz,IMM,POS,0,40000
- FORM REAL,32
- TRAC:IQ:DATA?
- TRAC:IQ OFF

Reference measurement:

► Read and calculate the IQ values according to the user handbook, section „Read Trace Data“

► - Search for the maximum absolute value of the IQ values

► $L_{ref} = \sqrt{}\,(\max.\,(I_i^2 + Q_i^2))$

► with I = 1 to 40000

Measurement:

FSQ settings:

FREQ:CENT 136 MHz
TRAC:IQ ON
TRAC:IQ:SET NORM, 20 MHz, 40 MHz,IMM,POS,0,40000
TRAC:IQ:DATA?
TRAC:IQ OFF

1st measured value:

► Read and calculate the IQ values according to the user handbook, section „Read Trace Data“

► Search for the maximum absolute value of the IQ values
$L_{136MHz} = \sqrt{}\,(\max.\,(I_i^2 + Q_i^2))$ with i = 1 to 40000

R&S FSQ settings:

- FREQ:CENT 120 MHz
- TRAC:IQ ON
- TRAC:IQ:SET NORM, 20 MHz, 40 MHz,IMM,POS,0,40000
- TRAC:IQ:DATA?
- TRAC:IQ OFF

2nd measured value:

► Read and calculate the IQ values according to the user handbook, section „Read Trace Data“

► Search for the maximum absolute value of the IQ values
$L_{120MHz} = \sqrt{(max. (I_i^2 + Q_i^2))}$ with i = 1 to 40000

Evaluation:

The frequency response is differences of the measured values of the 1st resp. 2nd measurement to the reference measurement in dB.
F_{resp} at 136 MHz = $20*\log10(L_{136}/L_{ref})$
F_{resp} at 120 MHz = $20*\log10(L_{120}/L_{ref})$

1.4 Test Procedure Option Tracking Generator B9 with Option Attenuator B12

1.4.1 Checking the output level

Test equipment:

► N cable (section "Measurement Equipment", item 28)
- Frequency up to 3.6 GHz
- Maximum attenuation < 0.2 dB

Test setup:

► Connect the tracking generator output to the RF input of the FSQ.

FSQ settings:

- [**PRESET**]
- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **0 Hz**]
- [**BW** : RES BW MANUAL : **300 Hz**]
- [**AMPT** : RF ATTEN MANUAL : **5 dB**]
- [**AMPT** : **5 dBm**]
- [**TRACE** : AVERAGE : SWEEP COUNT : **10 ENTER]**
- [**NETWORK** : SOURCE POWER {level}]

Without option B12:

{level}: check from 0 dBm to –20 dBm in 5 dB steps

With option B12:

{level}: check 0 dBm, -10 dBm, -20 dBm, -40 dBm

- [**SETUP** : SERVICE : ENTER PASSWORD **894129**]
- [**SETUP** : SERVICE FUNCTIONS **2.29.21.1.0**]

Switch B12 to 0 dB (fixed value) with service command 2.29.21.1.0e (after entering the password) {level} : check from 0 dBm to –20 dBm in 5 dB steps
- [**SETUP** : SERVICE FUNCTIONS **2.29.21.0**]

Reactivate B12 with service command 2.29.21.0

Measurement:

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

► Read the value and store it as a reference for the frequency response measurement.

1.4.2 Checking the frequency response

Test equipment:

- N cable (section "Measurement Equipment", item 18)
- Frequency up to 3.6 GHz
- Maximum attenuation < 0.2 dB

Test setup:

► Connect the tracking generator output to the RF input of theFSQ .

R&S FSQ settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **5 dB**]
- [**AMPT** : **5 dBm**]
- [**AMPT** : RF INPUT DC] (FSQ 3 / 8 / 26 only)
- [**FREQ** : START : **100 kHz**]
- [**FREQ** : STOP : **3.6 GHz**]
- [**BW** : RES BW MANUAL : **30 kHz**]
- [**NETWORK** : SOURCE POWER {level}]

Without option B12:

{level} : check from 0 dBm to –20 dBm in 5 dB steps

With option B12:

{level}: check 0 dBm, -10 dBm, -20 dBm, -40 dBm

- [**SETUP** : SERVICE : ENTER PASSWORD **894129**]
- [**SETUP** : SERVICE FUNCTIONS **2.29.21.1.0**]

► Switch B12 to 0 dB (fixed value) with service command 2.29.21.1.0.

► {level}: check from 0 dBm to –20 dBm in 5 dB steps
- [**SETUP** : SERVICE FUNCTIONS **2.29.21.0**]

Reactivate B12 with service command 2.29.21.0.

Measurement:

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

► Set marker to minimum value:
- [**MKR ⇒** : NEXT : MIN]

Evaluation:

The difference between the min and max of the reference value at 128 MHz yields the frequency response.

1.4.3 Checking the dynamic range

Test equipment:

- N cable (section "Measurement Equipment", item 28)
- Frequency up to 3.6 GHz
- Maximum attenuation < 0.2 dB

Test setup:

► Connect the tracking generator output to the RF input of theFSQ.

FSQ settings:

- [**PRESET**]
- [FREQ : 128 MHz]
- [**SPAN** : ZERO SPAN]
- [**AMPT** : REF LEVEL : **0 dBm**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**AMPT** : RANGE LOG MANUAL : **120 dB**]
- [**NETWORK** : SOURCE POWER : **0 dBm**]
- [**MKR** : REFERENCE FIXED]

► Disconnect the cable and connect a 50 Ω termination to the tracking generator output and the RF input.

Measurement:

- [**TRACE** : AVERAGE : SWEEP COUNT : **50 ENTER]**

► Read off delta marker

1.4.4 Checking Modulation

1.4.4.1 Checking the I/Q modulator

Test equipment:

► - AMIQ (section "Measurement Equipment", item 30-35)

or

► Arbitrary waveform generator (section "Measurement Equipment", item 26)
- Spectrum analyzer (section "Measurement Equipment", item 29)
- Voltmeter, 2 units (refer to "Measurement Equipment", item 27)
- 2 BNC T pieces

Test setup with AMIQ:

► Connect the the I and Q outputs of the AMIQ to the I and Q inputs of the analyzer. Ensure that the modulation lines are equal (phase shift).

► Connect the spectrum analyzer to the tracking generator output.

Test setup with ADS:

► Connect the I and Q outputs of the generator to the I and Q inputs of the analyzer. Check the generator voltages in parallel via T pieces.

► Connect the spectrum analyzer to the tracking generator output.

Test setup with 33220A:

► Connect the outputs of the two generators to the I and Q inputs of the analyzer. Check the generator voltages in parallel via T pieces.

► Synchronize the two 33220A via Option 001.

► Connect the spectrum analyzer to the tracking generator output.

R&S AMIQ settings

► R&S AMIQ self-adjustment
- AC voltage I output: U = 0.5 V
- AC voltage Q output: U = 0.5 V
- Frequency: 1 MHz
- Phase (I/Q) = +/-90 degrees
(For this purpose, use AMIQ setup files from section "Measurement Equipment", items 22 and 23.)

Generator settings (ADS or 33220A):

► 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** : **10 MHz**]
- [**AMPT** : REF LEVEL : **10 dBm**]

R&S FSQ settings:

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

Measuring the residual carrier:

► Switch off the outputs on the generator.
Voltmeter display: DC voltage < 3 mV
AC voltage < 3 mV
Set marker to peak:

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

► Read off the measured value on the spectrum analyzer (Marker Peak)

Measuring the impairment (imbalance between the I and Q path) with R&S AMIQ:

► Switch on the I and Q channels on the R&S AMIQ.
Measure the carrier amplitude at 1 GHz and the lateral component amplitudes at 1 GHz + 1 MHz and 1 GHz - 1 MHz.
Perform this measurement for baseband signals with a phase shift of +90 degrees and –90 degrees between the I and Q channel.

Measuring the impairment (imbalance between the I and Q path) with ADS or 33220A:

► Switch on the I and Q channels on the generator.
Measure the carrier amplitude at 1 GHz and the lateral component amplitudes at 1 GHz + 200 kHz and 1 GHz - 200 kHz.

1.4.4.2 Checking the amplitude modulation

Test equipment:

► R&S AMIQ (section "Measurement Equipment", item 30-35)

or

► Arbitrary waveform generator (section "Measurement Equipment", item 26)
- Spectrum analyzer (section "Measurement Equipment", item 29)
- Voltmeter, 2 units (refer to "Measurement Equipment", item 27)
- 2 BNC T pieces

Test setup with AMIQ:

► Connect the I and Q outputs of the AMIQ to the I and Q inputs of the analyzer.

► Connect the spectrum analyzer to the tracking generator output.

Test setup with ADS:

► Connect the I and Q outputs of the generator to the I and Q inputs of the analyzer.
Check the generator voltages in parallel via T pieces.

► Connect the spectrum analyzer to the tracking generator output.

Test setup with 33220A:

► Connect the outputs of the two generators to the I and Q inputs of the analyzer. Check the generator voltages in parallel via T pieces.

► Synchronize the two 33220A via Option 001.

► Connect the spectrum analyzer to the tracking generator output.

R&S AMIQ settings:

► R&S AMIQ self-adjustment
AC voltage I output: U = 0.5 V
AC voltage Q output: U = 0 V
Frequency: 1 MHz
(For this purpose, use AMIQ setup files from section "Measurement Equipment", item 22)

Generator settings (ADS or 33220A):

► AC voltage: V(pp) = 1 V ± 10 mV
Frequency: 1 MHz

Spectrum analyzer settings:

- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **10 MHz**]
- [**AMPT** : REF LEVEL : **10 dBm**]

R&S FSQ settings:

- [**PRESET**]
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **0 MHz**]
- [**AMPT** : REF LEVEL : **10 dBm**]
- [**NETWORK** : SOURCE POWER: **0 dBm]**
- [MODULATION : EXT AM]

Measurement:

► Determine the level difference between the carrier signal at 1 GHz and the modulation lateral components at 1 GHz ± 1 MHz.

Checking the frequency modulation

Test equipment:

► R&S AMIQ (section "Measurement Equipment", item 30-35)

or

► Arbitrary waveform generator (section "Measurement Equipment", item 26)

► Spectrum analyzer (section "Measurement Equipment", item 29)
- Voltmeter, 2 units (refer to "Measurement Equipment", item 27)
- 2 BNC T pieces

Test setup with R&S AMIQ:

► Connect the I and Q outputs of the AMIQ to the I and Q inputs of the analyzer.

► Connect the spectrum analyzer to the tracking generator output.

Test setup with ADS:

► Connect the I and Q outputs of the generator to the I and Q inputs of the analyzer.

► Check the generator voltages in parallel via T pieces.

► Connect the spectrum analyzer to the tracking generator output.

Test setup with 33220A:

► Connect the outputs of the two generators to the I and Q inputs of the analyzer.

► Check the generator voltages in parallel via T pieces.

► Synchronize the two 33220A via Option 001.

► Connect the spectrum analyzer to the tracking generator output.

R&S AMIQ settings:

► AC voltage I output: U = 0 V
AC voltage Q output: U = 0.5 V
Frequency: 100 kHz
(For this purpose, use AMIQ setup files from section "Measuring Equipment", item 21)

Generator settings with ADS or 33220A:

► AC voltage: V(pp) = 100 mV ± 10 mV
Frequency: 100 kHz

Spectrum analyzer settings:

- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **1 MHz**]
- [**BW** : **10 kHz**]
- [**AMPT** : REF LEVEL : **10 dBm**]

R&S FSQ settings:

- [**PRESET**]
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **0 MHz**]
- [**AMPT** : REF LEVEL : **10 dBm**]
- [**NETWORK** : SOURCE POWER: **0 dBm**]
- [MODULATION : EXT FM : **100 kHz**]

Measurement:

► Determine the level difference between the carrier signal at 1 GHz and the modulation lateral components at 1 GHz ± 100 kHz.

1.5 Performance Test Option Preamplifier R&S FSU-B24

The option B24 is only avaible for the models FSU 26, FSU 43, FSU 46 and FSU 50.

1.5.2 Checking Noise Display

Test equipment:

► 50 Ω termination (Section "Measurement Equipment", item 9)
- Frequency range:
  R&S FSQ 26: DC to 26.5 GHz
  R&S FSQ 40: DC to 40 GHz

Test setup:

► Terminate the RF input 1of the R&S FSQ with 50 Ω

R&S FSQ settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**SPAN** : 0 Hz]
- [**SETUP** : PREAMP ON]
- [**SETUP** : SIGNAL SOURCE : YIG FILTER {state}
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**BW** : SWEEP TIME MANUAL : **50 ms**]
- [**TRACE 1** : AVERAGE]
- [**TRACE 1** : SWEEP COUNT : **30 ENTER**]
- [**AMPT** : {RefLev}]
- [**FREQ** : CENTER : {f_n}]
- [**MEAS** : Time Dom Power : **Mean**]

See table of performance test report for values of f_n and state of YIG filter

Measurement:

► Set the marker to the center frequency for the value below or equal 1 kHz.

► Read out the mean marker for frequencies above 1 kHz and correct the measurement value by –20 dB for the ratio of 10 Hz / 1 kHz .

Evaluation:

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

Frequency	< 1MHz	< 10MHz	> 10MHz
RefLev	-30 dBm	-60 dBm	-60 dBm

1.5.3 Checking the Level accuracy and the Frequency Response

Test equipment:

- - Signal Generator (Section "Measurement Equipment", item 3)
  - Frequency range 100 kHz to 3.6 GHz
  - Maximum level ≥ 0 dBm
- - Signal Generator (Section "Measurement Equipment", item 2)
  - Frequency range:
    R&S FSQ 26 10 MHz to 26.5 GHz
    R&S FSQ 40 10 MHz to 40 GHz
  - Maximum level ≥ 0 dBm
- - Power Meter (Section "Measurement Equipment", item 10)
  - Dual Channel
  - Power range -30 to 0 dBm
  - Instrumentation uncertainty <0.5%
  - Uncertainty of power reference <1.2%
  - VSWR of power reference <1.10
- - Power Sensor (Section "Measurement Equipment", item 11 (2x))
  - Frequency range 100 kHz to 3.6 GHz
  - Power range -30 to 0 dBm
  - Cal factor uncertainty 1 MHz to 3.6 GHz <1.6 %
  - VSWR 1 MHz to 3.6 GHz <1.30
    50 MHz to 128 MHz <1.10
- Power Sensor (Section "Measurement Equipment", item 12)
  - Frequency range:
    R&S FSQ 26 50 MHz to 26.5 GHz
    R&S FSQ 40 50 MHz to 40 GHz
  - Power range -30 to 0 dBm
  - Cal factor uncertainty 50 to 128 MHz <1.6 %
    3.6 to 8 GHz <2 %
    8 to 22 GHz<2.5 %
    22 to 40 GHz <3 %
  - VSWR 50 to 128 MHz <1.15
    3.6 to 8 GHz <1.15
    8 to 22 GHz <1.25
    22 to 40 GHz <1.35
- 6 dB Power Splitter (Section "Measurement Equipment", item 7)
  Frequency range DC to 3.6 GHz
  Level imbalance 10 MHz to 3.6 GHz n/a
  Equivalent output VSWR 10 MHz to 3.6 GHz ≤ 1.1
- 6 dB Power Splitter (Section "Measurement Equipment", item 8)
  - Frequency range:
    R&S FSQ 26 DC to 26.5 GHz
    R&S FSQ 40 DC to 40 GHz
  - Level imbalance 3.6 to 8 GHz ≤ 0.3 dB
    8 to 22 GHz ≤ 0.4 dB

	22 to 40 GHz	≤ 0.5 dB
- Equivalent output VSWR	3.6 to 8 GHz	≤ 1.3
	8 to 22 GHz	≤ 1.4
	22 to 40 GHz	≤ 1.5

- Absolute level accuracy at 128 MHz

Test setup:

► Standardize the Power Meter and Power Sensor (item 10, 11).

► Set the Power Meter Cal Factor to the appropriate value for the Power Sensor for 128 MHz.

► Connect Power Sensor through a cable to RF output of Signal Generator.

Signal generator settings:

- Frequency 128 MHz
- Level -10 dBm

Measurement:

► Adjust level to -10 dBm ± 0.1 dB as viewed on the Power Meter.

► Record the Power Meter indication.

► Disconnect Power Sensor from the cable.

R&S FSQ settings:

- [**PRESET**]
- [**SETUP** : PREAMP ON]
- [**AMPT** : RF INPUT DC] (FSQ 26 only)
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**AMPT** : **-10 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 R&S FSQ (level reading of marker 1) reflects the absolute level accuracy of the R&S FSQ. It can be calculated as:

Level $accuracy_{128MHz} = L_{FSQ} - L_{powermeter}$

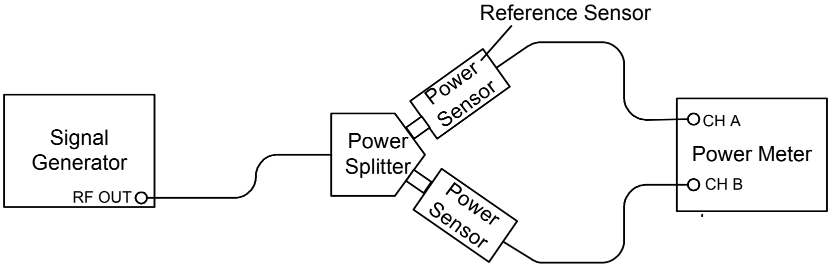
1.5.3.1 Frequency response < 3.6 GHz

Power splitter calibration

This section can be skipped, if a power splitter with a level imbalance <0.1 dB is available.

Test setup:

- Standardize the Power Meter and both Power Sensors (item 10, 11).
- Use Power Splitter (item) and connect equipment as shown below.



Signal generator settings:

- Level 0 dBm

Measurement:

1. Set the Signal Generator frequency to the first value listed in the table below.
2. Set the Power Meter Channel A Cal Factor to the appropriate value or the Power Sensor for the first frequency listed in the table below (Reference Sensor).
3. Set the Power Meter Channel B CAL Factor to 100%.
4. Calculate the Power Splitter imbalance as
   Imbalance / dB = L_{CHA} / dBm - L_{CHB} / dBm
   (L_{CHA} = Reference Sensor)
5. Record the calculated value in the table below.

Repeat steps 1, 2. 4 and 5 for the remaining frequencies listed in the table below.

Table 5 Power Splitter calibration data

Applied frequency (f_{fresp}	)Imbalance / dB
100 kHz	_______
1 MHz	_______
10 MHz	_______
50 MHz	_______
100 MHz	_______

128 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	_______
3000 MHz	_______
3599 MHz	_______

Reference Measurement

Test setup:

► Disconnect the Power Sensor (CHA, Reference Sensor) from the Power Splitter.

► Connect the open port of the Power Splitter directly to the RF input 1 of the R&S FSU.

Signal Generator settings:

- Level 0 dBm
- Frequency 128 MHz

R&S FSQ settings:

- [**PRESET**]

- [**SETUP** : PREAMP ON]
- [**AMPT** : RF INPUT DC] (FSQ 26 only)
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

R&S FSQ settings:

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

► Read level indication from R&S FSQ (reading of marker 1): L_{FSQ}

Power Meter:

► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

► Calculate
ΔRef / dB = L_{FSU} / dBm - $L_{PowerMeter}$ / dBm - Imbalance(128 MHz) / dB
Take value of Imbalance(128 MHz) from the table above.

► Record ΔRef / dB

Frequency Response Measurement

Signal generator settings:

- Frequency f_{fresp}
See table in performance test report for values of f_{fresp}.

R&S FSQ settings:

- [**FREQ** : CENTER : {f_{fresp}}]
See table in performance test report for values of f_{fresp}

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

► Read level indication from R&S FSQ (reading of marker 1): L_{FSQ}

Power Meter:

► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

► The frequency response can be calculated as:

► Freq. response / dB = L_{FSQ} - $L_{PowerMeter}$ - Imbalance(f_{fresp}) /
dB - ΔRef / dB

► Take the value of Imbalance(f_{fresp}) from the table above and ΔRef as ascertained before.

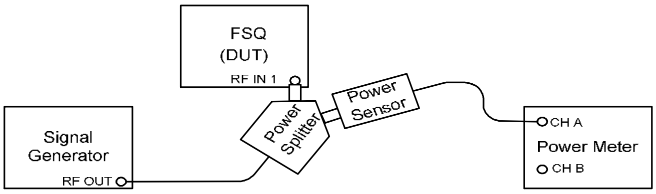
1.5.3.2 Frequency response > 3.6 GHz

Test setup:

► Standardize the Power Meter and Power Sensor (item 10, 12).

► Use Power Splitter/Combiner (item 8) and connect equipment as shown below.

► Connect the power splitter directly to the R&S FSQ RF input 1.



Throughout the remaining steps set the Power Meter Cal Factor as appropriate!.

Reference Measurement

Signal Generator settings:

- Level b0 dBm
- Frequency 128 MHz

R&S FSQ settings:

- [**PRESET**]
- [**SETUP** : PREAMP ON]
- [**AMPT** : RF INPUT DC] (FSQ 26 only)
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

R&S FSQ settings:

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

► Read level indication from R&S FSQ (reading of marker 1): L_{FSQ}

Power Meter:

► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

► Calculate
  ΔRef / dB = L_{FSQ} / dBm - $L_{PowerMeter}$ / dBm

► Record ΔRef / dB

Frequency Response Measurement (YIG filter = ON)

Signal generator settings:

- Frequency f_{fresp}
  See table in performance test report for values of f_{fresp}

R&S FSQ settings:

- [**FREQ** : CENTER : {f_{fresp}}]
  See table in performance test report for values of f_{fresp}

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

► Read level indication from R&S FSQ (reading of marker 1): L_{FSQ}

Power Meter:

► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

The frequency response can be calculated as:
Freq. response / dB = L_{FSQ} - $L_{PowerMeter}$ - ΔRef / dB

Take the value of ΔRef as ascertained before.

Frequency Response Measurement (YIG filter = OFF)

Signal generator settings:

- Frequency f_{fresp}
  See table in performance test report for values of f_{fresp}

R&S FSQ settings:

- [**SETUP** : SIGNAL SOURCE : YIG FILTER OFF]
- [**FREQ** : CENTER : {f_{fresp}}]
  See table in performance test report for values of f_{fresp}

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

► Read level indication from R&S FSQ (reading of marker 1): L_{FSQ}

Power Meter:

► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

► The frequency response can be calculated as:
  Freq. response / dB = L_{FSQ} - $L_{PowerMeter}$ - ΔRef / dB

► Take the value of ΔRef as ascertained before.

1.6 Performance Test Option Electronic Attenuator B25

NOTICE

With FSQ 26, 40 the option B25 is implemented in the signal path below 3.6 GHz. Therefore the measurements are done up to 3.6 GHz only.

1.6.1 Checking Noise Display with Preamplifier (B25)

Test equipment:

► 50 Ω termination (Section "Measurement Equipment", item 9)
- Frequency range:
FSQ 3 / 26 / 40: to 3.6 GHz
FSQ 8 to 8 GHz

Test setup:

Terminate the RF input of the R&S FSQ with 50 Ω

R&S FSQ settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**SPAN : 0 Hz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**BW** : SWEEP TIME MANUAL : **50 ms**]
- [**TRACE 1** : AVERAGE]
- [**TRACE 1** : SWEEP COUNT : **5 ENTER**]
- [**MEAS** : Time Dom Power : Mean]
- [**AMPT : - 80 dBm**]
- [**SETUP** : PREAMP ON]
- [**FREQ** : CENTER : {f_n}]

Measurement:

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

Evaluation:

► Read out the mean marker for frequencies above 1 kHz and correct the measurement value by –30 dB for the ratio of 1 Hz / 1 kHz

1.6.2 Checking the Level accuracy and the Frequency Response with Preamplifier

Test equipment:

- Signal generator (Section "Measurement Equipment", item 2)
  - Frequency range:
    R&S FSQ 3, 26, 40 10 MHz to 3.6 GHz
    R&S FSQ 8: 10 MHz to 8 GHz
  - Maximum level ≥ 0 dBm
- Power meter (Section "Measurement Equipment", item 10)
  - Dual Channel
  - Power range -30 to 0 dBm
  - Instrumentation uncertainty <0.5%
  - Uncertainty of power reference <1.2%
  - VSWR of power reference <1.10
- Power Sensor (Section "Measurement Equipment", item 11 (2x))
  - Frequency range 100 kHz to 3.6 GHz
- Power range -30 to 0 dBm
  - Cal factor uncertainty 1 MHz to 3.6 GHz <1.6 %
  - VSWR 1 MHz to 3.6 GHz <1.30
    50 MHz to 128 MHz <1.10
- - Power Sensor (Section "Measurement Equipment", item 12)
  - Frequency range:
    R&S FSQ 8 50 MHz to 8 GHz
  - Power range -30 to 0 dBm
  - Cal factor uncertainty 50 to 128 MHz <1.6 %
    3.6 to 8 GHz <2 %
    VSWR 50 to 128 MHz <1.15
    3.6 to 8 GHz <1.15
- - 6 dB Power Splitter (Section "Measurement Equipment", item 7)
  - Frequency range DC to 3.6 GHz
  - Level imbalance 10 MHz to 3.6 GHz n/a
  - Equivalent output VSWR 10 MHz to 3.6 GHz ≤ 1.1
- - 6 dB Power Splitter (Section "Measurement Equipment", item 8)
  - Frequency range:
    FSQ 8: DC to 8 GHz
  - Level imbalance 3.6 to 8 GHz ≤ 0.3 dB
  - Equivalent output VSWR 3.6 to 8 GHz ≤ 1.3

Determining the level accuracy at 128 MHz

Test setup:

- Standardize the Power Meter and Power Sensor (item 10, 11).
- Set the Power Meter Cal Factor to the appropriate value for the Power Sensor for 128 MHz.

► Connect Power Sensor through a cable to RF output of Signal Generator.

Signal generator settings:

- Frequency 128 MHz
- Level -10 dBm

Measurement:

► Adjust level to -10 dBm ± 0.1 dB as viewed on the Power Meter.

► Record the Power Meter indication.

► Disconnect Power Sensor from the cable.

B25 with preamplifier

Measurement:

► Connect the cable to RF input 1 of the R&S FSQ

R&S FSQ settings:

- [**PRESET**]
- [**SETUP** : PREAMP ON]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-10dBm**]
- [**SPAN** : **30kHz**]
- [**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 R&S FSQ (level reading of marker 1) reflects the absolute level accuracy of the R&S FSQ. It can be calculated as:

Level $accuracy_{128MHz} = L_{FSQ} - L_{powermeter}$

B25 with electronic attenuator

R&S FSQ settings:

- [**PRESET**]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : NEXT : ELEC ATTEN MANUAL : **0** : **dB**]
- [**AMPT** : **-10dBm**]
- [**SPAN** : **30kHz**]
- [**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 R&S FSQ (level reading of marker 1) reflects the absolute level accuracy of the R&S FSQ. It can be calculated as:

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

Checking frequency response <3.6 GHz

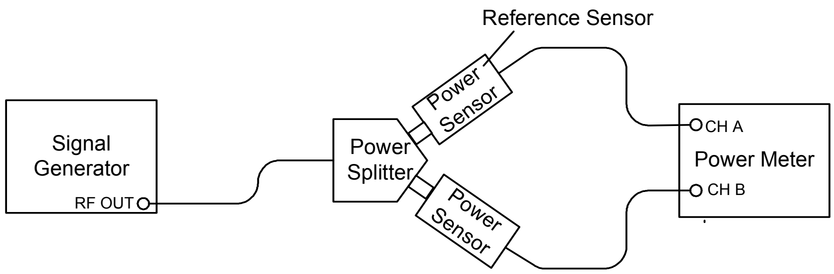
Power splitter calibration

This section can be skipped, if a power splitter with a level imbalance <0.1 dB is available.

Test setup:

► Standardize the Power Meter and both Power Sensors (item 10, 11).

► Use Power Splitter (item) and connect equipment as shown below.



Signal generator settings:

- Level 0 dBm

Measurement:

1. Set the Signal Generator frequency to the first value listed in the table below.
2. Set the Power Meter Channel A Cal Factor to the appropriate value for the Power Sensor for the first frequency listed in the table below (Reference Sensor).
3. Set the Power Meter Channel B CAL Factor to 100%.
4. Calculate the Power Splitter imbalance as
   Imbalance / dB = L_{CHA} / dBm - L_{CHB} / dBm
   (L_{CHA} = Reference Sensor)
5. Record the calculated value in the table below.

Repeat steps 1 2 d), 5 or the remaining frequencies listed in the table below.

Table 6 Power Splitter calibration data

Applied frequency (f_{fresp}	**)**	**Imbalance / dB**
100 kHz		_______
1 MHz		_______
10 MHz		_______
50 MHz		_______
100 MHz		_______
128 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		_______
3000 MHz		_______
3599 MHz		_______

B25 with preamplifier

Reference Measurement

Test setup:

► Disconnect the Power Sensor (CHA, Reference Sensor) from the Power Splitter.

► Connect the open port of the Power Splitter directly to the RF input 1 of the R&S FSQ.

Signal generator settings:

- Level 0 dBm
- Frequency 128 MHz

R&S FSQ settings

- [**PRESET**]
- [**AMPT** : RF INPUT DC]
- [**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**]

R&S FSQ settings:

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

► Read level indication from R&S FSQ (reading of marker 1): L_{FSQ}

Power Meter:

► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

► Calculate
ΔRef / dB = L_{FSQ} / dBm - $L_{PowerMeter}$ / dBm - Imbalance(128 MHz) / dB
Take value of Imbalance(128 MHz) from the table above.

► Record ΔRef / dB

Frequency Response Measurement

Signal Generator settings:

- Frequency f_{fresp}
See table in performance test report for values of f_{fresp}.

R&S FSQ settings:

- [**FREQ** : CENTER : {f_{fresp}}]
See table in performance test report for values of f_{fresp}

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

► Read level indication from R&S FSQ (reading of marker 1): L_{FSQ}

Power Meter:

► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

► The frequency response can be calculated as:
Freq. response / dB = L_{FSQ} - $L_{PowerMeter}$ - Imbalance(f_{fresp}) / dB - ΔRef / dB

► Take the value of Imbalance(f_{fresp}) from the table above and ΔRef as ascertained before.

B25 with Electronic Attenuator

Reference Measurement

Test setup:

► Disconnect the Power Sensor (CHA, Reference Sensor) from the Power Splitter.

► Connect the open port of the Power Splitter directly to the RF input 1 of the R&S FSQ.

Signal generator settings:

- Level 0 dBm
- Frequency 128 MHz

R&S FSQ 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**]
See table of performance test report for values of E_{ATT} .

R&S FSQ settings:

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

► Read level indication from R&S FSQ (reading of marker 1): L_{FSQ}

Power Meter:

► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

► Calculate
ΔRef / dB = L_{FSU} / dBm - $L_{PowerMeter}$ / dBm - Imbalance(128 MHz) / dB
Take value of Imbalance(128 MHz) from the table above.

► Record ΔRef / dB

Frequency Response Measurement:

Signal generator settings:

- Frequency f_{fresp}
 See table of performance test report for values of f_{fresp}

R&S FSQ settings:

- [**FREQ** : CENTER : {f_{fresp}}]
 See table in performance test report for values of f_{fresp}

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

► Read level indication from R&S FSQ (reading of marker 1): L_{FSQ}

Power Meter:

► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

► The frequency response can be calculated as:
Freq. response / dB = L_{FSQ} - $L_{PowerMeter}$ - Imbalance(f_{fresp}) / dB - ΔRef / dB

► Take the value of Imbalance(f_{fresp}) from the table above and ΔRef as ascertained before.

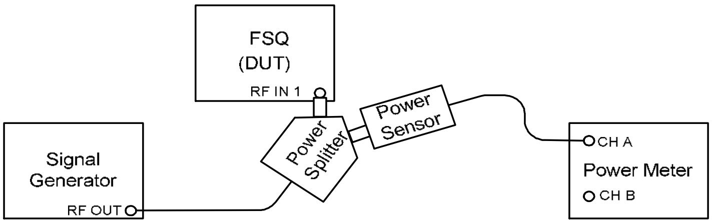
1.6.2.2 Frequency response > 3.6 GHz

Test setup:

► Standardize the Power Meter and Power Sensor (item 10, 12).

► Use Power Splitter/Combiner (item 8) and connect equipment as shown below.

► Connect the power splitter directly to the R&S FSQ RF input 1.



Throughout the remaining steps set the Power Meter Cal Factor as appropriate!

B25 with preamplifier

Reference Measurement

Signal generator settings:

- Level 0 dBm
- Frequency 128 MHz

R&S FSQ 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**]

R&S FSQ settings:

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

► Read level indication from R&S FSQ (reading of marker 1): L_{FSQ}

Power Meter:

► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

► Calculate
  ΔRef / dB = L_{FSQ} / dBm - $L_{PowerMeter}$ / dBm

► Record ΔRef / dB

Frequency Response Measurement

Signal generator settings:

- Frequency f_{fresp}
See table in performance test report for values of f_{fresp}

R&S FSQ settings:

- [**FREQ** : CENTER : {f_{fresp}}]
See table in performance test report for values of f_{fresp}

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

► Read level indication from R&S FSQ (reading of marker 1): L_{FSQ}

Power Meter:

► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

► The frequency response can be calculated as:
Freq. response / dB = L_{FSQ} - $L_{PowerMeter}$ - ΔRef / dB

► Take the value of ΔRef as ascertained before.

B25 with electronic attenuator

Reference Measurement

Signal generator settings:

- Level 0 dBm
- Frequency 128 MHz

R&S FSQ 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**]
See table of performance test report for values of E_{ATT} .

R&S FSQ settings:

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

► Read level indication from R&S FSQ (reading of marker 1): L_{FSQ}

Power Meter:

► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

Calculate
ΔRef / dB = L_{FSQ} / dBm - $L_{PowerMeter}$ / dBm
Record ΔRef / dB

Frequency Response Measurement

Signal generator settings:

- Frequency f_{fresp}
  See table in performance test report for values of f_{fresp}

R&S FSQ settings:

- [**FREQ** : CENTER : {f_{fresp}}]
  See table in performance test report for values of f_{fresp}

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

► Read level indication from R&S FSQ (reading of marker 1): L_{FSQ}

Power Meter:

► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

► The frequency response can be calculated as:
  Freq. response / dB = L_{FSQ} - $L_{PowerMeter}$ - ΔRef / dB

► Take the value of ΔRef as ascertained before.

1.6.3 Checking Nonlinearities with Electronic Attenuator

1.6.3.1 Third-Order Intercept

Test equipment:

► 2 signal generators (Section "Measurement Equipment", item 2)
  - Frequency range:
    R&S FSQ 3/26/40: 10 MHz to 3.6 GHz
    R&S FSQ 8: 10 MHz to 8 GHz
  - Maximum level ≥ 0 dBm

- 2 attenuators (Section "Measurement Equipment", item 16)
  - Attenuation aATT = 10 dB
  - Frequency range:
    R&S FSQ 3/26/40: 10 MHz to 3.6 GHz
    R&S FSQ 8: 10 MHz to 8 GHz
- Power splitter/combiner (Section "Measurement Equipment", item 8)
  - Frequency range
    R&S FSQ 3/26/40: 10 MHz to 3.6 GHz
    R&S FSQ 8: 10 MHz to 8 GHz

Test setup:

- Connect RF outputs of the signal generators via 10 dB attenuators to the inputs of the coupler.
- Connect output of the coupler to the RF input of the R&S FSQ.

Signal generator settings:
(both generators)

- Frequency: generator 1 $f_{g1} = f_{in} – 50$ kHz
generator 2 $f_{g2} = f_{in} + 50$ kHz
See table of performance test report for values of f_{in}

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

R&S FSQ settings:

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

See table of performance test report for values of f_{in}.

Measurement

- [**MKR FCTN** : TOI]

Evaluation:

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

1.6.4 Checking the RF Attenuator (with Option B25)

Test equipment:

- Signal generator (Section "Measurement Equipment", item 3)
  - Frequency 128 MHz
  - Maximum level ≥ 10 dBm
- Step attenuator (Section "Measurement Equipment", item 13)
  - 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 theFSQ.

Signal generator settings:

- Frequency 128 MHz
- Level 10 dBm

Step attenuator settings:

- Attenuation 70 dB

R&S FSQ 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 { 80dB - a_{FSQ} }

See table below for values of a_{ATT}.

R&S FSQ settings:

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

See table below for values of a $_{FSQ}$, a $_{ATT}$ and reference level.

Evaluation:

The difference between the level of the input signal of the FSQ 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_{FSQ} 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

1.6.5 Checking the RF Attenuator Accuracy with option B25 (alternative Measurement)

Test equipment:

► Signal Generator (Section "Measurement Equipment", item 4)
- Frequency 128 MHz
- Level range -62 to +8 dBm

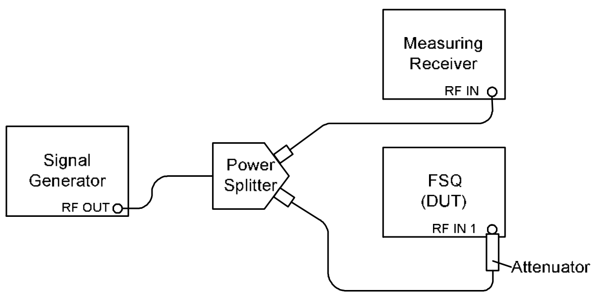
► Power Splitter (Section "Measurement Equipment", item 7)

► Fixed Attenuator (Section "Measurement Equipment", item 17)
3 dB / 128 MHz

► Measuring Receiver (Section "Measurement Equipment", item 19)
- Range +2 to -68dBm / 128 MHz
- Relative Accuracy (RSS): ±0.09 dB within -10 dB to +60 dB from set reference at -58 dBm

Test setup:

► Connect equipment as shown below:



R&S FSQ settings:

- [**PRESET**]
- [**FREQ** : **128 MHz**]
- [**SPAN** : **500 Hz**]
- [**TRACE** : DETECTOR : DETECTOR AVERAGE]
- [**BW** : RES BW MANUAL: **1 kHz**: VIDEO BW MANUAL : **100 Hz**]

R&S FSQ RF Attenuation dB	R&S FSQ Ref Level dBm	Signal Generator Power dBm
10	-60	-52
5	-65	-57
15	-55	-47
20	-50	-42
25	-45	-37
30	-40	-32
40	-30	-22
50	-20	-12
60	-10	-2
70	0	+8
80	10	+8

Step 1

► Set the power of the Signal Generator to the first value listed in the table above.

► Set RF Attenuation and Reference Level of the R&S FSU to the first value listed in the table above:
- [**AMPT** : RF ATTEN MANUAL : **xx dB :** REF LEVEL **xx dBm**]

► Set R&S FSU Delta Marker Reference
- [**MKR** : REFERENCE FIXED]

► Set Measuring Receiver Reference (SET REF)

Step 2

► Set the power of the Signal Generator to the second value listed in the table above.

► Set RF Attenuation and Reference Level of the R&S FSU to the second value listed in the table above.

► Record the difference
R&S FSQ Delta Marker indication[5] - Measuring Receiver indication in the Performance Test Report.Repeat step 2 for the remaining values of the table above.

[5] Delta 2 [T1 FXD] xx.xx dB

► Repeat step 2 for the remaining values of the table above.

1.6.6 Checking the electronic Attenuator accuracy

Test equipment:

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

► Step attenuator (Section "Measurement Equipment", item 13)
- 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 R&S FSQ

Signal generator settings:

- Frequency 128 MHz
- Level 0 dBm

Step attenuator settings:

- Attenuation 40 dB

R&S FSQ 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 { 40dB - a_{FSQ} }
See table below for values of a_{ATT}.

R&S FSQ settings:

- [**AMPT** : NEXT : ELEC ATTEN MANUAL : {a_{FSQ}}]
- [**AMPT** : {-30dBm + a_{FSQ} } **dBm**]
- [**MKR** ⇒ : PEAK]
See table below for values of a $_{FSQ}$, a $_{ATT}$ and reference level.

Evaluation:

The difference between the level of the input signal of the R&S FSQ 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_{FSQ}	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

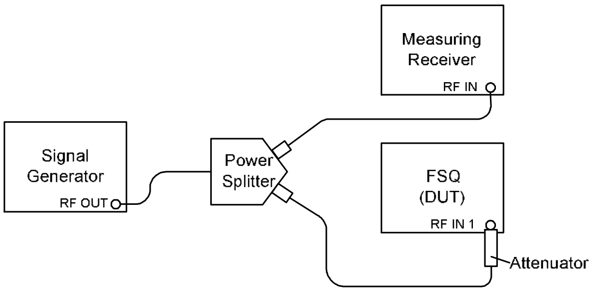
1.6.7 Checking the electronic Attenuator Accuracy with option B25 (alternative Measurement)

Test equipment:

- ► Signal Generator (Section "Measurement Equipment", item 4)
  - Frequency 128 MHz
  - Level range -62 to +8 dBm
- ► Power Splitter (Section "Measurement Equipment", item 7)
- ► Fixed Attenuator (Section "Measurement Equipment", item 17)
  - 3 dB / 128 MHz
- ► Measuring Receiver (Section "Measurement Equipment", item 19)
  - Range +2 to -68dBm / 128 MHz
  - Relative Accuracy (RSS): ±0.09 dB within -10 dB to +60 dB from set reference at -58 dBm

Test setup:

- ► Connect equipment as shown below:



R&S FSQ settings:

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

R&S FSU RF el. Attenuation dB	R&S FSU Ref Level dBm	Signal Generator Power dBm
10	-60	-52
15	-55	-47
20	-50	-42
25	-45	-37
30	-40	-32
35	-35	-27
40	-30	-22

Step 1

► Set the power of the Signal Generator to the first value listed in the table above.

► Set RF Attenuation and Reference Level of the R&S FSU to the first value listed in the table above:
- [**AMPT** :NEXT:ELEC ATTEN MANUAL: **xx dB :** REF LEVEL **xx dBm**]

► Set R&S FSU Delta Marker Reference
- [**MKR** : REFERENCE FIXED]

► Set Measuring Receiver Reference (SET REF)

Step 2

► Set the power of the Signal Generator to the second value listed in the table above.

► Set RF Attenuation and Reference Level of the R&S FSQ to the second value listed in the table above.

- Record the difference
  R&S FSQ Delta Marker indication[6] - Measuring Receiver indication in the Performance Test Report.
- Repeat step 2 for the remaining values of the table above.

1.7 Performance Test Option External Mixing B21

1.7.1 Checking LO-level

Measurement equipment:

- Power sensor (section "Measurement Equipment", item 12)
  - Frequency range 7.0 MHz to 15.5 GHz
  - Max. input power P_{max} = +23 dBm
  - RSS ≤ 2.5% referred to measured power impedance Z = 50 Ω
- Power Meter (Section "Measurement Equipment", item 10)
- Fixed attenuator with 10 dB (Section "Measurement Equipment" item 16)

Power meter settings:

- Connect power sensor to the power meter and execute function ´ZERO´ when there is no signal applied to the power sensor.

R&S FSQ settings:

- [**PRESET**]
- [**FREQ** : EXTERNAL MIXER : SELECT BAND]
- Table settings:
  Band: USER
  Harmonic # 20
- [**FREQUENCY SPAN** : ZERO SPAN]
- [**FREQUENCY CENTER** : {f_c}]
  f_c see table

Power meter settings:

- Connect power sensor via fixed attenuator to the output ‘LO_{out} / IF_{in}’

Measurement:

- Determine level of the LO-signal $L_{LO,meas}$.To achive higher accuracy it is recommended to compensate the frequency response of the power sensor

Evaluation:

The level of the LO-signal can be determined as:
$L_{LO} = L_{LO,meas} + 10$ dB

[6] Delta 2 [T1 FXD] xx.xx dB

1.7.2 Checking the Input LO_{out} / IF_{in} (2-Port-Mixers)

Measurement equipment:

► Generator (section "Measurement Equipment", item 2 or 3)
- Frequency f = 404.4 MHz
- Output power P = - 20 dBm

R&S FSQ settings:

- [**PRESET**]
- [**FREQ** : EXTERNAL MIXER : SELECT BAND]
- Table settings:
  Band USER
  Ports 2
  Bias 0 mA
  AVG Conv Loss 20 dB

► Switch off LO with service function:
- [**SETUP :** SERVICE : ENTER PASSWORT **894129**]
- [**SETUP :** SERVICE FUNCTION: **2.18.1.2**]
- [**AMPT** REF LEVEL **0 dBm**]

Test setup:

► Connect the generator to the connector LO_{out} / IF_{in};
Input level P = – 20 dBm +/- 0,1 dB

Evaluation:

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

1.7.3 Checking the Input IF_{in} (3-Port-Mixers)

Measurement equipment:

► Generator (section "Measurement Equipment", item 2 or 3)
- Frequency f = 404.4 MHz
- Output level P = - 20 dBm

R&S FSQ settings:

- [**PRESET**]
- [**FREQ** : EXTERNAL MIXER : SELECT BAND]
- Table settings:
  Band USER
  Ports 3
  Bias 0 mA
  AVG Conv Loss 20 dB

► Switch off LO with service function:
- [**SETUP :** SERVICE : ENTER PASSWORT **894129**]
- [**SETUP :** SERVICE FUNCTION : **2.18.1.2**]
- [**AMPT** : REF LEVEL **0 dBm**]

Test setup:

► Connect the generator to the connector IF_{in}.
Input level P = – 20 dBm +/- 0,1 dB

Evaluation:

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

1.7.4 Checking the bias supply

Measurement equipment:

► DC-current meter (section "Measurement Equipment", item 29)

R&S FSQ settings:

- [**PRESET**]
- [**FREQ** : EXTERNAL MIXER]

► Switch off LO with service function:
- [**SETUP :** SERVICE : ENTER PASSWORT **894129]**
- [**SETUP :** SERVICE FUNCTION : **2.18.1.2**]
- [**FREQ** : EXTERNAL MIXER : SELECT BAND]
- Table settings:
Band: USER
Bias {I_{bias}}: - 10 mA, 0 mA, + 10 mA

Test setup:

► Connect the DC current meter between cable conductor and ground of LOout / IFin

Evaluation:

► - Read out current

1.8 Performance Test Option - B23

The option B23 is implemented in the signal path above 3.6 GHz and is only avaible for the model FSQ 26. Therefore the measurements are done between 3.6 GHz and 26.5 GHz..

1.8.2 Checking Noise Display with Preamplifier (B23)

Test equipment:

► 50-Ω termination (Section "Measurement Equipment", item 9)
- Frequency range: R&S FSQ 26 3.6 to 26.5 GHz

Test setup:

► Terminate the RF input of the R&S FSQ with 50 Ω

R&S FSQ settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**SPAN** : **0 Hz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**BW** : SWEEP TIME MANUAL : **50 ms**]
- [**TRACE 1** : AVERAGE]
- [**TRACE 1** : SWEEP COUNT : **5 ENTER**]
- [**FREQ** : CENTER : {f_n}]
- [**MEAS** : Time Dom Power : Mean]
- [**AMPT** : **- 80 dBm**]
- [**SETUP** : PREAMP ON]
- [**FREQ** : CENTER : {f_n}]

Measurement:

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

Evaluation

► Read out the mean marker for frequencies above 1 kHz and correct the measurement value by –30 dB for the ratio of 1 Hz / 1 kHz

1.8.3 Checking the Level accuracy and the Frequency Response with Preamplifier (B23)

Test equipment:

► Signal Generator (Section "Measurement Equipment", item 2)
- Frequency range:
  R&S FSQ 26 10 MHz to 26.5 GHz
  Maximum level ≥ 0 dBm

► Power Meter (Section "Measurement Equipment", item 10)
- Dual Channel
- Power range -30 to 0 dBm
- Instrumentation uncertainty <0.5%
- Uncertainty of power reference <1.2%
- VSWR of power reference <1.10

► Power Sensor (Section "Measurement Equipment", item 12)
- Frequency range:
  R&S FSQ 26 50 MHz to 26.5 GHz
- Power range -30 to 0 dBm
- Cal factor uncertainty 50 to 128 MHz <1.6 %
  3.6 to 8 GHz <2 %
  8 to 22 GHz<2.5 %
  22 to 40 GHz <3 %
- VSWR 50 to 128 MHz <1.15
  3.6 to 8 GHz <1.15
  8 to 22 GHz <1.25
  22 to 26.5 GHz <1.35

► 6 dB Power Splitter (Section "Measurement Equipment", item 8)
- Frequency range:
  R&S FSQ 26 DC to 26.5 GHz
- Level imbalance 3.6 to 8 GHz ≤ 0.3 dB
  8 to 22 GHz ≤ 0.4 dB
  22 to 26.5 GHz ≤ 0.5 dB
- Equivalent output VSWR 3.6 to 8 GHz ≤ 1.3
  8 to 22 GHz ≤ 1.4
  22 to 26.5 GHz ≤ 1.5

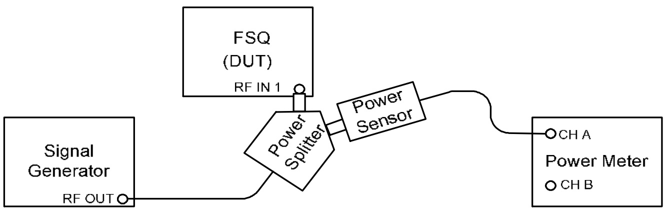
Measuring the frequency response

Test setup:

► Standardize the Power Meter and Power Sensor (item 10, 12).

► Use Power Splitter/Combiner (item 8) and connect equipment as shown below.

► Connect the power splitter directly to the R&S FSQ RF input 1.



Throughout the remaining steps set the Power Meter Cal Factor as appropriate!

Reference Measurement

Signal Generator settings:

- Level 0 dBm
- Frequency 128 MHz

R&S FSQ settings:

- [**PRESET**]
- [**AMPT** : RF INPUT DC]
- [**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**]

R&S FSQ settings:

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

► Read level indication from R&S FSQ (reading of marker 1): L_{FSQ}

Power Meter:

► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

Calculate
ΔRef / dB = L_{FSQ} / dBm - $L_{PowerMeter}$ / dBm
Record ΔRef / dB

Frequency Response Measurement

Signal generator settings:

- Frequency f_{fresp}
See table in performance test report for values of f_{fresp}

R&S FSQ settings:

- [**SETUP** : SIGNAL SOURCE : YIG FILTER {state}]
- [**FREQ** : CENTER : {f_{fresp}}]
See table in performance test report for values of f_{fresp}

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

► Read level indication from R&S FSQ (reading of marker 1): L_{FSQ}

Power Meter:

► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

► The frequency response can be calculated as:
Freq. response / dB = L_{FSQ} - $L_{PowerMeter}$ - ΔRef / dB

► Take the value of ΔRef as ascertained before.

1.9 Test Procedure for Option IQ Baseband Input FSQ-B71

The baseband input can only be checked using a program on an external PC.

For each measurement, 4096 samples of I/Q data are to be taken from the FSQ to calculate the spectrum by means of the complex FFT. The relevant quantities such as noise, harmonic ratio and level are determined from the spectrum. To obtain an accurate level display, the data must be evaluated with a flattop window before using the FFT algorithm.

```
Flattop window for FFT length 4096

N = 4096

a0 = 0.209671
a1 = -0.407331
a2 = 0.281225
a3 = -0.092669
a4 = 0.009104

phase = [0: (2*π/N): (2*π-(2*π/N))]            /* 4096 values

w = (a0+a1*cos(phase)+a2*cos(2*phase)+a3*cos(3*phase)+a4*cos(4*phase))/a0

(For "phase" 4096 values from 0 to 2π put into the window formula yields 4096
values for w: w1 to w4096. These are to be multiplied with the I and Q samples
#1 to #4096.)

This flattop window has a noise bandwidth = 3.88 bins.
```

The I/Q data is read out with the **TRACe:IQ subsystem** (→ operating manual). The command sequence is always the same since the parameters for the various baseband measurements are not modified (reads 4096 I/Q pairs of values; sampling rate = 81.6 MHz).

```
TRAC:IQ ON
TRAC:IQ:SET NORM, 10 MHz, 81.6 MHz, IMM, POS, 0, 4096
FORM REAL,32   or  FORM ASCII
TRAC:IQ:DATA?
TRAC:IQ OFF
```

The I/Q data consists of the sampling values in volts.

The complex FFT represents the frequency domain from –fa/2 to +fa/2 (fa = sampling rate). A signal in the channel I or Q alone generates a positive and identical negative spectrum whose power values are to be added together. It is also possible to take only the value at the positive (or negative) frequency and add 3.01dB (multiply with √2). This applies to all signals, including noise, except frequency zero. The correction is not required with the DC component since the two spectral lines coincide.

This correction is a prerequisite for the performance test. The specified correction factor for noise does not include these 3 dB.

A **Windows program** is available for manual measurements; this program reads the I/Q data, evaluates it with the flattop window and displays the FFT spectrum. The level can be read out with markers. For noise measurements, averaging can be switched on via a selectable number of FFTs.

The files required for this program can be loaded from "gloris" (https://gloris.rohde-schwarz.com/) as follows:

Firmware/software → software → FSQ-B71 → FSQ I/Q test program

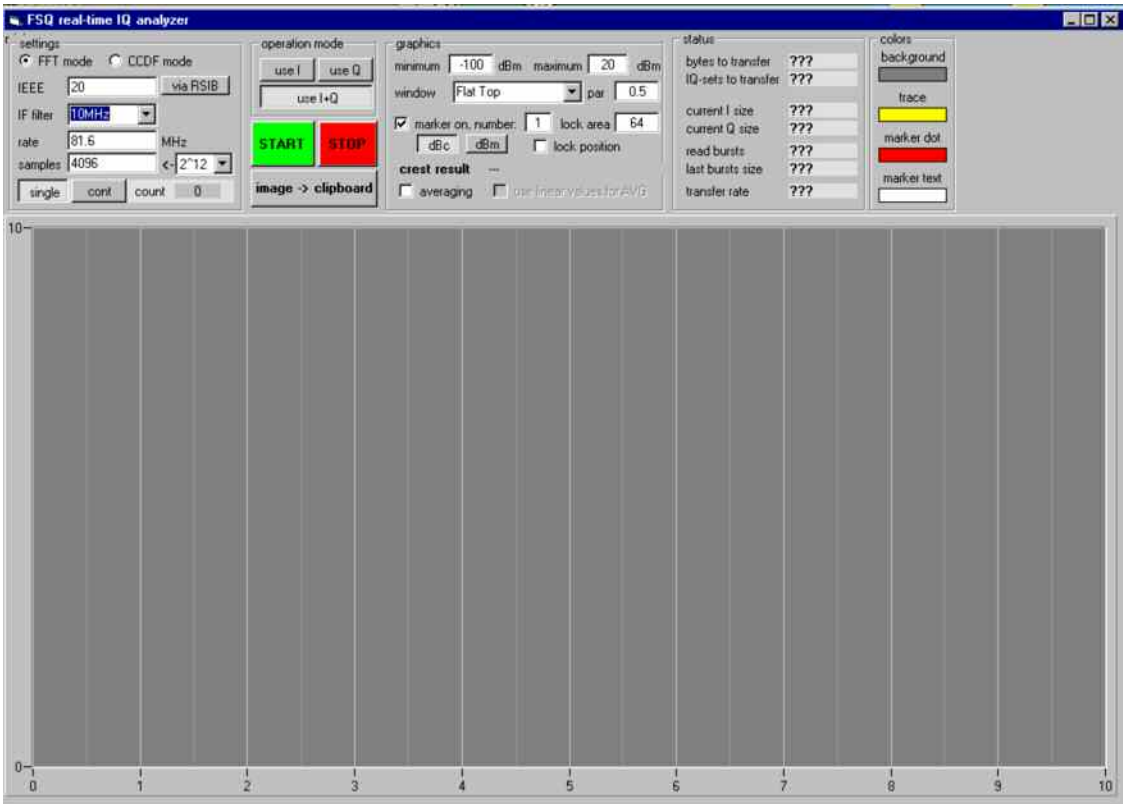
Follow the instructions in "readme.txt" for installing the program.

Two files are created in a directory selected by the user:

ccrptmr6.dll
FSUTest.exe

The program is started by executing "*FSUTest.exe*".

The program starts with the following default setting. This setting matches the above mentioned command TRACe:IQ: 4096 samples with a sampling rate of 81.6 MHz.



Important tips regarding the program:

1. Level

No complex test signals are used in the performance test, i.e. only one test signal is fed into I or Q. Therefore, the complex FFT always supplies two spectral lines at the positive and negative frequency. These two lines have the same level and are smaller than the test signal by 3.01 dB.

The marker automatically goes to the largest signal (the n largest signals, with number = n).

<u>Add 3.01 dB to the marker value (dBm).</u>

2. Harmonic ratio

► Activate several markers; the ratio can be directly read in dBc.

3. I/Q offset

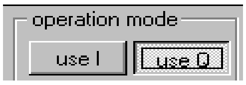
► Read out the level at frequency zero (DC). (No 3.01 dB correction with DC.)

► Conversion to voltage (DC): $U / V = \sqrt{\,(0.05 * 10^{(0.1 * power/dBm)})}$

4. Noise

► The noise is to be separately tested for each channel; therefore, only I or Q values are to be evaluated.

► Press the buttons "use I" or "use Q" depending on the channel to be measured.

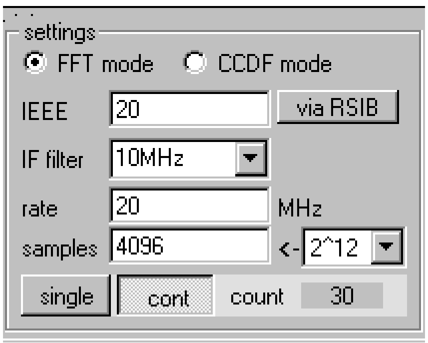


The following setting is recommended:

rate = 20 MHz

samples = 4096

cont(inuous), count = 30



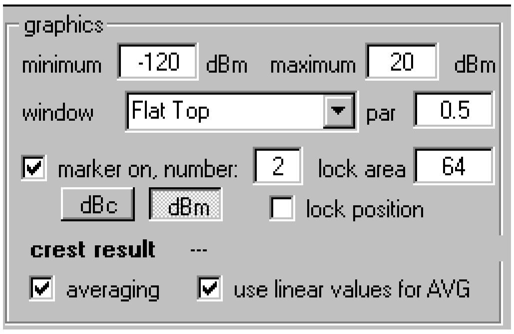
minimum = –120 dBm

window = Flat top

marker on, number = 2, (unit) dBm

averaging

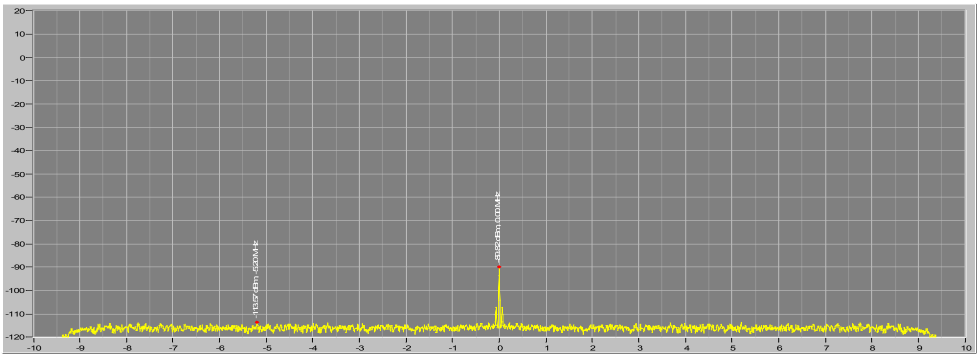
use linear values for AVG



► Press the start key to start the measurement.

30 FFTs are averaged. The first marker goes to the DC line, the second one to the maximum value in the noise (in the range 0 ± 10 MHz).

Measurement example:



► Conversion to power in 1 Hz bandwidth: value displayed at the marker – 41.1 dB.

► In the example: -113.57 dBm – 41.1 dB = -154.67 dBm [1Hz]

► The correction value –41,1 dB is only valid for the specified setting.
(30 linear averages, 4096 samples, flattop window, rate 20 MHz)

► Conversion to voltage (RMS): U_{RMS} / V = √ (0,05 * 10 $^{(0.1 * power/dBm)}$)

► In the example: -154.67 dBm = 4.13 *10^{-9} = 4.13 nV

Manual operation of the FSQ baseband signal input

For manual measurements using the FFT program described earlier, manual operation of the baseband signal is available after entering the service password.

[**SETUP:** SERVICE: ENTER PASSWORD: 894129: ENTER]

Instrument setting by manual operation is described in the following performance test.

The IEC/IEEE bus commands are provided in the operating manual.

Units delivered from June 2004 (model 03) have 1 MΩ input impedance instead of 1 kΩ. Changes in test procedure with 1 MΩ input impedance:

The 0.214 dB mismatch level correction is omitted.

The spurious measurement with 30 MHz is omitted. Specification is limited to 10 MHz.

1.9.2 Testing the Level Error (50 Ω)

All test results must be determined from the I/Q data. The sampling rate is 81.6 MHz in each case.

Test equipment:

- Signal generator item 3
- Power meter item 10
- Power sensor item 12
- 6 dB divider item 7

Determination of the absolute error at 1 MHz

Test setup:

► Set the frequency correction of the power meter to 1 MHz.

► Connect the power sensor to the power meter and execute the ZERO function if no signal is applied to the power sensor.

► Connect the power sensor to the RF output of the signal generator.

Signal generator settings:

- Frequency 1 MHz

- Level

peak	**dBm**
1000 mV	+10 dBm
562 mV	+5 dBm
316 mV	0 dBm
178 mV	-5 dBm
100 mV	-10 dBm
56.2 mV	-15 dBm
31.6 mV	-20 dBm

Measurement:

Determine the signal generator output power at all levels using the power meter.

Test setup:

Connect the RF output of the signal generator to the I-high input of the FSQ.

R&S FSQ settings:

- [**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG: I/Q INPUT 50Ω: BALANCED ON: FILTER OFF: DITHER OFF]
- [**AMPT** : REF LEVEL : **see table**]

Measurement sequence:

- Frequency on generator 1 MHz
- Level on generator

peak	dBm	REF LEVEL on FSQ
1000 mV	+10 dBm	5.62 V
1000 mV	+10 dBm	3.16 V
1000 mV	+10 dBm	1.78 V
1000 mV	+10 dBm	1 V
562 mV	+5 dBm	562 mV
316 mV	0 dBm	316 mV
178 mV	-5 dBm	178 mV
100 mV	-10 dBm	100 mV
56.2 mV	-15 dBm	56.2 mV
31.6 mV	-20 dBm	31.6 mV

► Repeat the measurement sequence after connecting the RF output of the signal generator to the I-low, Q-high, Q-low input of the R&S FSQ.

Evaluation:

The difference between the signal levels of the power meter and the FSQ reflects the level error of the R&S FSQ.

Then evaluate the imbalance: The ratio I-high/Q-high as well as I-low/Q-low at all levels.

Determine the level using the FFT.

Testing the frequency response-without filter

Test setup:

► Connect the RF output of the signal generator to the input of the 6 dB divider.

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

► Connect output 2 of the divider to the I-high input of the R&S FSQ.

FSQ settings:

- [**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG**:** I/Q INPUT 50Ω: BALANCED ON: FILTER OFF: DITHER OFF]
- [**AMPT** : REF LEVEL : **see table**]

Measurement sequence:

Level on FSQ	Freq. on generator	REF LEVEL on FSQ
10 dBm	1 MHz	1 V
	2 MHz	
	5 MHz	
	10 MHz	
	20 MHz	
	36 MHz	
5 dBm	1 MHz	562 mV
	20 MHz	
	36 MHz	
0 dBm	1 MHz	316 mV
	20 MHz	
	36 MHz	
-10 dBm	1 MHz	100 mV
	20 MHz	
	36 MHz	

► Repeat the measurement sequence after connecting the RF output of the signal generator to the I-low, Q-high, Q-low input of the FSQ.

Evaluation:

Reference frequency = 1 MHz.

The power meter controls the frequency response of the source. Deduct the frequency response from the value displayed on the FSQ. The frequency correction of the power meter must correspond to the test frequency used.

Then evaluate the imbalance: At all levels calculate the difference of the frequency responses between I-high and Q-high as well as I-low and Q-low.

Determine the level using the FFT.

Testing the frequency response with filter

Test setup:

Test setup as above.

► Connect output 2 of the divider to the I-high input of the R&S FSQ.

R&S FSQ settings:

- [**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG**:** I/Q INPUT 50Ω: BALANCED ON: FILTER ON: DITHER OFF]
- [**AMPT** : REF LEVEL : **1 V**]

Measurement sequence:

Level on FSQ	Freq. on generator
10 dBm	1 MHz
	2 MHz
	5 MHz
	10 MHz
	20 MHz
	30 MHz

► Repeat the measurement sequence after connecting the RF output of the signal generator to the I-low, Q-high, Q-low input of the FSQ.

Evaluation:

Reference frequency = 1 MHz.

The power meter controls the frequency response of the source. Deduct the frequency response from the value displayed on the FSQ. The frequency correction of the power meter must correspond to the test frequency used.

Then evaluate the imbalance: Calculate the difference of the frequency responses between I-high and Q-high as well as I-low and Q-low.

Determine the level using the FFT.

1.9.3 Dynamic Range (50 Ω)

Test equipment:

- Signal generator Item 3
- 6 dB divider Item 7
- Lowpass 15 MHz Item 18
- 4 x 50 Ω termination Item 25

Spurious and harmonics

Test setup:

► Connect the signal generator RF output with inserted lowpass to the I-high input of the R&S FSQ. It should be possible to bypass the lowpass .

► Measurements at 12 MHz with lowpass.

► Measurements at 30 MHz without lowpass.

FSQ settings:

- [**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG**:** I/Q INPUT 50Ω: BALANCED ON: FILTER ON: DITHER OFF]
- [**AMPT** : REF LEVEL : **see table**]

Measurement sequence:

Level at FSQ input	Freq. on generator	REF LEVEL on FSQ
10 dBm	12 MHz	1 V
	30 MHz	
0 dBm	12 MHz	316 mV
	30 MHz	
-10 dBm	12 MHz	100 mV
	30 MHz	

► Repeat the measurement sequence after connecting the RF output of the signal generator to the I-low, Q-high, Q-low input of the FSQ.

Evaluation:

Use the FFT to determine the level difference (dBc) between the test signal and the next higher spectral line (without DC).

Only evaluate the frequency range >0 to 36 MHz.

All following measurements are to be performed with 50 Ω termination.

Noise floor

Test setup:

Terminate all 4 baseband inputs of the FSQ with 50 Ω (item 25). No connection to other instruments such as signal generator. Otherwise, interference signals can be coupled via ground loops, which would corrupt the noise floor measurement.

FSQ settings:

- [**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG**:** I/Q INPUT 50Ω: BALANCED ON: FILTER ON: DITHER OFF]
- [**AMPT** : REF LEVEL : **562mV**]

Evaluation:

Measure the noise floor using the FFT. Measure I and Q separately. Also use the measured I data for the FFT and set all Q values to zero and vice versa.

The noise is almost constant in the entire frequency range up to 30 MHz and can therefore be measured at any frequency.

Averaging is required to obtain stable measurement results. It is possible to average over several FFTs at one frequency (e.g. 10 MHz) or, what is much faster, to average all values in a sufficiently large frequency range (e.g. 9 to 11 MHz) within one FFT.

The result is the average value in volts.

Conversion to the rms value in 1 Hz bandwidth:

Assuming a sampling rate of 81.6 MHz and 4k FFT with flattop window (NBW 3.88 bins), the correction factor is –47.8 dB or 4.06 * 10^{-3}.

FSQ settings:

- [**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG**:** I/Q INPUT 50Ω: BALANCED ON: FILTER ON: DITHER OFF]
- [**AMPT** : REF LEVEL : **178mV**]

Evaluation:

as before

FSQ settings:

- [**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG**:** I/Q INPUT 50Ω: BALANCED ON: FILTER ON: DITHER OFF]
- [**AMPT** : REF LEVEL : **31.6mV**]

Evaluation:

as before

I/Q offset

Test setup:

► Equip all 4 baseband inputs of the FSQ with 50 Ω termination (item 25).

FSQ settings:

- [**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG**:** I/Q INPUT 50Ω: BALANCED see table: FILTER ON: DITHER OFF]
- [**AMPT** : REF LEVEL : **see table**]

Measurement sequence:

BALANCED	REF LEVEL on the FSQ
ON	1 V
	562 mV
	316 mV
	178 mV
	100 mV
	56.2 mV

	31.6 mV
OFF	1 V
	562 mV
	316 mV
	178 mV
	100 mV
	56.2 mV
	31.6 mV

Evaluation:

Evaluation performed from the FFT at the zero frequency. Directly yields the I/Q offset in volts (= length of the vector for the zero-point error).

Measurements with 1 kΩ Input Impedance

Since a 50 Ω termination is screwed into the input for all measurements, the input impedance is approximately 50 Ω (precisely 47.62 Ω). Therefore, the same level settings as for the previous measurements with 50 Ω can be used on the signal generator.

1.9.4 Checking the Level Error (1 kΩ / 1MΩ)

All measurement results must be determined from the I/Q data. The sampling rate is 81.6 MHz.

Test equipment:

Signal generator Item 3

Power meter Item 10

Power sensor Item 12

6 dB divider Item 7

4 x 50 Ω termination Item 25

Determination of the absolute error at 1 MHz

Test setup:

- ► Equip all 4 baseband inputs of the FSQ with a 50 Ω termination (to be directly screwed on).
- ► Connect the RF output of the signal generator to the I-high input of the FSQ.

FSQ settings:

- [**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG**:** I/Q INPUT 1 kΩ / **1 MΩ**: BALANCED ON: FILTER ON: DITHER OFF]
- [**AMPT** : REF LEVEL : **1 V**]

Measurement:

- Frequency on signal generator 1 MHz
- Level on signal generator 10 dBm

► Repeat the measurement after connecting the RF output of the signal generator to the I-low, Q-high, Q-low input of the FSQ.

Evaluation:

The difference between the signal level of the power meter (from previous calibration) and the FSQ reflects the absolute level error of the FSQ.

With 1kΩ input impedance, mismatch must be taken into account. The FSQ measures, by definition, the voltage at the I/Q input. The source was calibrated with a load of 50 Ω (power sensor). The load for the source is now 50 Ω in parallel with 1 kΩ. This means that the nominal value displayed by the FSQ is 0.214 dB lower than the value displayed by the power meter during source calibration.
With 1 MΩ input impedance no correction is necessary.

Determine the level by using the FFT.
Also evaluate the imbalance: I-high/Q-high ratio in dB.

Checking the frequency response

Test setup:

► Equip all 4 baseband inputs of the FSQ with a 50 Ω termination (to be directly screwed on).

► Connect the RF output of the signal generator to the input of the 6 dB divider.

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

► Connect output 2 of the divider to the I-high input of the FSQ.

FSQ settings:

- [**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG: I/Q INPUT 1 kΩ / **1 MΩ**: BALANCED ON: FILTER ON: DITHER OFF]
- [**AMPT** : REF LEVEL : 1 V]

Measurement sequence:

Level on the FSQ	Freq. on the generator
10 dBm	1 MHz
	5 MHz
	10 MHz

► Repeat the measurement sequence after connecting the RF output of the signal generator to the I-low, Q-high, Q-low input of the FSQ.

Evaluation:

Reference frequency = 1 MHz.

The power meter controls the frequency response of the source. Deduct the frequency response from the value displayed on the FSQ. The frequency correction of the power meter must correspond to the test frequency used.

Also evaluate the imbalance: Calculate the difference between I-high and Q-high as well as between I-low and Q-low.

Determine the level using the FFT.

1.9.5 Dynamic Range (1 kΩ / 1 MΩ)

Test equipment:

- Signal generator Item 3
- 6 dB divider Item 7
- Lowpass 15 MHz Item 18
- 4 x 50 Ω termination Item 25

Spurious and harmonics

Test setup:

► Equip all 4 baseband inputs of the FSQ with a 50 Ω termination (to be directly screwed on).

► Connect the signal generator RF output with inserted lowpass to the I-high input of the FSQ. It should be possible to bypass the lowpass.

► Measurements at 12 MHz with lowpass.

► Measurements at 30 MHz without lowpass.

R&S FSQ settings:

- [**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG: I/Q INPUT 1 kΩ / **1 MΩ**: BALANCED ON: FILTER ON: DITHER OFF]
- [**AMPT** : REF LEVEL : 1 V]

Measurement sequence:

Level on the FSQ input	Freq. on the generator
10 dBm	12 MHz
	30 MHz (1 kΩ only)

► Repeat the measurement sequence after connecting the RF output of the signal generator to the I-low, Q-high, Q-low input of the FSQ.

Evaluation:

Use the FFT to determine the level difference between the test signal and the next higher spectral line (without DC).

Only evaluate the frequency range >0 to 36 MHz.

Noise floor

Test setup:

► Equip all 4 baseband inputs of the FSQ with a 50 Ω termination (item 25). No connection to other instruments such as signal generator. Otherwise, interference signals can be coupled via ground loops, which would corrupt the noise floor measurement.

FSQ settings:

- [**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG**:** I/Q INPUT 1 kΩ / **1 MΩ**: BALANCED ON: FILTER ON: DITHER OFF]
- [**AMPT** : REF LEVEL : **31.6mV**]

Evaluation:

Measure the noise floor using the FFT. Measure I and Q separately. Also use the measured I data for the FFT and set all Q values to zero and vice versa.

The noise is almost constant in the entire frequency range up to 30 MHz and can therefore be measured at any frequency.

Averaging is required to obtain stable measurement results. It is possible to average over several FFTs at one frequency (e.g. 10 MHz) or, what is much faster, to average all values in a sufficiently large frequency range (e.g. 9 to 11 MHz) within one FFT.

The result is the average value in volts.

Conversion to the rms value in 1 Hz bandwidth:

Assuming a sampling rate of 81.6 MHz and 4k FFT with flattop window (NBW 3.88 bins), the correction factor is –47.8 dB or 4.06 * 10^{-3}.

I/Q offset

Test setup:

► Equip all 4 baseband inputs of the FSQ with a 50 Ω termination (item 25).

FSQ settings:

- [SETUP: SIGNAL SOURCE: BASEBAND ANALOG: I/Q INPUT 1kΩ / 1 MΩ: BALANCED ON: FILTER ON: DITHER OFF]
- [AMPT : REF LEVEL : 100mV]

Evaluation:

Evaluation performed from the FFT at the zero frequency. Directly yields the I/Q offset in volts (= length of the vector for the zero-point error).

1.10 Test Procedure for Option I/Q Bandwidth Extension R&S FSQ-B72

The bandwidth extension can only be checked using a program on an external PC.

For each measurement, 4096 samples of I/Q data are to be taken from the FSQ to calculate the spectrum by means of the complex FFT. The relevant quantities such as noise, harmonic ratio and level are determined from the spectrum. To obtain an accurate level display, the data must be evaluated with a flattop window before using the FFT algorithm

```
Flattop window for FFT length 4096
N = 4096
a0=0.209671
a1=-0.407331
a2=0.281225
a3=-0.092669
a4=0.009104

phase=[0: (2*π/N): (2*π-(2*π/N))]             /* 4096 values

w=(a0+a1*cos(phase)+a2*cos(2*phase)+a3*cos(3*phase)+a4*cos(4*pha
se))/a0

(For "phase" 4096 values from 0 to 2π put into the window
formula yields 4096 values for w: w1 to w4096. These are to be
multiplied with the I and Q samples #1 to #4096.)
```

This flattop window has a noise bandwidth = 3.88 bins.

The I/Q data is read out with the **TRACe:IQ subsystem** (→ operating manual).

The command sequence is always the same since the parameters for the various baseband measurements are not modified (reads 4096 I/Q pairs of values; sampling rate = 326.4 MHz).

```
TRAC:IQ ON
TRAC:IQ:SET NORM, 50 MHz, 326.4 MHz, IMM, POS, 0, 4096
FORM REAL,32   or  FORM ASCII
TRAC:IQ:DATA?
TRAC:IQ OFF
```

Note:

The I/Q data consists of the sampling values in volts.

Conversions:

U_{RMS} / V = $\sqrt{I^2 + Q^2}$

P / dBm = $10 \cdot \log\left[20 \cdot (I^2 + Q^2)\right]$

The complex FFT represents the frequency domain from –fa/2 to +fa/2 (fa = sampling rate = 326.4 MHz).

Windows program

A **Windows program** is available for manual measurements; this program reads the I/Q data, evaluates it with the flattop window and displays the FFT spectrum.

The files required for this program can be loaded from "gloris" (https://gloris.rohde-schwarz.com/) as follows:

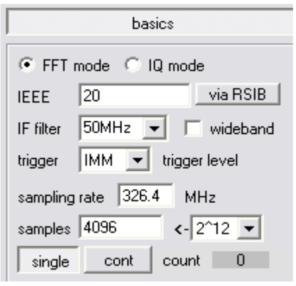
Firmware/Software → Software → FSQ-B72 → Test program for manual performance test of FSQ-B72

Rename installer: *IQRealTime_1.1.bin* → *IQRealTime_1.1.exe*

Next, execute and follow instructions.

The installed program is started by executing "*IQRealTime.exe*".

The default setting has to be changed as specified below:



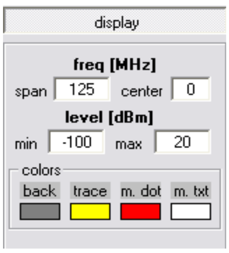
IF filter → 50 MHz
Sampling rate → 326.4 MHz

Set the IEC/IEEE-bus address in line with that of the analyzer.

Program operating instructions:

General

The span (level and frequency) is user-selectable, even after the measurement has been performed.

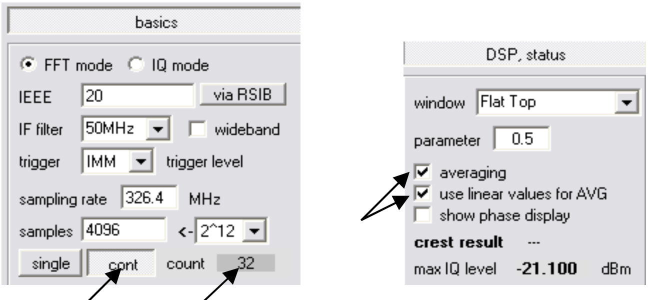


Averaging

Continuous averaging: Select averaging and cont(inous), count = 0

Averaging over n FFTs: Set count = n

Lin/Log: Default is the averaging of the logarithmic values.
For linear averaging, select "use linear values for AVG".



Markers

on	On/off switch for all markers.
number	Number of automatically placed markers (peak search).
lock area	Area (number of FFT bins) to the left and right of an automatically placed marker where no other markers are placed.
1 bin	= sampling rate / #samples, with a sampling rate of 326.4 MHz and 4096 samples, 1 bin = 80 kHz. With flattop window, values = 10 are useful.
lock position	Normally the markers are replaced after each FFT. Lock position freezes the markers in their frequency position.
dBc	The marker on the largest signal displays the level absolute in dBm, all other markers display the level relative to the largest signal (dBc).
dBm	All markers display the level absolute in dBm.
dBF	All markers display the level relative to the *free marker* (dBRef).
limit	If “Limit” is selected, the range where markers are placed automatically is limited to the specified frequency range (entry in MHz).
free marker	If “free marker” is selcected, one marker is additionally placed exactly on the specified frequency (entry in MHz). The free marker always displays the level absolute in dBm.

Measuring the absolute level

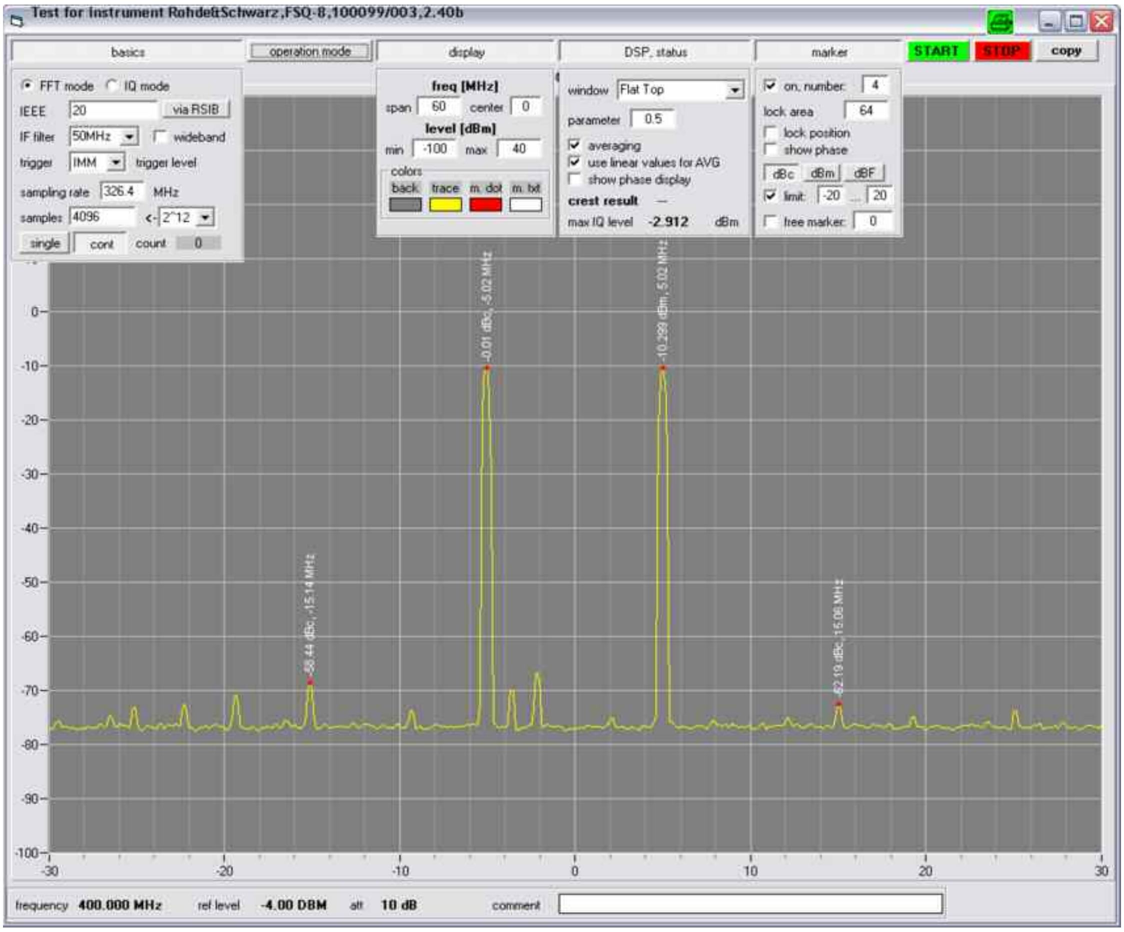
A marker is active in the default setting. The marker automatically jumps to the largest signal and displays the level in dBm. The peak search range of the marker can be limited with *limit*, if required.

Measuring the frequency response: operate the program in the cont(inuous) mode with count = 0, averaging off, only one marker is active. When the frequency is changed on the signal generator, the marker follows the signal and displays the level.

Third-order intermodulation

Activate four markers and select *dBc.* Limit the search range (*limit*) to a value slightly above the expected intermodulation frequencies to prevent the markers from being set to other signals beyond the frequency range of interest. Activate *averaging.*

The intermodulation ratio can be read out directly in dBc.



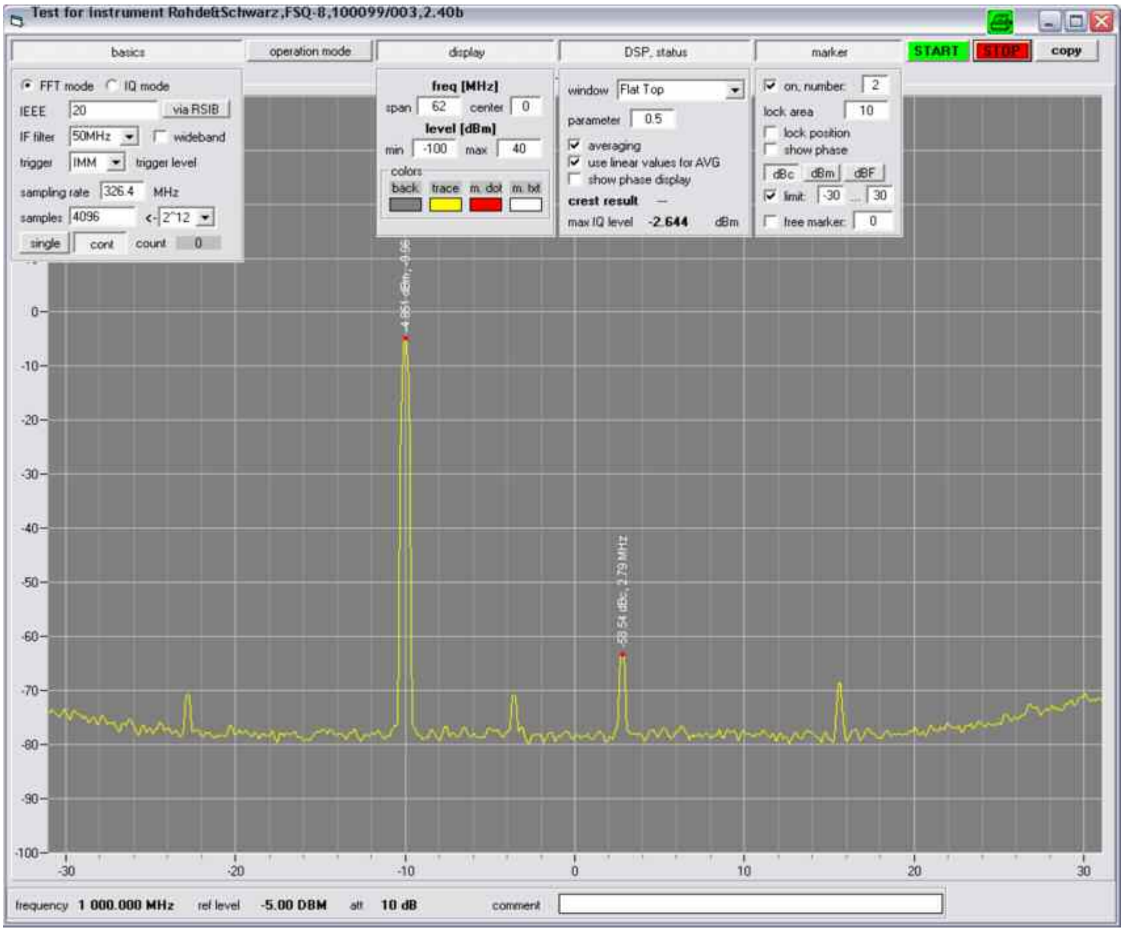
If the markers jump to other spurious signals, the easiest solution is to increase the number of markers so that markers can be placed on both intermodulation products. It may then be necessary to reduce the *lock area.*

Note on the preceding hardcopy: No marker will jump to the large spurious signal at -2 MHz, because *lock area* = 64 locks the ±5.1 MHz range around the two large signals for the peak search.(64 * 326.4 MHz / 4096 = 5.1 MHz).

Spurious with input signal

Activate two markers, select *dBc*, set *limit* to the range specified in the test instruction, *averaging*, *cont(inuous)*, *count = 0*. Important: Set *lock area = 10* to ensure that also spurious close to the test signal can be detected.

One marker jumps to the test signal, the other marker to the largest spurious signal within the search range and displays its level directly in dBc.



Spurious without input signal

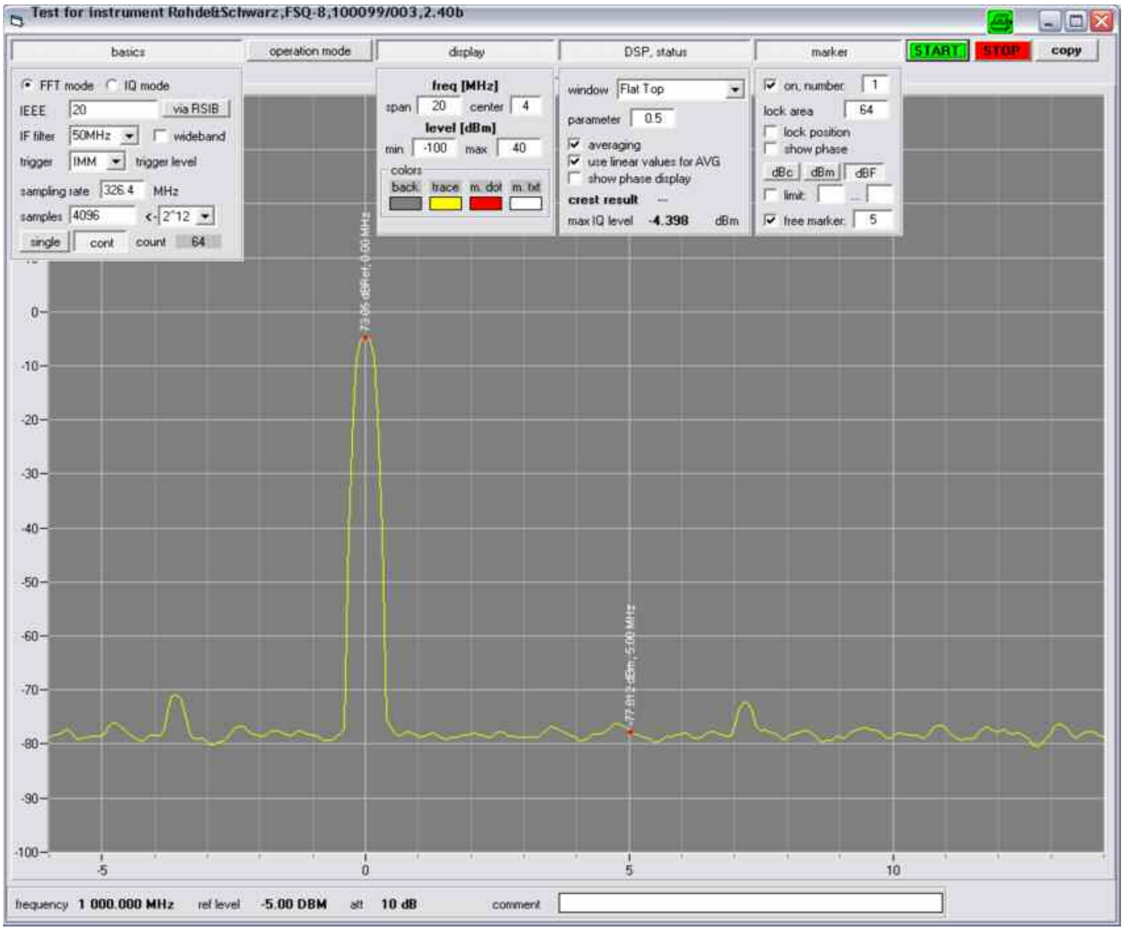
The same setting as for “spurious with input signal”; however, activate only one marker and set *count = 32.* The marker displays the largest spurious signal within the search range directly in dBm.

Set the search range (*limit*) according to the test instruction.

Signal-to-noise ratio

Number of markers = 1, select *dBF*, set *free marker* to the frequency where the noise is to be measured (5 MHz), *averaging*, *use linear values for AVG*, *cont(inuous)*, *count = 64*.

The marker on the test signal displays the signal-to-noise ratio in dBc (the displayed unit *dBRef* signifies dB referenced to the *free marker*).



Conversion to power in 1 Hz bandwidth: value displayed at the marker + 53.85 dB

Applies only to: 326.4 MHz sampling rate, 4096 samples, flattop window, linear average!

In the example given: 73.05 dB + 53.85 dB = 126.9 dB

Result: S/N ratio [1 Hz] = 126.9 dBc

Obtaining the correction value:

FFT noise bandwidth

Window bandwidth (flattop) * sampling rate / samples= 3.88 * 326.4 MHz / 4096 = 309 kHz

Correction in dB: 10 * log (noise bandwidth) = 10 * log (309E3) = 54.9 dB.

Correction of linear averaging instead of RMS

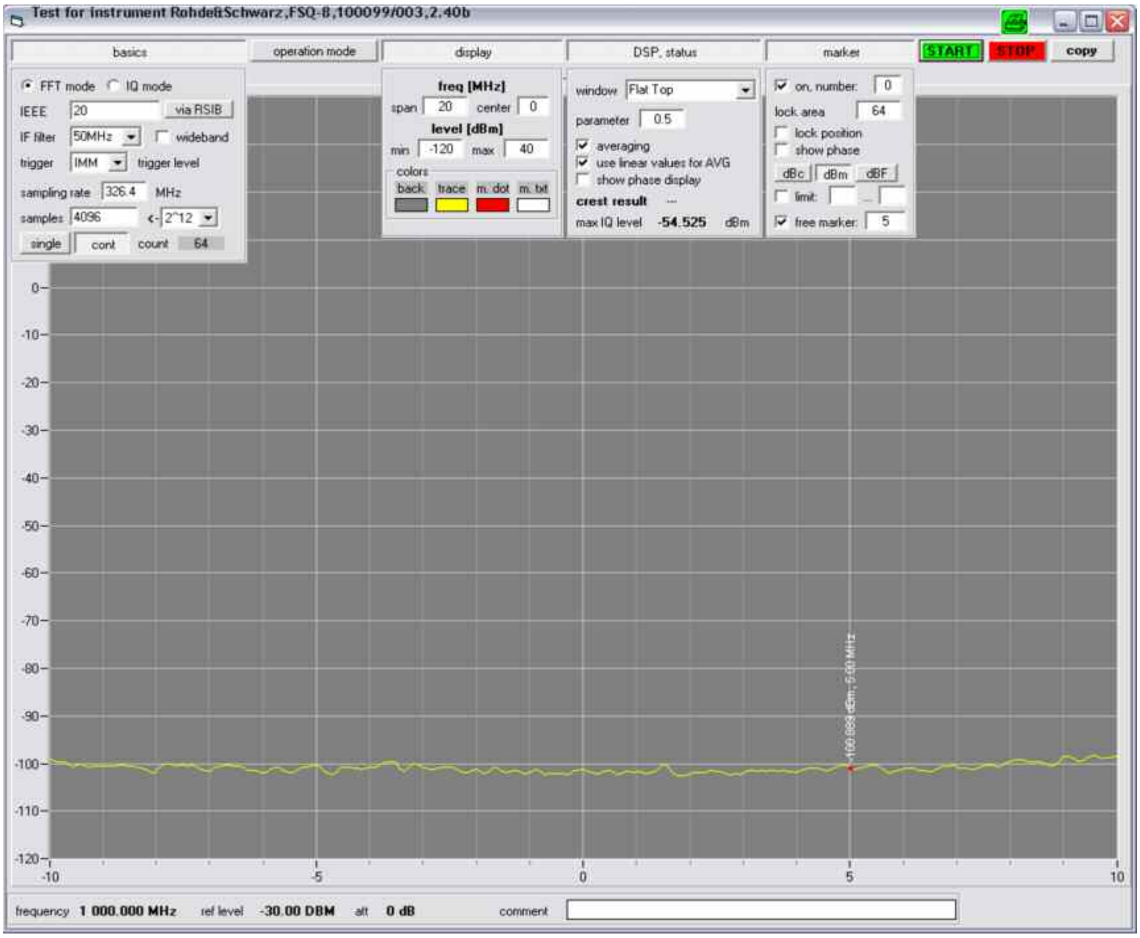
The noise is displayed minus 1.05 dB.

Overall correction value 54.9 dB – 1.05 dB = 53.85 dB

Noise Floor

Number of markers = 0, set *free marker* to the frequency where the noise is to be measured (5 MHz), *averaging*, *use linear values for AVG*, *cont(inuous)*, *count = 64*.

The marker displays the noise power in dBm.



Conversion to power in 1 Hz bandwidth: value displayed at the marker - 53.85 dB.
Applies only to: 326.4 MHz sampling rate, 4096 samples, flattop window, linear average! (See above on how to obtain the correction value.)
In the example given: -100.009 dBm – 53.85 dB = -153.859 dBm [1 Hz]
Result: noise floor [1 Hz] = -153.859 dBm

Test settings and specifications depend on the model number of the installed option FSQ-B72. Unless otherwise noted test procedures apply to both models 02 and 12. The model number can be read from the instrument as follows:
[SETUP : SYSTEM INFO: HARDWARE INFO]
The FSQ-B72 model number is displayed in line "Bandwidth Ext." / column "MODEL".

Level uncertainty

Test equipment:

- Signal generator (2)
- Attenuator (13)
- Power meter (10)
- Power sensor (12)
- Power splitter (7)

1.10.1 Level uncertainty at 128 MHz vs IF gain

Test setup:

► Set the frequency correction of the power meter to 128 MHz.

► Connect the power sensor to the power meter and execute the ZERO function if no signal is applied to the power sensor.

► Connect the power sensor to the RF output of the signal generator.

Signal generator settings:

- Frequency 128 MHz
- Level 0 dBm
  -5 dBm
  -10 dBm
  -15 dBm
  -20 dBm
  -30 dBm

Measurement:

► Determine the signal generator output power at all levels using the power meter.

Test setup:

► Connect the RF output of the signal generator to the I-high input of the R&S FSQ.

FSQ settings:

- [**FREQ** : CENTER : **128 MHz**]
- [**AMPT** : RF ATT: **10 dB**: REF LEVEL : **see table**]

Measurement sequence:

- Frequency on generator 128 MHz

- Level on generator	REF LEVEL on the FSQ
model 02	
0 dBm	+5 dBm
0 dBm	0 dBm
-5 dBm	-5 dBm
-10 dBm	-10 dBm
-15 dBm	-15 dBm
-20 dBm	-20 dBm
-30 dBm	-30 dBm
model 12	
0 dBm	+10 dBm
0 dBm	+5 dBm
-5 dBm	0 dBm
-10 dBm	-5 dBm
-15 dBm	-10 dBm
-20 dBm	-15 dBm

Evaluation:

The difference between the signal levels of the power meter and the FSQ reflects the level error of the FSQ

Level uncertainty vs RF frequency

Test setup:

Connect the power sensor to the RF output of the signal generator.

Set the frequency correction of the power meter to the applicable measurement frequency.

Signal generator settings:

- Level -10 dBm

- Frequency

Any R&S FSQ	900 MHz
	1800 MHz
	2400 MHz
	3600 MHz
Only R&S FSQ8	5 GHz
	6 GHz
	8 GHz
Only R&S FSQ26	5 GHz
	12 GHz
	18 GHz
	22 GHz
	26 GHz
Only R&S FSQ40	5 GHz
	12 GHz
	18 GHz
	22 GHz
	26 GHz
	30 GHz
	34 GHz
	38 GHz
	40 GHz

Measurement:

► Determine the output power of the signal generator using the power meter.

Test setup:

► Connect the RF output of the signal generator to the RF input of the R&S FSQ.

R&S FSQ settings:

- [**AMPT** : RF ATT: **10 dB**: REF LEVEL : **-10 dBm**]
- [**FREQ** : CENTER : **see table above**]

Evaluation:

The difference between the signal levels of the power meter and the FSQ reflect the absolute level error of the FSQ.

1.10.2 Level nonlinearity

Test setup:

Connect the RF output of the signal generator via the attenuator to the RF input of the R&S FSQ.

R&S FSQ settings:

- [**FREQ** : CENTER : **128 MHz**]
- [**AMPT** : RF ATT: **10 dB**: REF LEVEL : **-10 dBm**]

Activate dither:

```
Remote control: SENSE:IQ:DITHER ON
```

Manual operation:

- [**SETUP** : SERVICE: ENTER PASSWORD : **894129: ENTER**]
- [**SETUP** : SIGNAL SOURCE: I/Q DITHER ON]

Measurement sequence:

Freq. on transmitter: 128 MHz

model 02

Level at R&S FSQ starts at -10 dBm, reduce to -60 dBm in 5-dB steps using the attenuator.

In the case of -40 dBm to -60 dBm, averaging over several FFTs is necessary.

Level	-40	-45	-50	-55	-60 dBm
Averaging =	4	8	16	32	64

model 12

Level at R&S FSQ starts at -10 dBm, reduce to -70 dBm in 5-dB steps using the attenuator.

A minimum FFT length of 64k must be used.
Averaging over several FFTs is necessary.

With 64k FFT length use the following number of averages:
≥ -55 dBm: none
-60 dBm: 3 averages
-65 dBm: 10 averages
-70 dBm: 30 averages

Evaluation:

► Check the linearity of the FSQ display (considering the attenuator correction values, if available).

Reference = display at -10 dBm.

R&S FSQ settings:

Deactivate dither:

Remote control: SENSE:IQ:DITHER OFF

Manual operation:

[**SETUP** : SIGNAL SOURCE: I/Q DITHER OFF]

1.10.3 I/Q frequency response

Test equipment:

- Signal generator (2)
- Power meter (8)
- Power sensor (10)
- Power splitter (6)

I/Q frequency response at 128 MHz vs IF gain

Test setup:

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

► Connect output 1 of the attenuator to the power sensor of the power meter.

► Connect output 2 of the attenuator to the RF input of the FSQ.

R&S FSQ settings:

- [**AMPT** : RF ATT: **10 dB**: REF LEVEL : **see table**]
- [**FREQ** : CENTER : **128 MHz**]

Measurement sequence:

model 02

R&S FSQ input level	R&S FSQ reference level
-5 dBm (±2dB)	0 dBm

- Frequencies on transmitter
  - R&S FSQ center -30 MHz (98)
  - R&S FSQ center -25 MHz (103)
  - R&S FSQ center -15 MHz (113)
  - R&S FSQ center 128)
  - R&S FSQ center +15 MHz (143)
  - R&S FSQ center +25 MHz (153)
  - R&S FSQ center +30 MHz (158)

► Repeat measurement with the following levels:

R&S FSQ input level	R&S FSQ reference level
-10 dBm (±2dB	-5 dBm
-15 dBm (±2dB)	-10 dBm
-20 dBm (±2dB)	-15 dBm
-25 dBm (±2dB)	-20 dBm
-30 dBm (±2dB)	-25 dBm

model 12

R&S FSQ input level	FSQ reference level
0 dBm (±2dB)	10dBm

- Frequencies on transmitter
  - R&S FSQ Center -60MHz (98)
  - R&S FSQ Center -40MHz (103)
  - R&S FSQ Center -30MHz (98)
  - R&S FSQ Center -25MHz (103)
  - R&S FSQ Center -15MHz (113)
  - R&S FSQ Center (128)
  - R&S FSQ Center +15MHz (143)
  - R&S FSQ Center +25MHz (153)
  - R&S FSQ Center +30MHz (158)
  - R&S FSQ Center +40MHz (98)
  - R&S FSQ Center +60MHz (103)

► Repeat measurement with the following levels:

R&S FSQ input level	R&S FSQ reference level
0 dBm (±2dB)	+5dBm
-5 dBm (±2dB)	0dBm
-10 dBm (±2dB)	-5dBm
-15 dBm (±2dB)	-10dBm
-20 dBm (±2dB)	-15dBm

Evaluation:

Reference frequency = R&S FSQ center frequency (128 MHz).

The power meter controls the frequency response of the source. Deduct the frequency response from the value displayed on the R&S FSQ.

I/Q frequency response vs RF frequency

RF range

Test setup:

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

► Connect output 1 of the attenuator to the power sensor of the power meter.

► Connect output 2 of the attenuator to the RF input of the R&S FSQ.

R&S FSQ settings:

- [AMPT : RF ATT: 10 dB: REF LEVEL : -10 dBm]
- [FREQ : CENTER : see table]

Measurement sequence:

Center frequencies on the R&S FSQ

Any R&S FSQ models 900 MHz, 1800 MHz, 3600 MHz

model 02

Frequencies on the transmitter
R&S FSQ center -30 MHz
R&S FSQ center -25 MHz
R&S FSQ center -15 MHz
R&S FSQ center
R&S FSQ center +15 MHz
R&S FSQ center +25 MHz
R&S FSQ center +30 MHz

R&S FSQ input level -15 dBm ±2 dB

model 12

- Frequencies on the transmitter
  R&S FSQ Center -60MHz
  R&S FSQ Center -40MHz
  R&S FSQ Center -30MHz
  R&S FSQ Center -25MHz
  R&S FSQ Center -15MHz
  R&S FSQ Center
  R&S FSQ Center +15MHz
  R&S FSQ Center +25MHz
  R&S FSQ Center +30MHz
  R&S FSQ Center +40MHz
  R&S FSQ Center+60MHz

- R&S FSQ input level -15 dBm ±2 dB

Evaluation:

Reference frequency = R&S FSQ center frequency

The power meter controls the frequency response of the source. Deduct the frequency response from the value displayed on the R&S FSQ.

MW range

Test setup:

As before

R&S FSQ settings:

[AMPT : RF ATT: 10 dB: REF LEVEL : -10 dBm]
[FREQ : CENTER : see table]

Measurement sequence:

- Center frequencies on the R&S FSQ

Only R&S FSQ 8	5 GHz
	6 GHz
	7.9 GHz
Only R&SFSQ26FSQ40	5 GHz
	12 GHz
	18 GHz
	26 GHz

- Frequencies on the transmitter
  R&S FSQ center -60MHz
  R&S FSQ center -40MHz
  R&S FSQ center -20MHz
  R&S FSQ center
  R&S FSQ center +20MHz
  R&S FSQ center +40MHz
  R&SFSQ center +60MHz
  R&S FSQ input level -15 dBm ±2 dB

Evaluation:

Reference frequency = R&S FSQ center frequency.

The power meter controls the frequency response of the source. Deduct the frequency response from the value displayed on the R&S FSQ.

1.10.4 Dynamic range

Test equipment:

Signal generator (2) 2 units

Power splitter (7)

50 Ω termination (9)

1.10.5 Spurious responses

Spurious with full-scale input signal

RF range

Test setup:

► Connect the RF output of the signal generator (2) to the RF input of the R&S FSQ.

R&SFSQ settings:

- [FREQ : CENTER : 1000 MHz]
- [AMPT : RF ATT: 10 dB: REF LEVEL : -5 dBm]

Measurement sequence:

- R&S FSQ input Frequency
- Level on transmitter

model 02

-5 dBm	990 MHz
	1000 MHz
	1025 MHz

model 12

5 dBm	960 MHz
	1005 MHz
	1030 MHz

Evaluation:

Use the FFT to determine the level difference between the largest spurious signal and the test signal within:

model 02 ±30 MHz

model 12 ±60 MHz

Exclude the signal at center frequency which is specified especially as IQ offset.

MW range

Test setup:

As before

R&S FSQ settings:

- [FREQ : CENTER : 4000 MHz]
- [AMPT : RF ATT: 10 dB: REF LEVEL : -5 dBm]

Measurement sequence:

R&S FSQ input Frequency
Level on transmitter

(+0/-1dB)

-5 dBm	3960 MHz
	4000 MHz
	4025 MHz
	4055 MHz

Evaluation:

Use the FFT to determine the level difference between the largest spurious signal and the test signal within ±60 MHz.

Exclude the signal at center frequency which is specified especially as IQ offset.

1.10.6 Spurious without input signal

RF range

Test setup:

As before, however RF OFF on the signal generator.

R&S FSQ settings:

- [FREQ : CENTER : 1000 MHz]
- [AMPT : RF ATT: 0 dB: REF LEVEL : -15 dBm]

Evaluation:

Use the FFT to determine the level of the largest spurious signal within:

model 02 ±30 MHz

model 12 ±60 MHz

Exclude the signal at center frequency which is specified especially as IQ offset.

Use averaging over 32 FFTs.

MW range

Test setup:

As before

R&S FSQ settings:

- [FREQ : CENTER : 4000 MHz]
- [AMPT : RF ATT: 0 dB:

model 02

- REF LEVEL : **-15 dBm**]

model 12

- REF LEVEL : **-10 dBm**]

Evaluation:

Use the FFT to determine the level of the largest spurious signal within ±60 MHz.

Exclude the signal at center frequency which is specified especially as IQ offset.

Use averaging over 32 FFTs.

1.10.7 Signal-to-noise ratio

Test setup:

► Connect the RF output of the signal generator (3) to the RF input of the R&S FSQ.

Signal generator settings

model 02

► Set the level so that -5 dBm (+0/-0.5dB) is present at the R&S FSQ input. Frequency 1000 MHz.

model 12

Set the level so that +5 dBm (+0/-0.5dB) is present at the R&S FSQ input. Frequency

- first measurement 1000 MHz
- second measurement 3500 MHz.

R&S FSQ settings:

model 02

- [FREQ : CENTER : 1000 MHz]
- [AMPT : RF ATT: 10 dB: REF LEVEL : -5 dBm]

model 12

first meas.: [FREQ : CENTER : 1000 MHz]
second meas.: [FREQ : CENTER : 3500 MHz]
[AMPT : RF ATT: 5 dB: REF LEVEL : +5 dBm]

Evaluation:

Measure noise using the FFT.

Use averaging over 64 FFTs. Read out averaged noise level at +5 MHz frequency. (Alternatively, average only one FFT and the frequency range from +3 MHz to +10 MHz.) Convert to 1 Hz bandwidth (using the FFT noise bandwidth).

Measure the test signal level at center frequency.

Calculate the logarithmic ratio between signal and noise level.

1.10.8 Third-order intermodulation

RF range

Test setup:

Connect the RF outputs of the two signal generators (2) using a power splitter to the RF input of the R&S FSQ.

R&S FSQ settings:

- [FREQ : CENTER : 1000 MHz]
- [AMPT : RF ATT: 10 dB: REF LEVEL : -4 dBm]

Measurement sequence:

R&S FSQ input level	Freq. on transmitter
2 x -10 dBm	995 MHz + 1005 MHz

Evaluation:

Determine the ratio of the intermodulation products to the test signals (f = ±15 MHz) using the FFT.

MW range

Test setup:

As before

R&S FSQ settings:

- [FREQ : CENTER : 4000 MHz]
- [AMPT : RF ATT: 10 dB: REF LEVEL : -4 dBm]

Measurement sequence:

R&S FSQ input level (+0 / -0.5 dB)	Freq. on transmitter
2 x -10 dBm	3990 MHz + 4010 MHz

Evaluation:

Use the FFT to determine the ratio of the intermodulation products to the test signals (f = ±30 MHz).

1.10.9 Noise floor

RF range

Test setup:

► Screw a 50 Ω termination to the R&S FSQ RF input.

R&S FSQ settings:

- [FREQ : CENTER : 1000 MHz]
- [AMPT : RF ATT: 0 dB:

model 02

REF LEVEL : **-30 dBm**]

model 12

REF LEVEL : **-20 dBm**]

Evaluation:

Measure noise using the FFT.

Average over 64 FFTs. Read out averaged noise level at +5 MHz frequency. (Alternatively, average only one FFT and the frequency range from +3 MHz to +10 MHz.) Convert to 1 Hz bandwidth (dBm/Hz) using the FFT noise bandwidth.

MW range

Test setup:

50 Ω termination at R&S FSQ RF input

or signal generator with RF Off

R&S FSQ settings:

- [FREQ : CENTER : 5000 MHz]
- [AMPT : RF ATT: 0 dB:

model 02

REF LEVEL : **-30 dBm**]

model 12

REF LEVEL : **-20 dBm**]

Evaluation:

Measuring noise via FFT.

Averaging over 64 FFTs. Read out averaged noise level at +5 MHz frequency. (Alternatively, average only one FFT and the frequency range from +3 MHz to +10 MHz.) Convert to 1 Hz bandwidth (dBm/Hz) using the FFT noise bandwidth.

1.11 Test Procedure for Option Digital Baseband Interface R&S FSQ-B17

► Interconnect both connectors of option R&S FSQ-B17 (IQ DATA I/O) with MDR cable (e.g. R&S Order No. 1130.1302.00).

► Enter service password
- [SETUP: SERVICE: ENTER PASSWORD: 894129 ENTER]

► Enter service function
[SETUP: SERVICE FUNCTIONS: 2.39.10.2.1 : ENTER]

► Disable service password
[SETUP: SERVICE: ENTER PASSWORD: 0 ENTER]

► Start selftest procedure
[SETUP: SERVICE: SELFTEST]

- Check selftest status
  [SELFTEST RESULTS]: check status = passed
- The R&S R&S FSQ-B17 self test result is listed at the end of test block "wideband detector board VSA tests":
  without option R&S R&S FSQ-B100: Det LVDS loopback 1 PASSED
  with option R&S R&S FSQ-B100: B100 LVDS loopback 1 PASSED

1.12 Performance Test Report R&S FSQ

ROHDE & SCHWARZ	Performance Test Report	Signal Analyzer R&S FSQ	Version 11-06-07
Model R&S FSQ 3 / R&S FSQ 8 /R&S FSQ 26 / R&S FSQ 40): Order number: Serial number: Test person: Date: Signature:			

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency accuracy Reference oscillator	Page 17					
Model w/o Opt. B4		9.999999	________	10.000001	MHz	
Model with Opt. B4		9.9999997	________	10.0000003	MHz	
Image frequency rejection,1st IF, f_{in}	Page 20					
11 MHz		90	________	-	dB	
101 MHz		90	________	-	dB	
1701 MHz		90	________	-	dB	
3001 MHz		90	________	-	dB	
Image frequency rejection 2nd IF, f_{in} **f_{in} + 808.8 MHz** ***) f_{in} – 808.8 MHz:** 101 MHz	Page 20	90	________	-	dB	
8 / 26 / 40:						
3700 MHz		70	________	-	dB	
5000 MHz		70	________	-	dB	
7999 MHz		70	________	-	dB	
R&S FSQ 26 / 40: 26000 MHz *)		70	________	-	dB	
R&S FSQ 40: 35000 MHz		70	________	-	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Image frequency rejection 3rd IF, f_{in}	Page 20					
R&S FSQ						
101 MHz		90	________	-	dB	
R&S FSQ 8 / 26 / 40:						
4500 MHz		70	________	-	dB	
R&S FSQ:						
2000 MHz		70	________	-	dB	
1st IF rejection f_{in}	Page 21					
11 MHz		90	________	-	dB	
101 MHz		90	________	-	dB	
1701 MHz		90	________	-	dB	
2990 MHz		90	________	-	dB	
2nd IF rejection f_{in}	Page 21					
R&S FSQ:						
101 MHz		90	________	-	dB	
R&S FSQ 8 / 26 / 40:						
4500 MHz		70	________	-	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
3rd-order intercept point, f_{in}	Page 22					
R&S FSQ 3 /8:						
28 MHz		17	________	-	dBm	
106 MHz		17	________	-	dBm	
261 MHz		17	________	-	dBm	
640 MHz		20	________	-	dBm	
1000 MHz		20	________	-	dBm	
1700 MHz		20	________	-	dBm	
2500 MHz		20	________	-	dBm	
3590 MHz		20	________	-	dBm	
R&S FSQ 8:						
4001 MHz		18	________	-	dBm	
5001 MHz		18	________	-	dBm	
7999 MHz		18	________	-	dBm	
R&S FSQ 26 / 40:						
28 MHz		17	________	-	dBm	
106 MHz		17	________	-	dBm	
261 MHz		17	________	-	dBm	
640 MHz		22	________	-	dBm	
1000 MHz		22	________	-	dBm	
1700 MHz		22	________	-	dBm	
2500 MHz		22	________	-	dBm	
3590 MHz		22	________	-	dBm	
4001 MHz		12	________	-	dBm	
5001 MHz		12	________	-	dBm	
7999 MHz		12	________	-	dBm	
12000 MHz		12	________	-	dBm	
20000 MHz		12	________	-	dBm	
26000 MHz		12	________	-	dBm	
R&S FSQ 40:						
32000 MHz		12	________	-	dBm	
38000 MHz		12	________	-	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
2nd-order harmonic distortion, f_{in} :	Page 23					
28 MHz		35	________	-	dBm	
106 MHz		35	________	-	dBm	
261 MHz		45	________	-	dBm	
640 MHz		45	________	-	dBm	
1000 MHz		45	________	-	dBm	
1700 MHz		35	________	-	dBm	
with option 88 additional:						
900 MHz		55	________	-	dBm	
IF bandwidth switch. level accuracy	Page 25					
100 Hz		-0.1	________	+0.1	dB	
1 kHz		-0.1	________	+0.1	dB	
10 kHz		-	reference	-		
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		-0.5	________	+0.5	dB	
20 MHz		-0.5	________	+0.5	dB	
50 MHz		-0.5	________	+0.5	dB	
FFT Bandwidth level accuracy	Page 25					
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	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
IF bandwidth	Page 26					
Bandwidth:						
100 Hz		97	________	103	Hz	
1 kHz		970	________	1030	Hz	
10 kHz		9.7	________	10.3	kHz	
100 kHz		97	________	103	kHz	
300 kHz		270	________	330	kHz	
1 MHz		900	________	1100	kHz	
3 MHz		2.7	________	3.3	MHz	
10 MHz		7	________	11	MHz	
20 MHz		14	________	22	MHz	
50 MHz		35	________	55	MHz	
IF Bandwidths	Page 27					
Shape factor:						
100 Hz		-	________	6	-	
1 kHz		-	________	6	-	
10 kHz		-	________	6	-	
100 kHz		-	________	6	-	
300 kHz		-	________	12	-	
1 MHz		-	________	12	-	
3 MHz		-	________	7	-	
10 MHz		-	________	7	-	
Noise Display	Page 27					
normalized to 1Hz: [7]						
f_{noise}:						
20 Hz		-	________	-90	dBm	
90 Hz		-	________	-110	dBm	
900 Hz		-	________	-120	dBm	

[7] Noise Display with option FSU-B24 installed see performance test report of FSU-B24

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1Hz: [8] f_{noise}:	Page 27					
R&S FSQ3 / 8:						
9 kHz		-	________	–130	dBm	
95 kHz		-	________	–136	dBm	
999 kHz		-	________	–146	dBm	
9.99 MHz		-	________	–155	dBm	
19.99 MHz		-	________	–155	dBm	
49.99 MHz		-	________	–155	dBm	
99.99 MHz		-	________	–155	dBm	
199.9 MHz		-	________	–155	dBm	
499.9 MHz		-	________	–155	dBm	
999.9 MHz		-	________	–155	dBm	
1499 MHz		-	________	–155	dBm	
1999 MHz		-	________	–155	dBm	
2499 MHz		-	________	–153	dBm	
2999 MHz		-	________	–153	dBm	
3599 MHz		-	________	–152	dBm	

[8] Noise Display with option FSU-B24 installed see performance test report of FSU-B24

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1Hz: [4]	Page 27					
f_{noise}:						
R&S FSQ 8:						
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	
7499 MHz		-	________	– 149	dBm	
7999 MHz		-	________	– 149	dBm	
Noise Display normalized to 1 Hz: [9]	Page 27					
f_{noise}:						
R&S FSQ 26 / 40:						
9 kHz		-	________	–130	dBm	
95 kHz		-	________	–136	dBm	
999 kHz		-	________	–146	dBm	
9.99 MHz		-	________	–153	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	
3599 MHz		-	________	–150	dBm	

[9] Noise Display with option FSU-B24 installed see performance test report of FSU-B24

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1Hz: [10] f_{noise}:	Page 27					
R&S FSQ 26:						
3601 MHz		-	________	–151	dBm	
6999 MHz		-	________	–151	dBm	
9999 MHz		-	________	–149	dBm	
12999 MHz		-	________	–149	dBm	
17999 MHz		-	________	–147	dBm	
21999 MHz		-	________	–145	dBm	
26499 MHz		-	________	–143	dBm	
Noise Display normalized to 1Hz: [5] f_{noise}:	Page 27					
R&S FSQ 40:						
3601 MHz		-	________	–150	dBm	
6999 MHz		-	________	–150	dBm	
9999 MHz		-	________	–148	dBm	
12999 MHz		-	________	–148	dBm	
17999 MHz		-	________	–148	dBm	
21999 MHz		-	________	–148	dBm	
26499 MHz		-	________	–144	dBm	
26799 MHz		-	________	–138	dBm	
30999 MHz		-	________	–138	dBm	
34999 MHz		-	________	–138	dBm	
38999 MHz		-	________	–138	dBm	
39999 MHz		-	________	–138	dBm	
Level accuracy at 128 MHz. –30 dBm	Page 29	-0.2	________	+0.2	dB	

[10] Noise Display with option FSU-B24 installed see performance test report of FSU-B24

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response RF Attenuation 10 dB DC coupling **R&S FSQ :** f_{fresp}	Page 29					
1 MHz		-0.5	________	+0.5	dB	
10 MHz		-0.3	________	+0.3	dB	
50 MHz		-0.3	________	+0.3	dB	
100 MHz		-0.3	________	+0.3	dB	
200 MHz		-0.3	________	+0.3	dB	
300 MHz		-0.3	________	+0.3	dB	
400 MHz		-0.3	________	+0.3	dB	
500 MHz		-0.3	________	+0.3	dB	
600 MHz		-0.3	________	+0.3	dB	
700 MHz		-0.3	________	+0.3	dB	
800 MHz		-0.3	________	+0.3	dB	
900 MHz		-0.3	________	+0.3	dB	
1000 MHz		-0.3	________	+0.3	dB	
1500 MHz		-0.3	________	+0.3	dB	
2000 MHz		-0.3	________	+0.3	dB	
2500 MHz		-0.3	________	+0.3	dB	
3000 MHz		-0.3	________	+0.3	dB	
3599 MHz		-0.3	________	+0.3	dB	
Frequency response RF Attenuation 10 dB DC coupling YIG filter = ON **R&S FSQ 8 / 26 / 40:** f_{resp}	Page 29					
3610 MHz		-1.5	________	+1.5	dB	
4000 MHz		-1.5	________	+1.5	dB	
4500 MHz		-1.5	________	+1.5	dB	
5000 MHz		-1.5	________	+1.5	dB	
5500 MHz		-1.5	________	+1.5	dB	
6000 MHz		-1.5	________	+1.5	dB	
6500 MHz		-1.5	________	+1.5	dB	
7000 MHz		-1.5	________	+1.5	dB	
7990 MHz		-2	________	+2	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response RF Attenuation 10 dB DC coupling YIG filter = ON **R&S FSQ 26 / 40:** f_{resp} 9000 MHz 10000 MHz 11000 MHz 12000 MHz 13000 MHz 14000 MHz 15000 MHz 16000 MHz 17000 MHz 18000 MHz 19000 MHz 20000 MHz 21000 MHz 22000 MHz 23000 MHz 24000 MHz 25000 MHz 26000 MHz	Page 29	-2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2.5 -2.5 -2.5 -2.5	________ ________ ________ ________ ________ ________ ________ ________ ________ ________ ________ ________ ________ ________ ________ ________ ________ ________	+2 +2 +2 +2 +2 +2 +2 +2 +2 +2 +2 +2 +2 +2 +2.5 +2.5 +2.5 +2.5	dB dB dB dB dB dB dB dB dB 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 DC coupling YIG filter = ON **R&S FSQ 40:**	Page 29					
f_{resp}						
27000 MHz		-2.5	________	+2.5	dB	
28000 MHz		-2.5	________	+2.5	dB	
29000 MHz		-2.5	________	+2.5	dB	
30000 MHz		-2.5	________	+2.5	dB	
31000 MHz		-2.5	________	+2.5	dB	
32000 MHz		-2.5	________	+2.5	dB	
33000 MHz		-2.5	________	+2.5	dB	
34000 MHz		-2.5	________	+2.5	dB	
35000 MHz		-2.5	________	+2.5	dB	
36000 MHz		-2.5	________	+2.5	dB	
37000 MHz		-2.5	________	+2.5	dB	
38000 MHz		-2.5	________	+2.5	dB	
39000 MHz		-2.5	________	+2.5	dB	
39999 MHz		-2.5	________	+2.5	dB	
Frequency response RF attenuation 10 dB AC coupling **Not with R&S FSQ 40**	Page 29					
f_{fresp}						
10 MHz		-0.3	________	+0.3	dB	
50 MHz		-0.3	________	+0.3	dB	
100 MHz		-0.3	________	+0.3	dB	
200 MHz		-0.3	________	+0.3	dB	
500 MHz		-0.3	________	+0.3	dB	
1000 MHz		-0.3	________	+0.3	dB	
1500 MHz		-0.3	________	+0.3	dB	
2000 MHz		-0.3	________	+0.3	dB	
2500 MHz		-0.3	________	+0.3	dB	
3000 MHz		-0.3	________	+0.3	dB	
3599 MHz		-0.3	________	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response RF attenuation 5 dB DC coupling	Page 29					
f_{resp}						
10 MHz		-0.3	________	+0.3	dB	
50 MHz		-0.3	________	+0.3	dB	
100 MHz		-0.3	________	+0.3	dB	
200 MHz		-0.3	________	+0.3	dB	
500 MHz		-0.3	________	+0.3	dB	
1000 MHz		-0.3	________	+0.3	dB	
1500 MHz		-0.3	________	+0.3	dB	
2000 MHz		-0.3	________	+0.3	dB	
2500 MHz		-0.3	________	+0.3	dB	
3000 MHz		-0.3	________	+0.3	dB	
3599 MHz		-0.3	________	+0.3	dB	
Frequency response RF attenuation 20 dB DC coupling	Page 29					
f_{resp}						
10 MHz		-0.3	________	+0.3	dB	
50 MHz		-0.3	________	+0.3	dB	
100 MHz		-0.3	________	+0.3	dB	
200 MHz		-0.3	________	+0.3	dB	
500 MHz		-0.3	________	+0.3	dB	
1000 MHz		-0.3	________	+0.3	dB	
1500 MHz		-0.3	________	+0.3	dB	
2000 MHz		-0.3	________	+0.3	dB	
2500 MHz		-0.3	________	+0.3	dB	
3000 MHz		-0.3	________	+0.3	dB	
3599 MHz		-0.3	________	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response RF attenuation 40 dB DC coupling	Page 29					
f_{fresp}						
10 MHz		-0.3	________	+0.3	dB	
50 MHz		-0.3	________	+0.3	dB	
100 MHz		-0.3	________	+0.3	dB	
200 MHz		-0.3	________	+0.3	dB	
500 MHz		-0.3	________	+0.3	dB	
1000 MHz		-0.3	________	+0.3	dB	
1500 MHz		-0.3	________	+0.3	dB	
2000 MHz		-0.3	________	+0.3	dB	
2500 MHz		-0.3	________	+0.3	dB	
3000 MHz		-0.3	________	+0.3	dB	
3599 MHz		-0.3	________	+0.3	dB	
Frequency response RF Attenuation 10 dB DC coupling YIG filter = OFF	Page 29					
R&S FSQ 8 / 26 / 40:						
f_{resp}						
3610 MHz		-1	________	+1	dB	
4000 MHz		-1	________	+1	dB	
4500 MHz		-1	________	+1	dB	
5000 MHz		-1	________	+1	dB	
5500 MHz		-1	________	+1	dB	
6000 MHz		-1	________	+1	dB	
6500 MHz		-1	________	+1	dB	
7000 MHz		-1	________	+1	dB	
7990 MHz		-1.5	________	+1.5	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response RF Attenuation 10 dB DC coupling YIG filter = OFF	Page 29					
R&S FSQ 26 / 40:						
f_{resp}						
9000 MHz		-1.5	________	+1.5	dB	
10000 MHz		-1.5	________	+1.5	dB	
11000 MHz		-1.5	________	+1.5	dB	
12000 MHz		-1.5	________	+1.5	dB	
13000 MHz		-1.5	________	+1.5	dB	
14000 MHz		-1.5	________	+1.5	dB	
15000 MHz		-1.5	________	+1.5	dB	
16000 MHz		-1.5	________	+1.5	dB	
17000 MHz		-1.5	________	+1.5	dB	
18000 MHz		-1.5	________	+1.5	dB	
19000 MHz		-1.5	________	+1.5	dB	
20000 MHz		-1.5	________	+1.5	dB	
21000 MHz		-1.5	________	+1.5	dB	
22000 MHz		-1.5	________	+1.5	dB	
23000 MHz		-1.5	________	+1.5	dB	
24000 MHz		-1.5	________	+1.5	dB	
25000 MHz		-1.5	________	+1.5	dB	
26000 MHz		-1.5	________	+1.5	dB	
R&S FSQ 40:						
f_{resp}						
27000 MHz		-1.5	________	+1.5	dB	
28000 MHz		-1.5	________	+1.5	dB	
29000 MHz		-1.5	________	+1.5	dB	
30000 MHz		-1.5	________	+1.5	dB	
31000 MHz		-1.5	________	+1.5	dB	
32000 MHz		-1.5	________	+1.5	dB	
33000 MHz		-1.5	________	+1.5	dB	
34000 MHz		-1.5	________	+1.5	dB	
35000 MHz		-1.5	________	+1.5	dB	
36000 MHz		-1.5	________	+1.5	dB	
37000 MHz		-1.5	________	+1.5	dB	
38000 MHz		-1.5	________	+1.5	dB	
39000 MHz		-1.5	________	+1.5	dB	
39999 MHz		-1.5	________	+1.5	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Display linearity RBW 500 Hz	Page 34					
a_{ATT}:						
10 dB		9.9	________	10.1	dB	
15 dB		4.9	________	5.1	dB	
20 dB		-	reference	-	-	
25 dB		-5.1	________	-4.9	dB	
30 dB		- 10.1	________	-9.9	dB	
35 dB		-15.1	________	-14.9	dB	
40 dB		-20.1	________	-19.9	dB	
45 dB		-25.1	________	-24.9	dB	
50 dB		-30.1	________	-29.9	dB	
55 dB		-35.1	________	-34.9	dB	
60 dB		-40.1	________	-39.9	dB	
65 dB		-45.1	________	-44.9	dB	
70 dB		-50.1	________	-49.9	dB	
75 dB		-55.1	________	-54.9	dB	
80 dB		-60.1	________	-59.9	dB	
85 dB		-65.3	________	-64.7	dB	
90 dB		-70.3	________	-69.7	dB	
95 dB		-75.3	________	-74.7	dB	
100 dB		-80.3	________	-79.7	dB	
Display linearity RBW 300 kHz	Page 34					
a_{ATT}:						
10 dB		9.8	________	10.2	dB	
15 dB		4.8	________	5.2	dB	
20 dB		-	reference	-	-	
25 dB		-5.2	________	-4.8	dB	
30 dB		- 10.2	________	-9.8	dB	
35 dB		-15.2	________	-14.8	dB	
40 dB		-20.2	________	-19.8	dB	
45 dB		-25.2	________	-24.8	dB	
50 dB		-30.2	________	-29.8	dB	
55 dB		-35.2	________	-34.8	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	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Display linearity	Page 34					
RBW 20 MHz						
a_{ATT} :						
10 dB		9.5	________	10.5	dB	
15 dB		4.5	________	5.5	dB	
20 dB		-	reference	-	-	
25 dB		-5.5	________	-4.5	dB	
30 dB		– 10.5	________	-9.5	dB	
35 dB		-15.5	________	-14.5	dB	
40 dB		-20.5	________	-19.5	dB	
45 dB		-25.5	________	-24.5	dB	
50 dB		-30.5	________	-29.5	dB	
55 dB		-35.5	________	-34.5	dB	
60 dB		-40.5	________	-39.5	dB	
Attenuator accuracy	Page 38					
a_{ATT} :						
0 dB		-9.8	________	-10.2	dB	
5 dB		-4.8	________	-5.2	dB	
10 dB		-	reference	-	-	
20 dB		+9.8	________	+10.2	dB	
40 dB		+29.8	________	+30.2	dB	
Reference level switching accuracy	Page 43					
Reference level						
0 dBm		+9,85	________	+10,15	dB	
-10 dBm		-	reference	-	-	
-20 dBm		-10.15	________	-9,85	dB	
-30 dBm		-20.15	________	-19,85	dB	
-40 dBm		-30.15	________	-29,85	dB	
-50 dBm		-40.15	________	-39,85	dB	
-11 dBm		-1.15	________	-0,85	dB	
-12 dBm		-2.15	________	-1,85	dB	
-13 dBm		-3.15	________	-2,85	dB	
-14 dBm		-4.15	________	-3,85	dB	
-15 dBm		-5.15	________	-4,85	dB	
-16 dBm		-6.15	________	-5,85	dB	
-17 dBm		-7.15	________	-6,85	dB	
-18 dBm		-8.15	________	-7,85	dB	
-19 dBm		-9.15	________	-8,85	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Phase noise for instruments with serial numbers smaller than 200000	Page 46					
Offset frequency:						
100 Hz		-	________	-90	dBc (1Hz)	
1 kHz		-	________	-112	dBc (1Hz)	
10 kHz		-	________	-120	dBc (1Hz)	
100 kHz		-	________	-120	dBc (1Hz)	
1 MHz		-	________	-138	dBc (1Hz)	
Phase noise at 639 MHz or 640 MHz for instruments with serial number larger than 200000	Page 50					
Offset:						
100 Hz		-	________	-98	dBc (1Hz)	
1 kHz		-	________	-116	dBc (1Hz)	
10 kHz		-	________	-128	dBc (1Hz)	
100 kHz		-	________	-128	dBc (1Hz)	
1 MHz		-	________	-140	dBc (1Hz)	
Phase noise testing at 800 MHz for instruments with a serial number larger than 200000	Page 52					
Offset:						
100 Hz		-	________	-98	dBc (1Hz)	
1 kHz		-	________	-116	dBc (1Hz)	
10 kHz		-	________	-128	dBc (1Hz)	
100 kHz		-	________	-128	dBc (1Hz)	
1 MHz		-	________	-140	dBc (1Hz)	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Return Loss RF input RF att 10 dB / DC f_{in}	Page 54					
R&S FSQ 3 / 8:						
10 MHz		14	________	-	dB	
250 MHz		14	________	-	dB	
500 MHz		14	________	-	dB	
750 MHz		14	________	-	dB	
1000 MHz		14	________	-	dB	
1250 MHz		14	________	-	dB	
1500 MHz		14	________	-	dB	
1750 MHz		14	________	-	dB	
2000 MHz		14	________	-	dB	
2250 MHz		14	________	-	dB	
2500 MHz		14	________	-	dB	
2750 MHz		14	________	-	dB	
3000 MHz		14	________	-	dB	
3250 MHz		14	________	-	dB	
3500 MHz		14	________	-	dB	
R&S FSQ 8:						
3750 MHz		9,5	________	-	dB	
4000 MHz		9,5	________	-	dB	
4250 MHz		9,5	________	-	dB	
4500 MHz		9,5	________	-	dB	
4750 MHz		9,5	________	-	dB	
5000 MHz		9,5	________	-	dB	
5500 MHz		9,5	________	-	dB	
6000 MHz		9,5	________	-	dB	
6500 MHz		9,5	________	-	dB	
7000 MHz		9,5	________	-	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
R&S FSQ 26 / 40:						
10 MHz		14	________	-	dB	
250 MHz		14	________	-	dB	
500 MHz		14	________	-	dB	
750 MHz		14	________	-	dB	
1000 MHz		14	________	-	dB	
1250 MHz		14	________	-	dB	
1500 MHz		14	________	-	dB	
1750 MHz		14	________	-	dB	
2000 MHz		14	________	-	dB	
2250 MHz		14	________	-	dB	
2500 MHz		14	________	-	dB	
2750 MHz		14	________	-	dB	
3000 MHz		14	________	-	dB	
3250 MHz		14	________	-	dB	
3500 MHz		14	________	-	dB	
4000 MHz		10.5	________	-	dB	
6000 MHz		10.5	________	-	dB	
8000 MHz		10.5	________	-	dB	
10000 MHz		10.5	________	-	dB	
12000 MHz		10.5	________	-	dB	
14000 MHz		10.5	________	-	dB	
16000 MHz		10.5	________	-	dB	
18000 MHz		9,5	________	-	dB	
20000 MHz		9,5	________	-	dB	
22000 MHz		9,5	________	-	dB	
24000 MHz		9,5	________	-	dB	
26000 MHz		9,5	________	-	dB	
R&S FSQ 40:						
28000 MHz		7,5	________	-	dB	
30000 MHz		7,5	________	-	dB	
32000 MHz		7,5	________	-	dB	
34000 MHz		7,5	________	-	dB	
36000 MHz		7,5	________	-	dB	
38000 MHz		7,5	________	-	dB	
40000 MHz		7,5	________	-	dB	
Frequency response IQ-path f_{fresp} 120 MHz 136 MHz	Page 55	 -0.3 -0.3	 ________ ________	 +0.3 +0.3	 dB dB	

1.13 Performance Test Report Option R&S FSU-B9

ROHDE & SCHWARZ	Performance Test Report	Option B9	Version 11-06-07
Serial number: Option B12 installed: yes / no Test person: Date: Signature:			

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Level accuracy of the output level at 128 MHz:	Page 57					
Without option B12						
0 dBm		- 1	________	+ 1	dBm	
- 5 dBm		- 6	________	- 4	dBm	
-10 dBm		- 11	________	- 9	dBm	
-15 dBm		- 16	________	- 14	dBm	
-20 dBm		– 21	________	- 19	dBm	
With option B12						
0 dBm		– 1	________	+ 1	dBm	
-10 dBm		– 11	________	– 9	dBm	
-20 dBm		– 21	________	– 19	dBm	
-40 dBm		– 41	________	– 39	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response Tracking generator 100 kHz to 3.6 GHz output level, referenced to 128 MHz:	Page 58					
Without option B12						
0 dBm		- 3	________	+ 3	dB	
- 5 dBm		– 3	________	+ 3	dB	
– 10 dBm		– 3	_______	+ 3	dB	
– 15 dBm		– 3	________	+ 3	dB	
– 20 dBm		– 3	________	+ 3	dB	
With option B12						
0 dBm		- 4	________	+ 4	dB	
-10 dBm		– 4	________	+ 4	dB	
-20 dBm		– 4	________	+ 4	dB	
-40 dBm		– 4	________	+ 4	dB	
Dynamic range Tracking generator at 128 MHz:	Page 62					
reference level		- 1	________	+ 1	dBm	
isolation		-	________	- 100	dBc	
Checking modulation Tracking generator I/Q modulation +90 ° output level:	Page 59					
Signal 1001 MHz		- 3	________	+ 3	dBm	
residual carrier		-	________	- 30	dBc	
sideband 999 MHz		-	________	- 30	dBc	
I/Q modulation -90 ° output level:						
Signal 999 MHz		- 3	________	+ 3	dBm	
residual carrier		-	________	- 30	dBc	
sideband 1001 MHz		-	________	- 30	dBc	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Checking Modulation	Page 61					
Tracking generator						
AM modulation						
Carrier level		- 3	________	+ 3	dBm	
Sgnl spacing 1001 MHz		- 8	________	- 4	dBc	
Signal spacing 999 MHz		- 8	________	- 4	dBc	
Checking modulation	Page 62					
Tracking generator						
FM modulation						
Carrier level		- 5	________	+ 1	dBm	
Sgnl spcng 1000.1 MHz		- 5	________	- 3	dBc	
Sgnl spcng 999.9 MHz		- 5	________	- 3	dBc	

1.14 Performance Test Report Option R&S FSU-B24

ROHDE & SCHWARZ	Performance Test Report	Option R&S FSU-B24	Version 11-06-07
Serial number: Test person: Date: Signature:			

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1 Hz preamplifier = OFF f_{noise}	Page 64					
R&S FSQ 26/40:						
20 Hz		-	________	-90	dBm	
90 Hz		-	________	-110	dBm	
900 Hz		-	________	-120	dBm	
9 kHz		-	________	–130	dBm	
95 kHz		-	________	–130	dBm	
999 kHz		-	________	–140	dBm	
9.99 MHz		-	________	–150	dBm	
19.99 MHz		-	________	–151	dBm	
49.99 MHz		-	________	–151	dBm	
99.99 MHz		-	________	–151	dBm	
199.9 MHz		-	________	–151	dBm	
499.9 MHz		-	________	–151	dBm	
999.9 MHz		-	________	–151	dBm	
1499 MHz		-	________	–151	dBm	
1999 MHz		-	________	–151	dBm	
2499 MHz		-	________	–149	dBm	
2999 MHz		-	________	–149	dBm	
3599 MHz		-	________	–149	dBm	
3601 MHz		-	________	–147	dBm	
6999 MHz		-	________	–147	dBm	
9999 MHz		-	________	–145	dBm	
12999 MHz		-	________	–145	dBm	
17999 MHz		-	________	-144	dBm	
21999 MHz		-	________	-142	dBm	
26499 MHz		-	________	-138	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1 Hz preamplifier = OFF f_{noise}	Page 64					
R&S FSQ 40:						
26799 MHz		-	________	-131	dBm	
30999 MHz		-	________	-131	dBm	
34999 MHz		-	________	-129	dBm	
38999 MHz		-	________	-129	dBm	
39999 MHz		-	________	-129	dBm	
Noise Display normalized to 1 Hz preamplifier = ON YIG filter = ON f_{noise}	Page 64					
R&S FSQ 26/40						
101 kHz		-	________	–140	dBm	
999 kHz		-	________	–150	dBm	
9.99 MHz		-	________	–161	dBm	
19.99 MHz		-	________	–163	dBm	
49.99 MHz		-	________	–163	dBm	
99.99 MHz		-	________	–163	dBm	
199.9 MHz		-	________	–163	dBm	
499.9 MHz		-	________	–163	dBm	
999.9 MHz		-	________	–163	dBm	
1499 MHz		-	________	–163	dBm	
1999 MHz		-	________	–163	dBm	
2499 MHz		-	________	–161	dBm	
2999 MHz		-	________	–161	dBm	
3599 MHz		-	________	–161	dBm	
3601 MHz		-	________	–162	dBm	
6999 MHz		-	________	–162	dBm	
9999 MHz		-	________	–162	dBm	
12999 MHz		-	________	–162	dBm	
17999 MHz		-	________	–162	dBm	
21999 MHz		-	________	–162	dBm	
26499 MHz		-	________	–162	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1 Hz preamplifier = ON YIG filter = ON f_{noise} **R&S FSQ 40:**	Page 64					
26799 MHz		-	________	-160	dBm	
30999 MHz		-	________	-160	dBm	
34999 MHz		-	________	-158	dBm	
38999 MHz		-	________	-158	dBm	
39999 MHz		-	________	-158	dBm	
Noise Display normalized to 1 Hz preamplifier = ON YIG filter = OFF f_{noise} **R&S FSQ 26/40:**	Page 64					
3601 MHz		-	________	–160	dBm	
6999 MHz		-	________	–160	dBm	
9999 MHz		-	________	–160	dBm	
12999 MHz		-	________	–160	dBm	
17999 MHz		-	________	–160	dBm	
21999 MHz		-	________	–160	dBm	
26499 MHz		-	________	–157	dBm	
Noise Display normalized to 1 Hz preamplifier = ON YIG filter = OFF f_{noise} **R&S FSQ 40:**	Page 64					
26799 MHz		-	________	-156	dBm	
30999 MHz		-	________	-156	dBm	
34999 MHz		-	________	-153	dBm	
38999 MHz		-	________	-153	dBm	
39999 MHz		-	________	-153	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Level accuracy RF input 1 at 128 MHz. –30 dBm preamplifier = ON	Page 65	-0.3	________	+0.3	dB	
Frequency response <3.6 GHz RF Attenuation 10 dB DC coupling preamplifier = ON f_{fresp} **R&S FSQ 26/40:**	Page 65					
100 kHz		-0.8	________	+0.8	dB	
1 MHz		-0.8	________	+0.8	dB	
10 MHz		-0.6	________	+0.6	dB	
50 MHz		-0.6	________	+0.6	dB	
100 MHz		-0.6	________	+0.6	dB	
200 MHz		-0.6	________	+0.6	dB	
300 MHz		-0.6	________	+0.6	dB	
400 MHz		-0.6	________	+0.6	dB	
500 MHz		-0.6	________	+0.6	dB	
600 MHz		-0.6	________	+0.6	dB	
700 MHz		-0.6	________	+0.6	dB	
800 MHz		-0.6	________	+0.6	dB	
900 MHz		-0.6	________	+0.6	dB	
1000 MHz		-0.6	________	+0.6	dB	
1500 MHz		-0.6	________	+0.6	dB	
2000 MHz		-0.6	________	+0.6	dB	
2500 MHz		-0.6	________	+0.6	dB	
3000 MHz		-0.6	________	+0.6	dB	
3599 MHz		-0.6	________	+0.6	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response >3.6 GHz RF Attenuation 10 dB DC coupling preamplifier = ON YIG filter = ON	Page 65					
f_{fresp}						
R&S FSQ 26/40:						
3610 MHz		-2.0	________	+2.0	dB	
4000 MHz		-2.0	________	+2.0	dB	
4500 MHz		-2.0	________	+2.0	dB	
5000 MHz		-2.0	________	+2.0	dB	
5500 MHz		-2.0	________	+2.0	dB	
6000 MHz		-2.0	________	+2.0	dB	
6500 MHz		-2.0	________	+2.0	dB	
7000 MHz		-2.0	________	+2.0	dB	
7500 MHz		-2.0	________	+2.0	dB	
7990MHz		-2.0	________	+2.0	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	
14000 MHz		-2.5	________	+2.5	dB	
15000 MHz		-2.5	________	+2.5	dB	
16000 MHz		-2.5	________	+2.5	dB	
17000 MHz		-2.5	________	+2.5	dB	
18000 MHz		-2.5	________	+2.5	dB	
19000 MHz		-2.5	________	+2.5	dB	
20000 MHz		-2.5	________	+2.5	dB	
21000 MHz		-2.5	________	+2.5	dB	
21990 MHz		-2.5	________	+2.5	dB	
23000 MHz		-3.0	________	+3.0	dB	
24000 MHz		-3.0	________	+3.0	dB	
25000 MHz		-3.0	________	+3.0	dB	
26000 MHz		-3.0	________	+3.0	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response >3.6 GHz RF Attenuation 10 dB DC coupling preamplifier = ON YIG filter = ON						
f_{fresp}						
R&S FSQ 40:						
27000 MHz		-3.0	________	+3.0	dB	
28000 MHz		-3.0	________	+3.0	dB	
29000 MHz		-3.0	________	+3.0	dB	
30000 MHz		-3.0	________	+3.0	dB	
31000 MHz		-3.0	________	+3.0	dB	
32000 MHz		-3.0	________	+3.0	dB	
33000 MHz		-3.0	________	+3.0	dB	
34000 MHz		-3.0	________	+3.0	dB	
35000 MHz		-3.0	________	+3.0	dB	
36000 MHz		-3.0	________	+3.0	dB	
37000 MHz		-3.0	________	+3.0	dB	
38000 MHz		-3.0	________	+3.0	dB	
39000 MHz		-3.0	________	+3.0	dB	
39999 MHz		-3.0	________	+3.0	dB	
Frequency response >3.6 GHz RF Attenuation 10 dB DC coupling preamplifier = ON YIG filter = OFF	Page 69					
f_{fresp}						
R&S FSQ 26/40:						
3610 MHz		-1.5	________	+1.5	dB	
4000 MHz		-1.5	________	+1.5	dB	
4500 MHz		-1.5	________	+1.5	dB	
5000 MHz		-1.5	________	+1.5	dB	
5500 MHz		-1.5	________	+1.5	dB	
6000 MHz		-1.50	________	+1.5	dB	
6500 MHz		-1.5	________	+1.5	dB	
7000 MHz		-1.5	________	+1.5	dB	
7500 MHz		-1.5	________	+1.5	dB	
7990MHz		-1.5	________	+1.5	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
9000 MHz		-2	________	+2	dB	
10000 MHz		-2	________	+2	dB	
11000 MHz		-2	________	+2	dB	
12000 MHz		-2	________	+2	dB	
13000 MHz		-2	________	+2	dB	
14000 MHz		-2	________	+2	dB	
15000 MHz		-2	________	+2	dB	
16000 MHz		-2	________	+2	dB	
17000 MHz		-2	________	+2	dB	
18000 MHz		-2	________	+2	dB	
19000 MHz		-2	________	+2	dB	
20000 MHz		-2	________	+2	dB	
21000 MHz		-2	________	+2	dB	
21990 MHz		-2	________	+2	dB	
23000 MHz		-2.5	________	+2.5	dB	
24000 MHz		-2.5	________	+2.5	dB	
25000 MHz		-2.5	________	+2.5	dB	
26000 MHz		-2.5	________	+2.5	dB	
Frequency response >3.6 GHz RF Attenuation 10 dB DC coupling preamplifier = ON YIG filter = OFF						
f_{fresp}						
R&S FSQ 40:						
27000 MHz		-2.5	________	+2.5	dB	
28000 MHz		-2.5	________	+2.5	dB	
29000 MHz		-2.5	________	+2.5	dB	
30000 MHz		-2.5	________	+2.5	dB	
31000 MHz		-2.5	________	+2.5	dB	
32000 MHz		-2.5	________	+2.5	dB	
33000 MHz		-2.5	________	+2.5	dB	
34000 MHz		-2.5	________	+2.5	dB	
35000 MHz		-2.5	________	+2.5	dB	
36000 MHz		-2.5	________	+2.5	dB	
37000 MHz		-2.5	________	+2.5	dB	
38000 MHz		-2.5	________	+2.5	dB	
39000 MHz		-2.5	________	+2.5	dB	
39999 MHz		-2.5	________	+2.5	dB	

1.15 Performance Test Report Option B25

Table 1-7: Performance Test Report Option B25

ROHDE & SCHWARZ	Performance Test Report	Option B25	Version 11-06-07
Serial number: Test person: Date: Signature:			

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display with Preamplifier (B25) normalized to 1Hz: **R&S FSQ:** f_{noise}:	Page 72					
10.99 MHz		-	________	-162 / -160*)	dBm	
19.99 MHz		-	________	-162	dBm	
49.99 MHz		-	________	-162	dBm	
99.99 MHz		-	________	-162	dBm	
199.9 MHz		-	________	-162	dBm	
499.9 MHz		-	________	-162	dBm	
999.9 MHz		-	________	-162	dBm	
1499 MHz		-	________	-162	dBm	
1999 MHz		-	________	-162	dBm	
2499 MHz		-	________	-160	dBm	
2999 MHz		-	________	-160	dBm	
3599 MHz		-	________	-160	dBm	
				*) -160 for **R&S FSQ, 40**		

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display with Preamplifier (B25) normalized to 1Hz **R&S FSQ 8:** f_{noise}	Page 72					
3601 MHz		-	________	-157	dBm	
3999 MHz		-	________	-157	dBm	
4499 MHz		-	________	-157	dBm	
4999 MHz		-	________	-157	dBm	
5499 MHz		-	________	-157	dBm	
5999 MHz		-	________	-157	dBm	
6499 MHz		-	________	-157	dBm	
6999 MHz		-	________	-157	dBm	
7999 MHz		-	________	-157	dBm	
Level accuracy with Preamplifier (B25) at 128 MHz, -30 dBm	Page 73	-0.3	________	+0.3	dB	
Level accuracy with electronic attenuator at 128 MHz, -30 dBm	Page 73	-0.3	________	+0.3	dB	
Frequency response with preamplifier (B25) **R&S FSQ:** f_{fresp}	Page 73					
10 MHz		-1	________	+1	dB	
50 MHz		-0.6	________	+0.6	dB	
100 MHz		-0.6	________	+0.6	dB	
200 MHz		-0.6	________	+0.6	dB	
300 MHz		-0.6	________	+0.6	dB	
400 MHz		-0.6	________	+0.6	dB	
500 MHz		-0.6	________	+0.6	dB	
600 MHz		-0.6	________	+0.6	dB	
700 MHz		-0.6	________	+0.6	dB	
800 MHz		-0.6	________	+0.6	dB	
900 MHz		-0.6	________	+0.6	dB	
1000 MHz		-0.6	________	+0.6	dB	
1500 MHz		-0.6	________	+0.6	dB	
2000 MHz		-0.6	________	+0.6	dB	
2500 MHz		-0.6	________	+0.6	dB	
2990 MHz		-0.6	________	+0.6	dB	
3590 MHz		-0.6	________	+0.6	dB	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency Response with preamplifier (B25)	Page 73					
R&S FSQ 8: f_{fresp}						
3610 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	
7990 MHz		-2	________	+2	dB	
Frequency Response elec. attenuator (B25)	Page 73					
E_{ATT} = 5 dB						
R&S FSQ: f_{fresp}						
10 MHz		-1	________	+1	dB	
50 MHz		-0.6	________	+0.6	dB	
100 MHz		-0.6	________	+0.6	dB	
200 MHz		-0.6	________	+0.6	dB	
300 MHz		-0.6	________	+0.6	dB	
400 MHz		-0.6	________	+0.6	dB	
500 MHz		-0.6	________	+0.6	dB	
600 MHz		-0.6	________	+0.6	dB	
700 MHz		-0.6	________	+0.6	dB	
800 MHz		-0.6	________	+0.6	dB	
900 MHz		-0.6	________	+0.6	dB	
1000 MHz		-0.6	________	+0.6	dB	
1500 MHz		-0.6	________	+0.6	dB	
2000 MHz		-0.6	________	+0.6	dB	
2500 MHz		-0.6	________	+0.6	dB	
2990 MHz		-0.6	________	+0.6	dB	
3590 MHz		-0.6	________	+0.6	dB	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency Response elec. attenuator (B25)	Page 73					
E_{ATT} = 5 dB						
R&S FSQ 8: f_{fresp}						
3610 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	
7990 MHz		-2	________	+2	dB	
Frequency Response elec. attenuator (B25)	Page 73					
E_{ATT} = 10 dB						
R&S FSQ: f_{fresp}						
10 MHz		-1	________	+1	dB	
50 MHz		-0.6	________	+0.6	dB	
100 MHz		-0.6	________	+0.6	dB	
200 MHz		-0.6	________	+0.6	dB	
300 MHz		-0.6	________	+0.6	dB	
400 MHz		-0.6	________	+0.6	dB	
500 MHz		-0.6	________	+0.6	dB	
600 MHz		-0.6	________	+0.6	dB	
700 MHz		-0.6	________	+0.6	dB	
800 MHz		-0.6	________	+0.6	dB	
900 MHz		-0.6	________	+0.6	dB	
1000 MHz		-0.6	________	+0.6	dB	
1500 MHz		-0.6	________	+0.6	dB	
2000 MHz		-0.6	________	+0.6	dB	
2500 MHz		-0.6	________	+0.6	dB	
2990 MHz		-0.6	________	+0.6	dB	
3590 MHz		-0.6	________	+0.6	dB	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency Response elec. attenuator (B25)	Page 73					
E_{ATT} = 10 dB						
R&S FSQ 8: f_{fresp}						
3610 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	
7990 MHz		-2	________	+2	dB	
Frequency Response elec. attenuator (B25)	Page 73					
E_{ATT} = 15 dB						
R&S FSQ: f_{fresp}						
10 MHz		-1	________	+1	dB	
50 MHz		-0.6	________	+0.6	dB	
100 MHz		-0.6	________	+0.6	dB	
200 MHz		-0.6	________	+0.6	dB	
300 MHz		-0.6	________	+0.6	dB	
400 MHz		-0.6	________	+0.6	dB	
500 MHz		-0.6	________	+0.6	dB	
600 MHz		-0.6	________	+0.6	dB	
700 MHz		-0.6	________	+0.6	dB	
800 MHz		-0.6	________	+0.6	dB	
900 MHz		-0.6	________	+0.6	dB	
1000 MHz		-0.6	________	+0.6	dB	
1500 MHz		-0.6	________	+0.6	dB	
2000 MHz		-0.6	________	+0.6	dB	
2500 MHz		-0.6	________	+0.6	dB	
2990 MHz		-0.6	________	+0.6	dB	
3590 MHz		-0.6	________	+0.6	dB	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency Response elec. attenuator (B25)	Page 73					
E_{ATT} = 15 dB						
R&S FSQ 8: f_{fresp}						
3610 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	
7990 MHz		-2	________	+2	dB	
3rd-order intercept point with elec. att., f_{in}	Page 82					
R&S FSQ:						
28 MHz		17	________	-	dBm	
106 MHz		17	________	-	dBm	
261 MHz		17	________	-	dBm	
640 MHz		20	________	-	dBm	
1000 MHz		20	________	-	dBm	
1700 MHz		20	________	-	dBm	
2500 MHz		20	________	-	dBm	
3590 MHz		20	________	-	dBm	
R&S FSQ 8:						
3610 MHz		18	________	-	dBm	
5000 MHz		18	________	-	dBm	
7990 MHz		18	________	-	dBm	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Attenuator accuracy, a_{ATT} :	Page 84					
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 85					
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	

1.16 Performance Test Report Option FSU-B21

Table 1-8: Performance Test Report Option B21

ROHDE & SCHWARZ	Performance Test Report	Option B21	Version 11-06-07
Serial number:			
Test person:			
Date:			
Signature:			

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
LO-level	Page 1.50					
fc						
140,5 GHz		14,5	________	16,5	dBm	
150,5 GHz		14,5	________	16,5	dBm	
160,5 GHz		14,5	________	16,5	dBm	
170,5 GHz		14,5	________	16,5	dBm	
180,5 GHz		14,5	________	16,5	dBm	
190,5 GHz		14,5	________	16,5	dBm	
200,5 GHz		14,5	________	16,5	dBm	
210,5 GHz		14,5	________	16,5	dBm	
220,5 GHz		14,5	________	16,5	dBm	
230,5 GHz		14,5	________	16,5	dBm	
240,5 GHz		14,5	________	16,5	dBm	
250,5 GHz		14,5	________	16,5	dBm	
260,5 GHz		14,5	________	16,5	dBm	
270,5 GHz		14,5	________	16,5	dBm	
280,5 GHz		14,5	________	16,5	dBm	
290,5 GHz		14,5	________	16,5	dBm	
300,5 GHz		14,5	________	16,5	dBm	
309,5 GHz		14,5	________	16,5	dBm	
level display 2-port-mixer	Page 1.51	- 1	________	+ 1	dBm	
level display 3-port-mixer	Page 1.51	- 1	________	+ 1	dBm	
bias current	Page 1.52	- 12,0	________	- 8,0	mA	
		- 1,0	________	+ 1,0	mA	
		+ 8,0	________	+ 12,0	mA	

1.17 Performance Test Report Option B23

ROHDE & SCHWARZ	Performance Test Report	Option B23	Version 11-06-07
Serial number:			
Test person:			
Date:			
Signature:			

Characteristic	**Included in**	**Min. value**	**Actual value**	**Max. value**	**Unit**	**Tolerance**
Noise Display with Preamplifier (B23) normalized to 1Hz	page 93					
R&S FSQ26: f_{noise}						
3601 MHz		-	________	-162	dBm	
3999 MHz		-	________	-162	dBm	
4499 MHz		-	________	-162	dBm	
4999 MHz		-	________	-162	dBm	
5499 MHz		-	________	-162	dBm	
5999 MHz		-	________	-162	dBm	
6499 MHz		-	________	-162	dBm	
6999 MHz		-	________	-162	dBm	
7999 MHz		-	________	-162	dBm	
8999 MHz		-	________	-159	dBm	
9999 MHz		-	________	-159	dBm	
10999 MHz		-	________	-159	dBm	
11999 MHz		-	________	-159	dBm	
12999 MHz		-	________	-159	dBm	
13999 MHz		-	________	-157	dBm	
14999 MHz		-	________	-157	dBm	
15999 MHz		-	________	-157	dBm	
16999 MHz		-	________	-157	dBm	
17999 MHz		-	________	-157	dBm	
18999 MHz		-	________	-154	dBm	
19999 MHz		-	________	-154	dBm	
20999 MHz		-	________	-154	dBm	
21999 MHz		-	________	-154	dBm	
22999 MHz		-	________	-150	dBm	
23999 MHz		-	________	-150	dBm	
24999 MHz		-	________	-150	dBm	
25999 MHz		-	________	-150	dBm	
26499 MHz		-	________	-150	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response with Preamplifier (B23)	page 93					
R&S FSQ 26: f_{fresp}						
3610 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	
7000 MHz		-2	________	+2	dB	
8000 MHz		-2	________	+2	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	
14000 MHz		-2.5	________	+2.5	dB	
15000 MHz		-2.5	________	+2.5	dB	
16000 MHz		-2.5	________	+2.5	dB	
17000 MHz		-2.5	________	+2.5	dB	
18000 MHz		-2.5	________	+2.5	dB	
19000 MHz		-2.5	________	+2.5	dB	
20000 MHz		-2.5	________	+2.5	dB	
21000 MHz		-2.5	________	+2.5	dB	
22000 MHz		-2.5	________	+2.5	dB	
23000 MHz		-3.0	________	+3.0	dB	
24000 MHz		-3.0	________	+3.0	dB	
25000 MHz		-3.0	________	+3.0	dB	
26000 MHz		-3.0	________	+3.0	dB	
26490 MHz		-3.0	________	+3.0	dB	

1.18 Performance Test Report Option R&S FSQ-B71

ROHDE & SCHWARZ	Performance Test Report	Option R&S FSQ-B71	Version 11-06-07
Serial number:			
Test person:			
Date:			
Signature:			

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Level error						
Absolute error at 1 MHz, 50 Ω	page 100					
Input I-high						
RefLevel						
5.62 V		-0.25	___________	+0.25	dB	
3.16 V		-0.25	___________	+0.25	dB	
1.78 V		-0.25	___________	+0.25	dB	
1 V		-0.25	___________	+0.25	dB	
562 mV		-0.25	___________	+0.25	dB	
316 mV		-0.25	___________	+0.25	dB	
178 mV		-0.25	___________	+0.25	dB	
100 mV		-0.25	___________	+0.25	dB	
56.2 mV		-0.25	___________	+0.25	dB	
31.6 mV		-0.25	___________	+0.25	dB	
Input I-low						
RefLevel						
5.62 V		-0.25	___________	+0.25	dB	
3.16 V		-0.25	___________	+0.25	dB	
1.78 V		-0.25	___________	+0.25	dB	
1 V		-0.25	___________	+0.25	dB	
562 mV		-0.25	___________	+0.25	dB	
316 mV		-0.25	___________	+0.25	dB	
178 mV		-0.25	___________	+0.25	dB	
100 mV		-0.25	___________	+0.25	dB	
56.2 mV		-0.25	___________	+0.25	dB	
31.6 mV		-0.25	___________	+0.25	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Input Q-high						
RefLevel						
5.62 V		-0.25	____________	+0.25	dB	
3.16 V		-0.25	____________	+0.25	dB	
1.78 V		-0.25	____________	+0.25	dB	
1 V		-0.25	____________	+0.25	dB	
562 mV		-0.25	____________	+0.25	dB	
316 mV		-0.25	____________	+0.25	dB	
178 mV		-0.25	____________	+0.25	dB	
100 mV		-0.25	____________	+0.25	dB	
56.2 mV		-0.25	____________	+0.25	dB	
31.6 mV		-0.25	____________	+0.25	dB	
Input Q-low						
RefLevel						
5.62 V		-0.25	____________	+0.25	dB	
3.16 V		-0.25	____________	+0.25	dB	
1.78 V		-0.25	____________	+0.25	dB	
1 V		-0.25	____________	+0.25	dB	
562 mV		-0.25	____________	+0.25	dB	
316 mV		-0.25	____________	+0.25	dB	
178 mV		-0.25	____________	+0.25	dB	
100 mV		-0.25	____________	+0.25	dB	
56.2 mV		-0.25	____________	+0.25	dB	
31.6 mV		-0.25	____________	+0.25	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
I/Q imbalance at 1 MHz, 50 Ω	page 100					
I-high – Q-high						
RefLevel						
5.62 V		-0.1	____________	+0.1	dB	
3.16 V		-0.1	____________	+0.1	dB	
1.78 V		-0.1	____________	+0.1	dB	
1 V		-0.1	____________	+0.1	dB	
562 mV		-0.1	____________	+0.1	dB	
316 mV		-0.1	____________	+0.1	dB	
178 mV		-0.1	____________	+0.1	dB	
100 mV		-0.1	____________	+0.1	dB	
56.2 mV		-0.1	____________	+0.1	dB	
31.6 mV		-0.1	____________	+0.1	dB	
I-low – Q-low						
RefLevel						
5.62 V		-0.1	____________	+0.1	dB	
3.16 V		-0.1	____________	+0.1	dB	
1.78 V		-0.1	____________	+0.1	dB	
1 V		-0.1	____________	+0.1	dB	
562 mV		-0.1	____________	+0.1	dB	
316 mV		-0.1	____________	+0.1	dB	
178 mV		-0.1	____________	+0.1	dB	
100 mV		-0.1	____________	+0.1	dB	
56.2 mV		-0.1	____________	+0.1	dB	
31.6 mV		-0.1	____________	+0.1	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response, reference 1 MHz, without filter, 50 Ω	page 100					
Input I-high						
RefLevel 1 V						
2 MHz		-0.3	____________	+0.3	dB	
5 MHz		-0.3	____________	+0.3	dB	
10 MHz		-0.3	____________	+0.3	dB	
20 MHz		-0.3	____________	+0.3	dB	
36 MHz		-0.3	____________	+0.3	dB	
RefLevel 562 mV						
20 MHz		-0.3	____________	+0.3	dB	
36 MHz		-0.3	____________	+0.3	dB	
RefLevel 316 mV						
20 MHz		-0.3	____________	+0.3	dB	
36 MHz		-0.3	____________	+0.3	dB	
RefLevel 100 mV						
20 MHz		-0.3	____________	+0.3	dB	
36 MHz		-0.3	____________	+0.3	dB	
Input I-low						
RefLevel 1 V						
2 MHz		-0.3	____________	+0.3	dB	
5 MHz		-0.3	____________	+0.3	dB	
10 MHz		-0.3	____________	+0.3	dB	
20 MHz		-0.3	____________	+0.3	dB	
36 MHz		-0.3	____________	+0.3	dB	
RefLevel 562 mV						
20 MHz		-0.3	____________	+0.3	dB	
36 MHz		-0.3	____________	+0.3	dB	
RefLevel 316 mV						
20 MHz		-0.3	____________	+0.3	dB	
36 MHz		-0.3	____________	+0.3	dB	
RefLevel 100 mV						
20 MHz		-0.3	____________	+0.3	dB	
36 MHz		-0.3	____________	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Input Q-high						
RefLevel 1 V						
2 MHz		-0.3	________	+0.3	dB	
5 MHz		-0.3	________	+0.3	dB	
10 MHz		-0.3	________	+0.3	dB	
20 MHz		-0.3	________	+0.3	dB	
36 MHz		-0.3	________	+0.3	dB	
RefLevel 562 mV						
20 MHz		-0.3	________	+0.3	dB	
36 MHz		-0.3	________	+0.3	dB	
RefLevel 316 mV						
20 MHz		-0.3	________	+0.3	dB	
36 MHz		-0.3	________	+0.3	dB	
RefLevel 100 mV						
20 MHz		-0.3	________	+0.3	dB	
36 MHz		-0.3	________	+0.3	dB	
Input Q-low						
RefLevel 1V						
2 MHz		-0.3	________	+0.3	dB	
5 MHz		-0.3	________	+0.3	dB	
10 MHz		-0.3	________	+0.3	dB	
20 MHz		-0.3	________	+0.3	dB	
36 MHz		-0.3	________	+0.3	dB	
RefLevel 562 mV						
20 MHz		-0.3	________	+0.3	dB	
36 MHz		-0.3	________	+0.3	dB	
RefLevel 316 mV						
20 MHz		-0.3	________	+0.3	dB	
36 MHz		-0.3	________	+0.3	dB	
RefLevel 100 mV						
20 MHz		-0.3	________	+0.3	dB	
36 MHz		-0.3	________	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
I/Q Imbalance, Frequency response without filter, 50Ω	page 100					
I-high – Q-high						
RefLevel 1 V						
2 MHz		-0.15	____________	+0.15	dB	
5 MHz		-0.15	____________	+0.15	dB	
10 MHz		-0.15	____________	+0.15	dB	
20 MHz		-0.15	____________	+0.15	dB	
36 MHz		-0.15	____________	+0.15	dB	
RefLevel 562 mV						
20 MHz		-0.15	____________	+0.15	dB	
36 MHz		-0.15	____________	+0.15	dB	
RefLevel 316 mV						
20 MHz		-0.15	____________	+0.15	dB	
36 MHz		-0.15	____________	+0.15	dB	
RefLevel 100 mV						
20 MHz		-0.15	____________	+0.15	dB	
36 MHz		-0.15	____________	+0.15	dB	
I-low – Q-low						
RefLevel 1 V						
2 MHz		-0.15	____________	+0.15	dB	
5 MHz		-0.15	____________	+0.15	dB	
10 MHz		-0.15	____________	+0.15	dB	
20 MHz		-0.15	____________	+0.15	dB	
36 MHz		-0.15	____________	+0.15	dB	
RefLevel 562 mV						
20 MHz		-0.15	____________	+0.15	dB	
36 MHz		-0.15	____________	+0.15	dB	
RefLevel 316 mV						
20 MHz		-0.15	____________	+0.15	dB	
36 MHz		-0.15	____________	+0.15	dB	
RefLevel 100 mV						
20 MHz		-0.15	____________	+0.15	dB	
36 MHz		-0.15	____________	+0.15	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response, Reference 1 MHz, with filter, 50 Ω	page 102					
Input I-high						
RefLevel 1 V						
2 MHz		-0.3	____________	+0.3	dB	
5 MHz		-0.3	____________	+0.3	dB	
10 MHz		-0.3	____________	+0.3	dB	
20 MHz		-0.3	____________	+0.3	dB	
30 MHz		-0.3	____________	+0.3	dB	
Input I-low						
RefLevel 1 V						
2 MHz		-0.3	____________	+0.3	dB	
5 MHz		-0.3	____________	+0.3	dB	
10 MHz		-0.3	____________	+0.3	dB	
20 MHz		-0.3	____________	+0.3	dB	
30 MHz		-0.3	____________	+0.3	dB	
Input Q-high						
RefLevel 1 V						
2 MHz		-0.3	____________	+0.3	dB	
5 MHz		-0.3	____________	+0.3	dB	
10 MHz		-0.3	____________	+0.3	dB	
20 MHz		-0.3	____________	+0.3	dB	
30 MHz		-0.3	____________	+0.3	dB	
Input Q-low						
RefLevel 1V						
2 MHz		-0.3	____________	+0.3	dB	
5 MHz		-0.3	____________	+0.3	dB	
10 MHz		-0.3	____________	+0.3	dB	
20 MHz		-0.3	____________	+0.3	dB	
30 MHz		-0.3	____________	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
I/Q Imbalance, Frequency response with filter, 50Ω	page 102					
I-high – Q-high						
RefLevel 1 V						
2 MHz		-0.15	____________	+0.15	dB	
5 MHz		-0.15	____________	+0.15	dB	
10 MHz		-0.15	____________	+0.15	dB	
20 MHz		-0.15	____________	+0.15	dB	
30 MHz		-0.15	____________	+0.15	dB	
I-low – Q-low						
RefLevel 1 V						
2 MHz		-0.15	____________	+0.15	dB	
5 MHz		-0.15	____________	+0.15	dB	
10 MHz		-0.15	____________	+0.15	dB	
20 MHz		-0.15	____________	+0.15	dB	
30 MHz		-0.15	____________	+0.15	dB	
Spurious & Harmonics, 50 Ω	page 103					
Input I-high						
RefLevel 1 V						
12 MHz		54	____________		dBc	
30 MHz		54	____________		dBc	
RefLevel 316 mV						
12 MHz		54	____________		dBc	
30 MHz		54	____________		dBc	
RefLevel 100 mV						
12 MHz		54	____________		dBc	
30 MHz		54	____________		dBc	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Input I-low						
RefLevel 1 V						
12 MHz		54	____________		dBc	
30 MHz		54	____________		dBc	
RefLevel 316 mV						
12 MHz		54	____________		dBc	
30 MHz		54	____________		dBc	
RefLevel 100 mV						
12 MHz		54	____________		dBc	
30 MHz		54	____________		dBc	
Input Q-high						
RefLevel 1 V						
12 MHz		54	____________		dBc	
30 MHz		54	____________		dBc	
RefLevel 316 mV						
12 MHz		54	____________		dBc	
30 MHz		54	____________		dBc	
RefLevel 100 mV						
12 MHz		54	____________		dBc	
30 MHz		54	____________		dBc	
Input Q-low						
RefLevel 1 V						
12 MHz		54	____________		dBc	
30 MHz		54	____________		dBc	
RefLevel 316 mV						
12 MHz		54	____________		dBc	
30 MHz		54	____________		dBc	
RefLevel 100 mV						
12 MHz		54	____________		dBc	
30 MHz		54	____________		dBc	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise floor, 50 Ω, balanced	page 104					
Noise voltage in 1 Hz bandwidth						
Channel Q						
RefLevel 562 mV			____________	70	nV	
RefLevel 178 mV			____________	35	nV	
RefLevel 31.6 mV			____________	10	nV	
Channel I						
RefLevel 562 mV			____________	70	nV	
RefLevel 178 mV			____________	35	nV	
RefLevel 31.6 mV			____________	10	nV	
I/Q offset, 50 Ω	page 105					
Balanced						
RefLevel						
1 V		-1.7	____________	1.7	mV	
562 mV		-1.04	____________	1.04	mV	
316 mV		-0.67	____________	0.67	mV	
178 mV		-0.47	____________	0.47	mV	
100 mV		-0.35	____________	0.35	mV	
56.2 mV		-0.28	____________	0.28	mV	
31.6 mV		-0.25	____________	0.25	mV	
Unbalanced						
RefLevel						
1 V		-2	____________	2	mV	
562 mV		-2	____________	2	mV	
316 mV		-2	____________	2	mV	
178 mV		-2	____________	2	mV	
100 mV		-2	____________	2	mV	
56.2 mV		-2	____________	2	mV	
31.6 mV		-2	____________	2	mV	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Level error						
Absolute error at 1 MHz, 1 kΩ / 1 MΩ RefLevel 1 V	page 106					
Input I-high		-0.25	____________	+0.25	dB	
Input I-low		-0.25	____________	+0.25	dB	
Input Q-high		-0.25	____________	+0.25	dB	
Input Q-low		-0.25	____________	+0.25	dB	
I/Q imbalance at 1 MHz, 1 kΩ / 1 MΩ RefLevel 1 V	page 106					
I-high – Q-high		-0.1	____________	+0.1	dB	
I-low – Q-low		-0.1	____________	+0.1	dB	
Frequency response, Reference 1 MHz, 1 kΩ / 1 MΩ, RefLevel 1V	page 107					
Input I-high						
5 MHz		-0.3	____________	+0.3	dB	
10 MHz		-0.3	____________	+0.3	dB	
Input I-low						
5 MHz		-0.3	____________	+0.3	dB	
10 MHz		-0.3	____________	+0.3	dB	
Input Q-high						
5 MHz		-0.3	____________	+0.3	dB	
10 MHz		-0.3	____________	+0.3	dB	
Input Q-low						
5 MHz		-0.3	____________	+0.3	dB	
10 MHz		-0.3	____________	+0.3	dB	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
I/Q imbalance, Frequency response, 1 kΩ / 1 MΩ RefLevel 1V	page 107					
I-high – Q-high						
5 MHz		-0.15	____________	+0.15	dB	
10 MHz		-0.15	____________	+0.15	dB	
I-low – Q-low						
5 MHz		-0.15	____________	+0.15	dB	
10 MHz		-0.15	____________	+0.15	dB	
Spurious & Harmonics 1 kΩ / 1MΩ, RefLevel 1 V	page 108					
Input I-high						
12 MHz		54	____________		dBc	
30 MHz (1 kΩ only)		54	____________		dBc	
Input I-low						
12 MHz		54	____________		dBc	
30 MHz (1 kΩ only)		54	____________		dBc	
Input Q-high						
12 MHz		54	____________		dBc	
30 MHz (1 kΩ only)		54	____________		dBc	
Input Q-low						
12 MHz		54	____________		dBc	
30 MHz (1 kΩ only)		54	____________		dBc	
Noise floor, 1 kΩ /1 MΩ, balanced, RefLevel 31.6 mV	page 109					
Noise voltage in 1 Hz bandwidth						
Channel Q			____________	28	nV	
Channel I			____________	28	nV	
I/Q offset, 1 kΩ /1 MΩ, balanced RefLevel 100mV	page 112	-2	____________	2	mV	

1.19 Performance Test Report Option R&S FSQ-B72

ROHDE & SCHWARZ	Performance Test Report	Option R&S FSQ-B72	Version 11-06-07
Serial number:			
Test person:			
Date:			
Signature:			

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Level uncertainty at 128 MHz vs IF gain	page 117					
model 02						
REF LEVEL						
+5 dBm		-0.8	________	0.8	dB	
0 dBm		-0.8	________	0.8	dB	
-5 dBm		-0.8	________	0.8	dB	
-10 dBm		-0.8	________	0.8	dB	
-15 dBm		-0.8	________	0.8	dB	
-20 dBm		-0.8	________	0.8	dB	
-30 dBm		-0.8	________	0.8	dB	
model 12						
REF LEVEL						
+10 dBm		-0.8	________	0.8	dB	
+5 dBm		-0.8	________	0.8	dB	
0 dBm		-0.8	________	0.8	dB	
-5 dBm		-0.8	________	0.8	dB	
-10 dBm		-0.8	________	0.8	dB	
-15 dBm		-0.8	________	0.8	dB	
Level uncertainty vs RF frequency f_{center}	Page 118					
all R&S FSQ models						
900 MHz		-0.8	________	0.8	dB	
1800 MHz		-0.8	________	0.8	dB	
2400 MHz		-0.8	________	0.8	dB	
3600 MHz		-0.8	________	0.8	dB	
only R&S R&S FSQ8						
5 GHz		-1.5	________	1.5	dB	
6 GHz		-1.5	________	1.5	dB	
8 GHz		-1.5	________	1.5	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
only R&S FSQ26/R&S FSQ40						
5 GHz		-1.5	________	1.5	dB	
12 GHz		-2.5	________	2.5	dB	
18 GHz		-2.5	________	2.5	dB	
22 GHz		-2.5	________	2.5	dB	
26 GHz		-2.5	________	2.5	dB	
only R&S FSQ40						
30 GHz		-2.5	________	2.5	dB	
34 GHz		-2.5	________	2.5	dB	
38 GHz		-2.5	________	2.5	dB	
40 GHz		-2.5	________	2.5	dB	
Level nonlinearity	Page 119					
model 02						
Level						
-10 dBm		---	Reference value	---	dB	
-15 dBm		-0.1	________	0.1	dB	
-20 dBm		-0.2	________	0.2	dB	
-25 dBm		-0.3	________	0.3	dB	
-30 dBm		-0.4	________	0.4	dB	
-35 dBm		-0.5	________	0.5	dB	
-40 dBm		-0.6	________	0.6	dB	
-45 dBm		-0.7	________	0.7	dB	
-50 dBm		-0.8	________	0.8	dB	
-55 dBm		-0.9	________	0.9	dB	
-60 dBm		-1.0	________	1.0	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
model 12						
Level						
-10 dBm		---	Reference value	---	dB	
-15 dBm		-0.15	________	0.15	dB	
-20 dBm		-0.15	________	0.15	dB	
-25 dBm		-0.15	________	0.15	dB	
-30 dBm		-0.15	________	0.15	dB	
-35 dBm		-0.15	________	0.15	dB	
-40 dBm		-0.15	________	0.15	dB	
-45 dBm		-0.15	________	0.15	dB	
-50 dBm		-0.15	________	0.15	dB	
-55 dBm		-0.15	________	0.15	dB	
-60 dBm		-0.15	________	0.15	dB	
-65 dBm		-0.15	________	0.15	dB	
-70 dBm		-0.15	________	0.15	dB	
I/Q frequency response at 128 MHz vs IF gain	Page 120					
model 02						
REF LEVEL 0 dBm						
f_{offset}						
-30 MHz		-0.6	________	0.6	dB	
-25 MHz		-0.3	________	0.3	dB	
-15 MHz		-0.3	________	0.3	dB	
0 MHz		---	Reference value	---	dB	
15 MHz		-0.3	________	0.3	dB	
25 MHz		-0.3	________	0.3	dB	
30 MHz		-0.6	________	0.6	dB	
REF LEVEL -5 dBm						
f_{offset}						
-30 MHz		-0.6	________	0.6	dB	
-25 MHz		-0.3	________	0.3	dB	
-15 MHz		-0.3	________	0.3	dB	
0 MHz		---	Reference value	---	dB	
+15 MHz		-0.3	________	0.3	dB	
+25 MHz		-0.3	________	0.3	dB	
+30 MHz		-0.6	________	0.6	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
REF LEVEL -10 dBm						
f_{offset}						
-30 MHz		-0.6	________	0.6	dB	
-25 MHz		-0.3	________	0.3	dB	
-15 MHz		-0.3	________	0.3	dB	
0 MHz		---	Reference value	---	dB	
+15 MHz		-0.3	________	0.3	dB	
+25 MHz		-0.3	________	0.3	dB	
+30 MHz		-0.6	________	0.6	dB	
REF LEVEL -15 dBm						
f_{offset}						
-30 MHz		-0.6	________	0.6	dB	
-25 MHz		-0.3	________	0.3	dB	
-15 MHz		-0.3	________	0.3	dB	
0 MHz		---	Reference value	---	dB	
+15 MHz		-0.3	________	0.3	dB	
+25 MHz		-0.3	________	0.3	dB	
+30 MHz		-0.6	________	0.6	dB	
REF LEVEL -20 dBm						
f_{offset}						
-30 MHz		-0.6	________	0.6	dB	
-25 MHz		-0.3	________	0.3	dB	
-15 MHz		-0.3	________	0.3	dB	
0 MHz		---	Reference value	---	dB	
+15 MHz		-0.3	________	0.3	dB	
+25 MHz		-0.3	________	0.3	dB	
+30 MHz		-0.6	________	0.6	dB	
REF LEVEL -25 dBm						
f_{offset}						
-30 MHz		-0.6	________	0.6	dB	
-25 MHz		-0.3	________	0.3	dB	
-15 MHz		-0.3	________	0.3	dB	
0 MHz		---	Reference value	---	dB	
+15 MHz		-0.3	________	0.3	dB	
+25 MHz		-0.3	________	0.3	dB	
+30 MHz		-0.6	________	0.6	dB	
I/Q frequency response at 128 MHz vs IF gain	Page 120					

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
model 12						
REF LEVEL +10 dBm						
f $_{offset}$						
-60 MHz		-0.6	________	+0.6	dB	
-40 MHz		-0.3	________	+0.3	dB	
-30 MHz		-0.3	________	+0.3	dB	
-25 MHz		-0.3	________	+0.3	dB	
-15 MHz		-0.3	________	+0.3	dB	
0 MHz		---	Reference value	---	dB	
+15 MHz		-0.3	________	+0.3	dB	
+25 MHz		-0.3	________	+0.3	dB	
+30 MHz		-0.3	________	+0.3	dB	
+40 MHz		-0.3	________	+0.3	dB	
+60 MHz		-0.6	________	+0.6	dB	
REF LEVEL +5 dBm						
f $_{offset}$						
-60 MHz		-0.6	________	+0.6	dB	
-40 MHz		-0.3	________	+0.3	dB	
-30 MHz		-0.3	________	+0.3	dB	
-25 MHz		-0.3	________	+0.3	dB	
-15 MHz		-0.3	________	+0.3	dB	
0 MHz		---	Reference value	---	dB	
+15 MHz		-0.3	________	+0.3	dB	
+25 MHz		-0.3	________	+0.3	dB	
+30 MHz		-0.3	________	+0.3	dB	
+40 MHz		-0.3	________	+0.3	dB	
+60 MHz		-0.6	________	+0.6	dB	
REF LEVEL 0 dBm						
f $_{offset}$						
-60 MHz		-0.6	________	+0.6	dB	
-40 MHz		-0.3	________	+0.3	dB	
-30 MHz		-0.3	________	+0.3	dB	
-25 MHz		-0.3	________	+0.3	dB	
-15 MHz		-0.3	________	+0.3	dB	
0 MHz		---	Reference value	---	dB	
+15 MHz		-0.3	________	+0.3	dB	
+25 MHz		-0.3	________	+0.3	dB	
+30 MHz		-0.3	________	+0.3	dB	
+40 MHz		-0.3	________	+0.3	dB	
+60 MHz		-0.6	________	+0.6	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
REF LEVEL -5 dBm						
f_{offset}						
-60 MHz		-0.6	________	+0.6	dB	
-40 MHz		-0.3	________	+0.3	dB	
-30 MHz		-0.3	________	+0.3	dB	
-25 MHz		-0.3	________	+0.3	dB	
-15 MHz		-0.3	________	+0.3	dB	
0 MHz		---	Reference value	---	dB	
+15 MHz		-0.3	________	+0.3	dB	
+25 MHz		-0.3	________	+0.3	dB	
+30 MHz		-0.3	________	+0.3	dB	
+40 MHz		-0.3	________	+0.3	dB	
+60 MHz		-0.6	________	+0.6	dB	
REF LEVEL -10 dBm						
f_{offset}						
-60 MHz		-0.6	________	+0.6	dB	
-40 MHz		-0.3	________	+0.3	dB	
-30 MHz		-0.3	________	+0.3	dB	
-25 MHz		-0.3	________	+0.3	dB	
-15 MHz		-0.3	________	+0.3	dB	
0 MHz		---	Reference value	---	dB	
+15 MHz		-0.3	________	+0.3	dB	
+25 MHz		-0.3	________	+0.3	dB	
+30 MHz		-0.3	________	+0.3	dB	
+40 MHz		-0.3	________	+0.3	dB	
+60 MHz		-0.6	________	+0.6	dB	
REF LEVEL -15 dBm						
f_{offset}						
-60 MHz		-0.6	________	+0.6	dB	
-40 MHz		-0.3	________	+0.3	dB	
-30 MHz		-0.3	________	+0.3	dB	
-25 MHz		-0.3	________	+0.3	dB	
-15 MHz		-0.3	________	+0.3	dB	
0 MHz		---	Reference value	---	dB	
+15 MHz		-0.3	________	+0.3	dB	
+25 MHz		-0.3	________	+0.3	dB	
+30 MHz		-0.3	________	+0.3	dB	
+40 MHz		-0.3	________	+0.3	dB	
+60 MHz		-0.6	________	+0.6	dB	
I/Q frequency response vs RF frequency	Page 122					

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
model 02						
f_{center} = 900 MHz						
f_{offset}						
-30 MHz		-0.6	________	0.6	dB	
-25 MHz		-0.3	________	0.3	dB	
-15 MHz		-0.3	________	0.3	dB	
0 MHz		---	Reference value	---	dB	
+15 MHz		-0.3	________	0.3	dB	
+25 MHz		-0.3	________	0.3	dB	
+30 MHz		-0.6	________	0.6	dB	
f_{center} = 1800 MHz						
f_{offset}						
-30 MHz		-0.6	________	0.6	dB	
-25 MHz		-0.3	________	0.3	dB	
-15 MHz		-0.3	________	0.3	dB	
0 MHz		---	Reference value	---	dB	
+15 MHz		-0.3	________	0.3	dB	
+25 MHz		-0.3	________	0.3	dB	
+30 MHz		-0.6	________	0.6	dB	
f_{center} = 3600 MHz						
f_{offset}						
-30 MHz		-0.6	________	0.6	dB	
-25 MHz		-0.3	________	0.3	dB	
-15 MHz		-0.3	________	0.3	dB	
0 MHz		---	Reference value	---	dB	
+15 MHz		-0.3	________	0.3	dB	
+25 MHz		-0.3	________	0.3	dB	
+30 MHz		-0.6	________	0.6	dB	
I/Q frequency response vs RF frequency	Page 122					

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
model 12						
f_{center} = 900 MHz						
f_{offset}						
-60 MHz		-0.6	________	0.6	dB	
-40 MHz		-0.3	________	0.3	dB	
-30 MHz		-0.3	________	0.3	dB	
-25 MHz		-0.3	________	0.3	dB	
-15 MHz		-0.3	________	0.3	dB	
0 MHz		---	Reference value	---	dB	
+15 MHz		-0.3	________	0.3	dB	
+25 MHz		-0.3	________	0.3	dB	
+30 MHz		-0.3	________	0.3	dB	
+40 MHz		-0.3	________	0.3	dB	
+60 MHz		-0.6	________	0.6	dB	
f_{center} = 1800 MHz						
f_{offset}						
-60 MHz		-0.6	________	0.6	dB	
-40 MHz		-0.3	________	0.3	dB	
-30 MHz		-0.3	________	0.3	dB	
-25 MHz		-0.3	________	0.3	dB	
-15 MHz		-0.3	________	0.3	dB	
0 MHz		---	Reference value	---	dB	
+15 MHz		-0.3	________	0.3	dB	
+25 MHz		-0.3	________	0.3	dB	
+30 MHz		-0.3	________	0.3	dB	
+40 MHz		-0.3	________	0.3	dB	
+60 MHz		-0.6	________	0.6	dB	
f_{center} = 3600 MHz						
f_{offset}						
-60 MHz		-0.6	________	0.6	dB	
-40 MHz		-0.3	________	0.3	dB	
-30 MHz		-0.3	________	0.3	dB	
-25 MHz		-0.3	________	0.3	dB	
-15 MHz		-0.3	________	0.3	dB	
0 MHz		---	Reference value	---	dB	
+15 MHz		-0.3	________	0.3	dB	
+25 MHz		-0.3	________	0.3	dB	
+30 MHz		-0.3	________	0.3	dB	
+40 MHz		-0.3	________	0.3	dB	
+60 MHz		-0.6	________	0.6	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
I/Q frequency response vs RF frequency	Page 122					
models 02 and 12						
only R&S R&S FSQ8						
f_{center} = 5 GHz						
f_{offset}						
-60 MHz		-0.6	________	0.6	dB	
-40 MHz		-0.6	________	0.6	dB	
-20 MHz		-0.6	________	0.6	dB	
0 MHz		---	Reference value	---	dB	
+20 MHz		-0.6	________	0.6	dB	
+40 MHz		-0.6	________	0.6	dB	
+60 MHz		-0.6	________	0.6	dB	
f_{center} = 6 GHz						
f_{offset}						
-60 MHz		-0.6	________	0.6	dB	
-40 MHz		-0.6	________	0.6	dB	
-20 MHz		-0.6	________	0.6	dB	
0 MHz		---	Reference value	---	dB	
+20 MHz		-0.6	________	0.6	dB	
+40 MHz		-0.6	________	0.6	dB	
+60 MHz		-0.6	________	0.6	dB	
f_{center} = 7.9 GHz						
f_{offset}						
-60 MHz		-0.6	________	0.6	dB	
-40 MHz		-0.6	________	0.6	dB	
-20 MHz		-0.6	________	0.6	dB	
0 MHz		---	Reference value	---	dB	
+20 MHz		-0.6	________	0.6	dB	
+40 MHz		-0.6	________	0.6	dB	
+60 MHz		-0.6	________	0.6	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
only R&S FSQ26/R&S FSQ40						
		-0.6	________	0.6	dB	
f_{center} = 5 GHz		-0.6	________	0.6	dB	
f_{offset}		-0.6	________	0.6	dB	
-60 MHz		---	Reference value	---	dB	
-40 MHz		-0.6	________	0.6	dB	
-20 MHz		-0.6	________	0.6	dB	
0 MHz		-0.6	________	0.6	dB	
+20 MHz						
+40 MHz						
+60 MHz						
f_{center} = 12 GHz						
f_{offset}						
-60 MHz		-0.6	________	0.6	dB	
-40 MHz		-0.6	________	0.6	dB	
-20 MHz		-0.6	________	0.6	dB	
0 MHz		---	Reference value	---	dB	
+20 MHz		-0.6	________	0.6	dB	
+40 MHz		-0.6	________	0.6	dB	
+60 MHz		-0.6	________	0.6	dB	
f_{center} = 18 GHz						
f_{offset}						
-60 MHz		-0.6	________	0.6	dB	
-40 MHz		-0.6	________	0.6	dB	
-20 MHz		-0.6	________	0.6	dB	
0 MHz		---	Reference value	---	dB	
+20 MHz		-0.6	________	0.6	dB	
+40 MHz		-0.6	________	0.6	dB	
+60 MHz		-0.6	________	0.6	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
f_{center} = 26 GHz f_{offset} -60 MHz -40 MHz -20 MHz 0 MHz +20 MHz +40 MHz +60 MHz		 -0.6 -0.6 -0.6 --- -0.6 -0.6 -0.6	 ________ ________ ________ Reference value ________ ________ ________	 0.6 0.6 0.6 --- 0.6 0.6 0.6	 dB dB dB dB dB dB dB	
Spurious with full-scale input signal	Page 124					
model 02 f_{center} = 1 GHz f_{signal} 990 MHz 1000 MHz 1025 MHz			 ________ ________ ________	 -50 -50 -50	 dBc dBc dBc	
f_{center} = 4 GHz f_{signal} 3960 MHz 4000 MHz 4025 MHz 4055 MHz			 ________ ________ ________ ________	 -50 -50 -50 -50	 dBc dBc dBc dBc	
model 12 f_{center} = 1 GHz f_{signal} 960 MHz 1005 MHz 1030 MHz			 ________ ________ ________	 -60 -60 -60	 dBc dBc dBc	
f_{center} = 4 GHz f_{signal} 3960 MHz 4000 MHz 4025 MHz 4055 MHz			 ________ ________ ________ ________	 -60 -60 -60 -60	 dBc dBc dBc dBc	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Spurious without input signal model 02	Page 126					
f_{center}						
1 GHz			________	-80	dBm	
4 GHz			________	-80	dBm	
model 12						
f_{center}						
1 GHz			________	-95	dBm	
4 GHz			________	-80	dBm	
Signal-to-noise ratio model 02	Page 126					
f_{center}						
1 GHz		125	________		dBc [1Hz]	
model 12						
f_{center}						
1 GHz		135	________		dBc [1Hz]	
3.5 GHz		135	________		dBc [1Hz]	
Third-order intermodulation	Page 127					
model 02						
f_{center} = 1 GHz						
f_{signal} = 995 / 1005 MHz			________	-50	dBc	
f_{center} = 4 GHz						
f_{signal} =3990 / 4010 MHz			________	-50	dBc	
model 12						
f_{center} = 1 GHz						
f_{signal} = 995 / 1005 MHz			________	-60	dBc	
f_{center} = 4 GHz						
f_{signal} =3990 / 4010 MHz			________	-60	dBc	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise floor	Page 128					
f_{center} = 1 GHz						
R&S FSQ3/R&S FSQ8			________	-150	dBm [1Hz]	
R&S FSQ26/R&S FSQ40			________	-148	dBm [1Hz]	
f_{center} = 5 GHz			________	-147	dBm [1Hz]	
R&S FSQ8			________	-149	dBm [1Hz]	
R&S FSQ26/R&S FSQ40						

1.20 Performance Test Report Option R&S FSQ-B17

ROHDE & SCHWARZ Performance Test Report Option R&S FSQ-B17 Version 11-06-07

Serial number:

Test person:

Date:

Signature:

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
LVDS loopback test	Page129	passed	__________			

2 Adjustment

NOTICE

Risk of erroneous measurement results

Adjustment must be carried out exclusively by qualified personnel since any change can considerably affect the instrument´s measurement accuracy.

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 R&S FSQ permits the following manual adjustments:

- Adjustment of the 10 MHz reference oscillator which determines the frequency accuracy of the R&S FSQ
- Adjustment of the 128 MHz calibration source which determines the level accuracy of the R&S FSQ
- Adjustment of the 50 MHz power reference

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

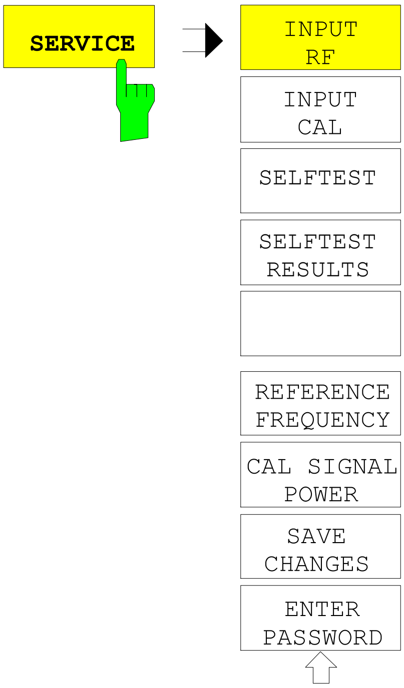
Manual adjustments must be performed at an ambient temperature of between +20 °C and +30 °C after the instrument has warmed up.

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

2.1 Service Menu

The service functions for adjusting the boards are only usable 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 selecting the service function

2.1.1 Entering Password

SETUP SERVICE submenu:

ENTER PASSWORD

The *ENTER PASSWORD* softkey allows the entry of a password.
The R&S FSQ 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 data to be changed that is required in order to calibrate or repair the instrument (for example, reference frequency adjustment, level adjustment, general board data). The password is "894129".

`Remote: SYST:PASS "<Password>"`

2.1.2 Adjustment Functions

NOTICE

The realignment 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:

REF FREQUENCY

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 R&S FSQ-B4 OCXO) or between 0 to 4095 (with option R&S FSQ-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 the setting permanently in nonvolatile memory.

`Remote: SENS:ROSC:INT:TUN 155`

CAL SIGNAL POWER

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 the setting permanently in nonvolatile memory.

`Remote: --`

SAVE CHANGES

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.

`Remote: SENS:ROSC:INT:TUN:SAV`

2.2 Manual Adjustment

This section explains the measuring instruments and auxiliary means required when manually adjusting the R&S FSQ the appropriate preparations of the instrument as well as the individual adjustments.

2.2.1 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 compliance with the guaranteed data be ensured.
- Inputs for setting the R&S FSQ 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**]

2.2.2 Measuring Equipment and Accessories

Table 6 Measuring equipment and accessories for manually adjusting the R&S FSQ

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	R&S SMHU	0835.8011.52	Calibration Source 128 MHz Frequency Accuracy of Reference Oscillator
3	Power meter		R&S NRVD	0857.8008.02	Calibration Source 128 MHz
4	Power sensor	1 MHz to 3 GHz RSS ≤ 0.8% meter noise ≤ 20 pW	R&S NRV-Z4	0828.3618.02	Calibration Source 128 MHz Power Reference

2.2.3 Adjusting Level Measurement Accuracy

Test equipment:

► Signal generator (Section "Measuring Equipment", item 2):
- Frequency 128 MHz
- Level -30 dBm

► Power meter (Section "Measuring Equipment", item 3)

- ► Power sensor (Section "Measuring 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 R&S FSQ.

Overall calibration of the R&S FSQ:

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

R&S FSQ 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.

NOTICE

The following realignment changes the level of the internal calibration source. Since this adjustment influences the level measurement accuracy of the R&S FSQ it is strongly recommended that this adjustment be performed only if the level is not within the tolerance.

R&S FSQ 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 non-volatile memory on the boards.

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`.

2.2.4 Adjusting Frequency Accuracy

Preparation:

The measurement can be performed either with a signal generator at connector RF INPUT (front of the R&S FSQ) at 1 GHz or at connector EXT REF OUT (rear of the R&S FSQ) at 10 MHz using a frequency counter.
To be adjusted, the R&S FSQ must be set to internal reference.

NOTICE

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

2.2.4.2 Preparations for adjustment with signal generator

Test equipment:

► Signal generator (Section "Measuring 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 the RF output of the signal generator to RF input of the R&S FSQ.

R&S FSQ 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)

Before the following measurement, the R&S FSQ 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]

2.2.4.3 Preparation for adjustment with frequency counter:

Test equipment:

- ► Frequency counter (Section "Measuring Equipment", item 1):
  - Error < 1×10^{-9}
  - Frequency range up to 10 MHz

Test setup:

- ► Connect frequency counter to 10 MHz reference output of the R&S FSQ (rear panel).

R&S FSQ settings:

- [**SETUP** : REFERENCE INT / EXT]

- ► Toggle to internal reference (INT).

Frequency counter settings:

- ► Set the necessary resolution:
  model without OCXO (option B4): 1 Hz
  model with OCXO (option B4): 0.1 Hz

Before the following measurement, the R&S FSQ must warm up at least 30 minutes to heat the reference oscillator.

Measurement:

- ► Measure frequency with frequency counter:

Nominal frequency:

model without OCXO (option R&S FSQ-B4) 10 MHz ± 10 Hz
model with OCXO (option R&S FSQ-B4) 10 MHz ± 1 Hz

2.2.4.4 Adjustment:

NOTICE

The following adjustment changes the frequency of the internal reference source. Since this adjustment influences the frequency accuracy of the R&S FSQ, it is strongly recommended that this adjustment be performed only if the frequency is not within the tolerance.

R&S FSQ settings:

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

The correction value for the reference frequency adjustment 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 non-volatile memory on the boards.

Preparation:

The measurement can be performed either with a signal generator at connector RF INPUT (front of the R&S FSQ) at 1 GHz or at connector EXT REF OUT (rear of the R&S FSQ) at 10 MHz using a frequency counter.

To be adjusted, the R&S FSQ must be set to internal reference.

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

2.3 Adjustment of Module Data

All boards of the R&S FSQ contain EEPROMS for storing 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. When a cold start is performed, this EEPROM data is read out and stored on hard disk. During normal operation, the data set stored on hard disk is always used.

In order to synchronize the data stored in EEPROMs on the respective modules with the complete instrument, a cold start must be performed after each module replacement so that the module data will be updated.

The complete contents of the new module are read from the EERPOM and copied to the hard disk of the R&S FSQ. The existing calibration data (results from the latest total calibration) are deleted and the instruments displays UNCAL. Thus, the R&S FSQ must always be calibrated again after a module is replaced (softkey *CAL TOTAL*).

After a full calibration has been completed successfully, a backup of the EEPROM files to hard disk must be performed using a service function.

Settings on the R&S FSQ:

- [**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 copied back to the EEPROM:

Settings on the R&S FSQ:

- [**SETUP :** SERVICE : SERVICE FUNCTION : **3.0.7 ENTER**]

If an option module is removed from an instrument (downgrade), the EEPROM file associated with the module as well as any ".bak" file(s) present under path D:\r_s\instr\eeprom\ and C:\r_s\instr\eeprom\backup must be deleted.

2.4 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 *R&S FSQ-FRQ*.

3 Repair

This chapter describes the design of the R&S FSQ, simple measures for repair and troubleshooting and the replacement of modules. For troubleshooting and diagnostics, a selftest is available that can be used to poll diagnostic voltages of the modules and signal limit violations.

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

3.1 Instrument Design and Function Description

A detailed schematic of the R&S FSQ design is presented in the block diagrams below and in the exploded views (see also chapter 5).

The following description of instrument functions refers to the block diagram.

3.1.1 Block Diagram

See also chapter 5 illustrations for a detailed block diagram.

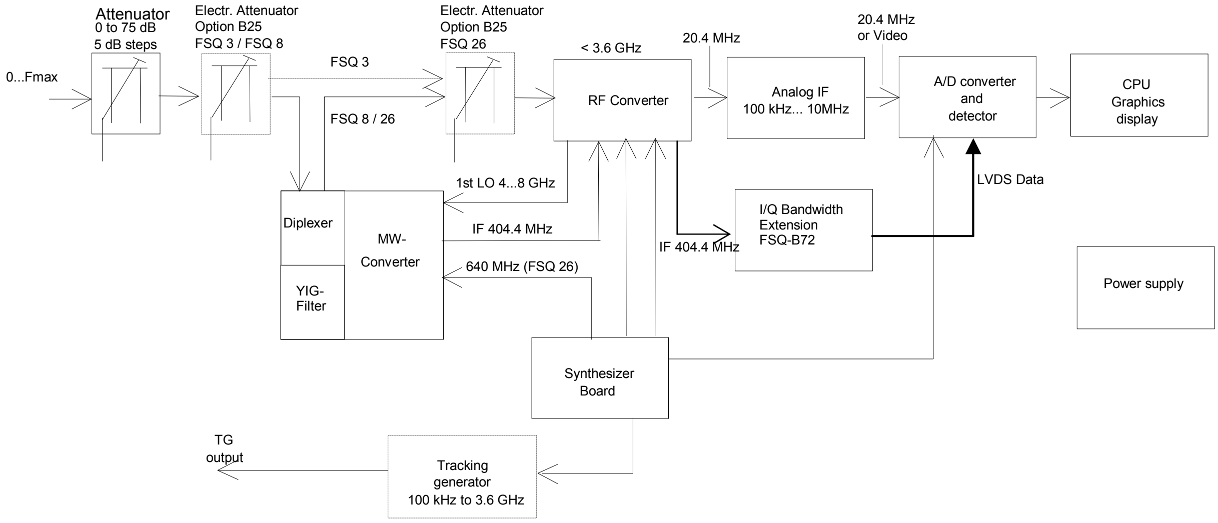


Fig. 3-1 Block diagram of instrument

3.1.2 Description of Block Diagram

The R&S FSQ is a triple-conversion superhet receiver (double-conversion for receive frequencies >3.6 GHz) for the frequency range 20 Hz to 3.6 GHz, 8 GHz, 26.5 or 40 GHz (depending on the instrument model). The signals are processed by one RF board (two for models > 3.6 GHz), one IF board, one signal detection board and a controller consisting of a Pentium industry 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 R&S FSU-B25 (electronic attenuator), this module follows in the signal path. In 3.6 GHz models, the attenuator is followed by the RF converter; in the high-frequency models, a diplexer is connected in between. The high-frequency signal component >3.6 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 synthesizer board. Here the 128 MHz reference frequency is generated 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.

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

3.1.2.1 Attenuator

The RF signal passes from the input connector via the input switch to the attenuator, which can be set. 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. Different attenuators are used: the 8 GHz attenuator in the R&S FSQ3 and R&S R&S FSQ8, and the microwave attenuators up to 26 GHz or 46 GHz. All attenuators switch in steps of 5 dB and have maximum total attenuation of 75 dB; the 8 and 26 GHz attenuators contain an AC coupling that can be bypassed. The lower limit frequency of AC coupling is 1 MHz with the 8 GHz attenuator and < 10 MHz with the attenuator in the R&S R&S FSQ 26; models > 26 GHz are permanently DC-coupled.

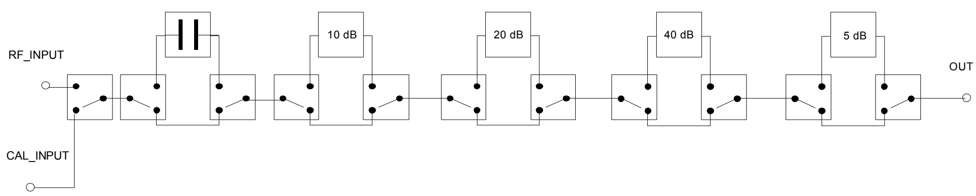


Fig. 3-2 Input attenuator

3.1.2.2 Electronic Attenuator (Option R&S FSU-B25)

The electronic attenuator is inserted in the signal path after the attenuator. It consists of a mechanical 5 dB attenuator pad, an electronic input attenuator, which can be switched from 0 to 30 dB in steps of 5 dB, and a switchable 20 dB preamplifier to reduce the noise figure of the R&S FSQ.

3.1.2.3 RF to IF Conversion for Frequencies < 3.6 GHz – RF Converter

The RF converter is used to convert the signal in the reception range from 20 Hz to 3.6 GHz to a low intermediate frequency of 20.4 MHz.

The balanced input mixer first converts the input signal to an intermediate frequency of approx. 4.63 GHz. The symmetric design reduces second-order intermodulation.

The first local oscillator in the frequency range 4.63 to 8.23 GHz is implemented with a YIG-tuned oscillator. This oscillator is synchronized via several dividers to the signal from the synthesizer module (600 to 620 MHz). The balanced output of the first mixer is amplified with two bipolar transistors to prevent 1/f noise. This balanced signal is fed to a three-stage filter with dielectric resonators. Flatness and group delay of the filter are optimized for broadband vector analysis in a bandwidth of 30 MHz. The filter feeds a second mixer, which converts the signal to the second IF of 404.4 MHz. The balanced output is amplified with two amplifiers to reduce intermodulation products. The output signals from the two amplifiers are combined in a transformer to form an unbalanced signal. Due to the symmetric design, there is no need for transformers in the mixers so that the conversion loss is reduced.

The second IF can be filtered to a bandwidth of 10 or 20 MHz using two five-stage filters with ceramic resonators. A bypass for a 50 MHz bandwidth (= 3 dB bandwidth of the first IF filter) can be selected also. The signal is fed to the third mixer via an attenuator pad that can be switched in steps of 1 dB. With 30 MHz FFT span, the K2 of the 3rd mixer causes spurious noise within the band. Therefore, the level has to be reduced before this mixer stage if high input levels are used (> -25 dBm). The attenuator can also be used to drive the input mixer up to +10 dBm, thus allowing a better dynamic range in phase noise or spurious measurements with a large carrier offset (> 1 MHz).

Fast overload detectors are used to detect compression in the stages of the first and second intermediate frequencies. The bandwidth of these detectors is above 100 MHz so that pulse signals can be detected as well with a preselector of the same width. The output signal of the detector on the second IF is also used with a logarithmic amplifier as an RF power trigger with a dynamic range of 70 dB.

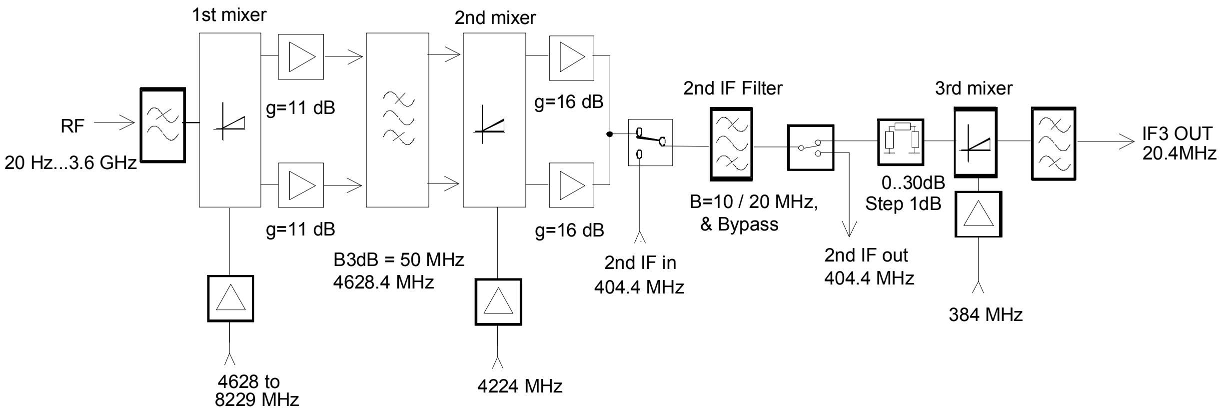


Fig. 3-3 Conversion of the RF to the third IF from 20 Hz to 3.6 GHz

3.1.2.4 RF to IF Conversion for Frequencies > 3.6 GHz - MW Converter

The high-frequency models of the R&S FSQ (frequency range > 3.6 GHz) also comprise a microwave converter board. After the RF attenuator, the input signals are fed to the microwave converter and split up in the diplexer to frequencies below 3.6 GHz and above 3.6 GHz. Signals below 3.6 GHz are forwarded to the RF converter like in the R&S FSQ. Signals above 3.6 GHz are taken via the YIG filter to the mixer, where they are directly converted to the 2nd IF of 404.4 MHz. In the range >26 GHz, the signals are converted to the 404.4 MHz IF in two stages. The YIG filter can be bypassed by means of a relay.

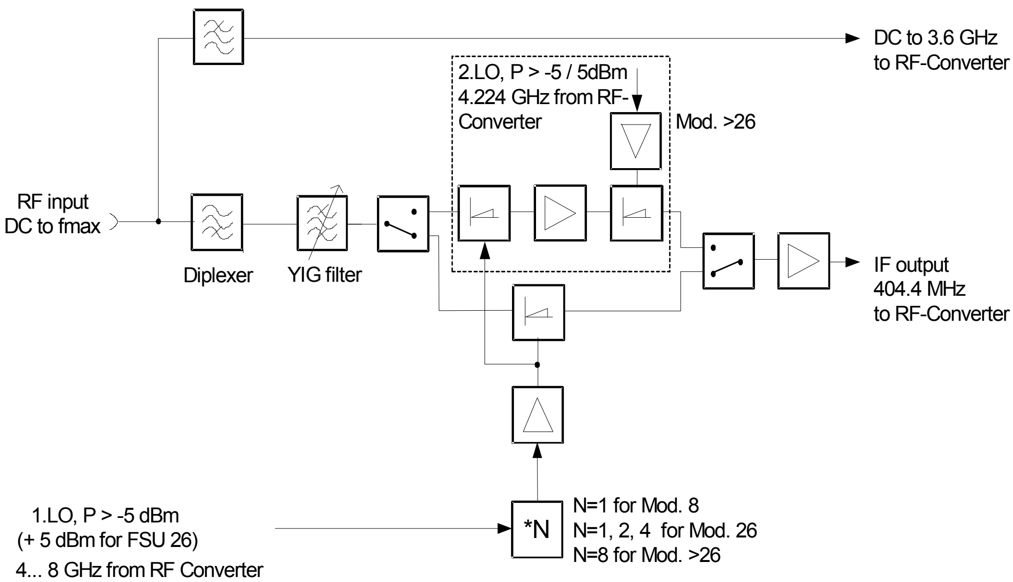


Fig. 3-4 Conversion of the RF to the IF from 3.6 GHz

The first LO converts the input frequency to the 404.4 MHz IF. For this purpose, the LO signal (4 GHz to 8 GHz) generated in the RF converter is amplified to the required LO level. The R&S FSQ26 has two additional doubler stages that can be bypassed and generate the LO signal for conversion to 26.5 GHz. Models >26 GHz have an additional doubler stage. The eight-way LO converts the signals to an initial IF of 3819.6 MHz or 4628.4 MHz. The second LO then converts the signal to the 404.4 MHz IF.

The basic model is equipped with the necessary interfaces (IF input 404.4 MHz, LO output 4 to 7.6 GHz) for extending the frequency range by simply adding a microwave converter.

3.1.2.5 IF Filter Module

The RF converter is followed by the analog IF filter module:

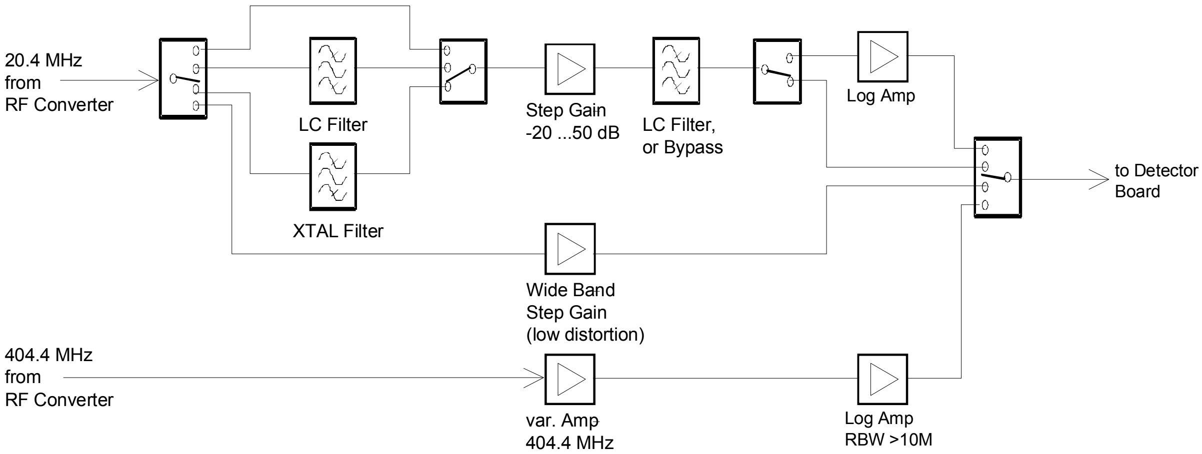


Fig. 3-5 IF filter

The R&S FSQ offers resolution bandwidths from 1 Hz to 20 MHz in steps of 1/2/3/5. For the bandwidths above 5 MHz, the selection filter is provided in the RF converter. There is no selection at the 20.4 IF; a logarithmic amplification to 404.4 MHz is performed.

The tunable bandwidths 100 kHz to 5 MHz are at the 3rd IF (20.4 MHz) on the IF filter module. The bandwidths 100 kHz to 5 MHz are provided by 5 LC circuits.

The step gain can be set from -20 to 50 dB in 0.1 dB steps and is adjusted as a function of the reference level and the input attenuation.

The IF filters are followed by a log detector to obtain the dynamic range of the display.

A limiting amplifier in the log amp provides the TTL output for the frequency counter.

With a 10 bandwidth, the LC filters are bypassed; however, step gain and log amp are used as with the analog bandwidths between 200 kHz and 5 MHz.

For the digital resolution filters from 10 Hz to 100 kHz, the 20.4 MHz IF signal at the IF filter output is routed to the A/D converter. With bandwidths below or equal to 30 kHz, a two-stage crystal filter is used to prevent the step gain and the ADC from being overdriven. This filter can be tuned from about 2.5 to 70 kHz in bandwidth. With the bandwidths 50 kHz and 100 kHz, the LC filter is set to about 400 kHz for the same reason.

An additional path without any filtering is used for the broadband vector analysis. The step gain is optimized for low distortion; as with a bandwidth of 30 MHz at a center frequency of 20.4 MHz, the harmonics of the IF are also present at the input of the ADC.

The R&S FSQ contains an AM/FM demodulator on the IF filter. In the spectrum analysis mode, the signal applied at the position of the reference marker can be demodulated during the sweep. For this purpose, the R&S FSQ stops the frequency sweep for a selectable period of time and demodulates the input signal. The volume is set using the rotary knob on the front panel (AF OUTPUT). The demodulator bandwidth corresponds to that of the input filter in the case of digital filters. To ensure good reception, the 30-kHz filter should be used, with the filter preceding the demodulator being at approx. 70 kHz.

3.1.2.6 Processing of Measured Data - Detector Board

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

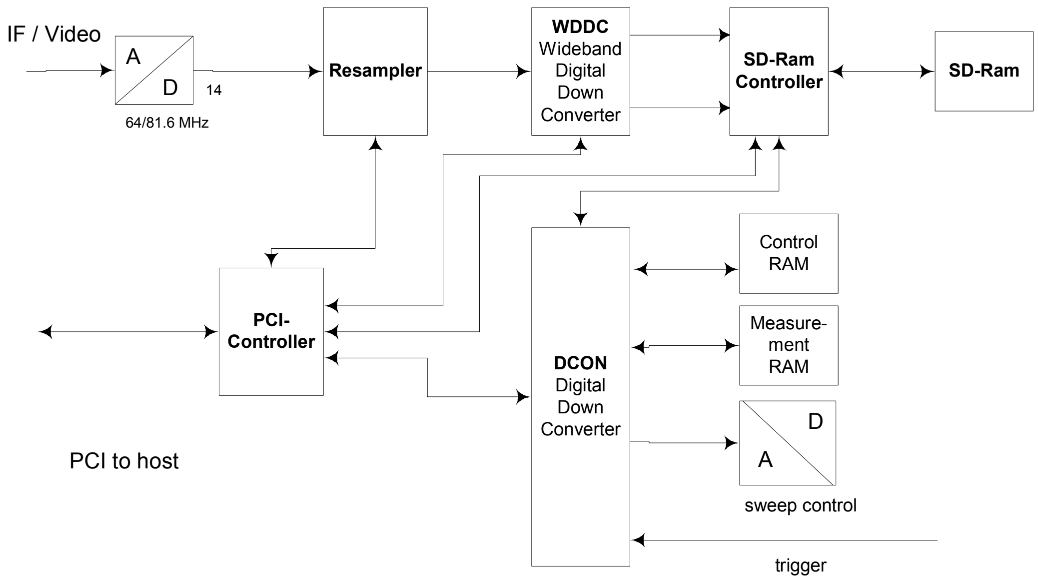


Fig. 3-6 Processing of measured data

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 64 MHz in the ADC and digitized.

The signal path is now directly routed to DCON.

In the DCON, the data is 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 max. peak, min. peak, sample, average, RMS and quasi peak values are determined.

With measurement data rates > 1 MHz, detector data has 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 is 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 WDDC (wideband digital down converter). The IF filter module provides an IF signal pre-filtered at 20.4 MHz. The WDDC mixes the input signal into the complex baseband using an NCO, and then filters the obtained I/Q signal via an HDF (high decimation filter) and an FIR (finite impulse response) filter. The magnitude and phase are calculated from the I/Q data and transferred to a second gate array in the DCON. As in operating mode RBW > 100 kHz, the signal is video-filtered and weighted depending on the set detector.

FFT Bandwidths

In 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 WDDC. The WDDC first mixes the input IF into the baseband using an NCO; 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 is then transferred by the WDDC to the SDRAM controller, which stores the data in SDRAM1 or SDRAM2. With data logging completed the I/Q data from the SDRAM controller is fetched from the SDRAM, transferred to the PCI interface, which transmits the I/Q data to the memory of the host. The host then performs the FFT for this sweep section.

Video Bandwidths (VBW)

The video filters of the R&S can be adjusted between 1 Hz and 10 MHz in steps of 1/2/3/5. 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 R&S FSQ 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.

3.1.2.7 1st Local Oscillator- RF Converter

The 1st local oscillator is a YIG oscillator on the RF converter. It is synchronized via a fractional N divider to the synthesizer signal of 600 to 620 MHz or 20 to 40 MHz. This signal can be set with very high resolution in steps of less than MHz. With 20 to 40 MHz, a whole octave can be swept with one divider setting. This setting is used with a fast sweep time over big spans. The 600 MHz setting is used with spans below 200 MHz because of the better phase noise.

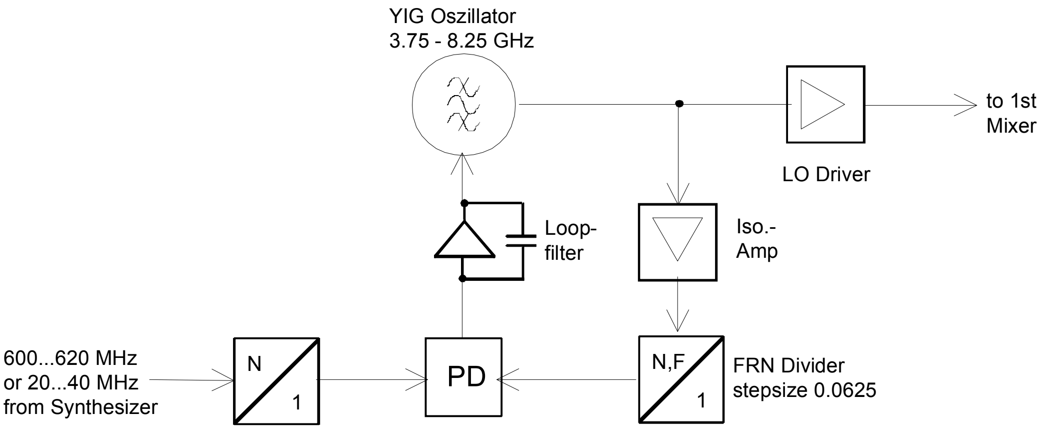


Fig. 3-7 Synchronization of 1st local oscillator

3.1.2.8 2nd Local Oscillator - Synthesizer

The second local oscillator is a DRO (dielectric resonator oscillator) on the synthesizer board at 4224 MHz. This oscillator is synchronized to a harmonic of the 3rd LO (384 MHz). This type of oscillator features excellent phase noise values.

3.1.2.9 3rd Local Oscillator- Synthesizer

The third oscillator is a VCO with ceramic resonator, which is synchronized via a mixer to the third harmonic of the crystal oscillator at 128 MHz.

3.1.2.10 Reference Frequency 128 MHz – Synthesizer

This reference is generated on the synthesizer board. To ensure perfect phase noise performance, an SC cut crystal is used as a resonator. The oscillator is synchronized with a bandwidth of approx. 30 Hz to the internal 10 MHz reference or to an external reference.

Harmonics of this signal are used for the synchronization of the 3rd local oscillator and the sweep oscillator 600 to 620 MHz.

It is also used to generate the 128 calibration signal via automatic level control. The level can be switched between 0 dBm and -30 dBm and adjusted with a D/A converter.

A 4:1 divider generates the 32 MHz clock for the detector board (A/D converter).

3.1.2.11 Reference Frequency 10 MHz – Synthesizer

The reference frequency is generated by an OCXO, and the frequency is adjustable by a D/A converter. If the external reference input is used, this OCXO is switched off and the external signal is used instead.

3.1.2.12 OCXO Reference (Option R&S FSU-B4)

The R&S FSQ contains the option R&S FSU-B4, an oven-controlled reference oscillator with extra low aging and improved phase noise at 10 Hz offset. If the option is installed, this OCXO is used instead of the OCXO on the synthesizer board. If an external reference is used, both OCXOs are switched off. The heater of the B4 option stays on.

3.1.2.13 Sweep VCO - Synthesizer

The sweep VCO on the synthesizer board is used to synchronize the YIG oscillator on the RF converter. An oscillator with ceramic resonator at approx. 600 MHz is used. This VCO can be tuned over quite a small range of about 20 MHz for good phase noise performance. A bigger tuning range would reduce the quality factor of the resonator. The oscillator is mixed with a comb line of the 128 crystal oscillator to an IF between 20 and 40 MHz. Via this IF, the VCO is synchronized to a digitally generated signal from a fractional N divider. This signal can be tuned in steps of smaller than 1 MHz in frequency. For small spans with a good phase-noise performance, the YIG oscillator is synchronized to the VCO, for fast sweeps and a big span to the IF.

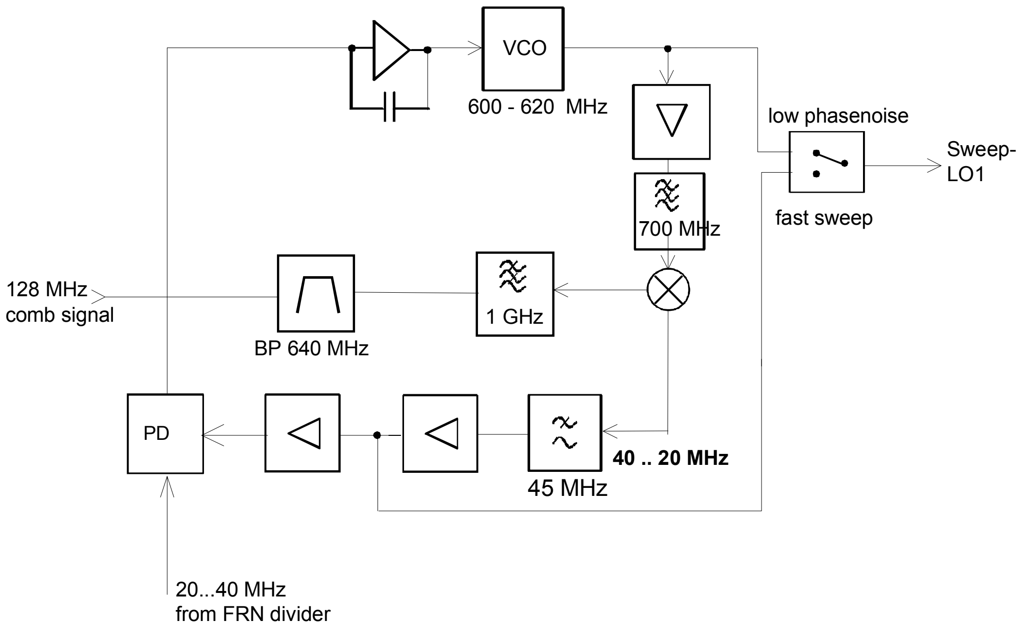


Fig. 3-8 Sweep synthesizer

3.1.2.14 Front Panel

The front panel consists of a mounting plate that accommodates the LCD, the keyboard mat with the membrane and the rotary knob. The case panel incorporates the front-module controller.

3.1.2.15 LCD

The colour LCD provides visible output of any information, measurements, etc, to the user. The resolution of the LCD is 800 * 600 pixels (SVGA).

The display includes a cold cathode tube for 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.

3.1.2.16 Keyboard

The keyboard consisting of a keyboard mat and a membrane releases a contact when the rubber key is pressed. Two LEDs for the STANDBY/ON key (yellow for STANDBY/green for ON) are also accommodated on this membrane.

The key evaluation and LED control are carried out via a film cable connector on the controller board. Like the control of the two LEDs, control is performed in a special microprocessor on the controller board by means of a matrix technique. This microprocessor permits the status of the STANDBY/ON key to be stored when switch-off is performed with the power switch.

3.1.2.17 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/IEEE-bus controller, 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.

The LAN interface is also integrated on the controller board of the FMR6.

3.1.2.18 Hard disk

The hard disk is screwed to the rear panel of the front module controller and connected to the printed circuit board via serial ATA cable.

3.1.2.19 Power Supply Module

The power supply module provides all currents necessary for operating the R&S FSQ. 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 operating key STANDBY/ON on the front of the instrument frame) activates the power supply. In standby operation, it only supplies the 12 V 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 over-temperature protective circuit is additionally installed to prevent overheating. The status is taken to the front module controller via a status signal (*OT*).

3.1.2.20 Fuses

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

Note:

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

3.1.2.21 Motherboard

The motherboard generates the -6 V supply for the analog boards with an integrated DC/DC converter.

The noise source output (28 V noise source) is also generated on this board.

All external supplies (probe, keyboard, etc) are short-circuit-protected by polyswitches (current-dependent, self-opening and closing fuses).

On the motherboard, a circuit for temperature-dependent instrument fan control is also implemented.

Probe Board

The probe PCB is located at the front of the instrument frame and accommodates PROBE POWER connector. For connection with the motherboard, a ribbon cable is used.

Volume / Phones

The volume/phones board is located on the front mounting plate and accommodates the external interfaces PHONES (headphones connector) and the volume control (rotary encoder) for the AF demodulator.

For connection with the motherboard, a ribbon cable is used.

Tracking Generator (Option FSU-B9)

In normal operation (no frequency offset), the tracking generator generates a signal exactly at the input frequency of the R&S R&S FSQ in the frequency range up to 3.6 GHz.

To support frequency-converting measurements, a constant frequency offset of ±200 MHz between the input frequency of the R&S   R&S FSQ and the output signal of the tracking generator can be set. In addition, I/Q modulation or AM or FM of the output signal can be performed using two analog input signals.

The output level is controlled and can be adjusted between -30 dBm and 0 dBm in 0.1 dB steps (between -100 dBm and + 5 dBm with the option R&S FSU-B12).

External Generator Control (Option R&S FSP-B10)

The external generator control option permits a number of commercially available generators to be operated as tracking generators on the R&S FSQ. The generator is controlled via the – optional – second IEC bus interface of the R&S FSQ (= IEC2, supplied together with the option); with some Rohde & Schwarz generators, it can also be controlled via the TTL synchronization interface included in the AUX interface of the R&S FSQ.

Removable Hard Disk (Option R&S FSQ–B18)

If the option R&S FSQ-B18 is used, a removable flash disk can be substituted for the hard disk in the instrument. The compact flash board contains a connector for a compact flash card of type 1 and one connector for a link to the serial ATA interface of the front module processor.

External Mixer Port (Option R&S FSU-B21)

The external mixer port option enables the R&S FSQ (model 26 or later) to be operated with external mixers to extend the frequency range. The option consists of a module that provides the LO output (7 GHz to 15.2 GHz) and an IF input (404.4 MHz) for the external mixer.

Preamplifier 26.5 GHz (Option R&S FSQ-B23)

A connectible preamplifier can be used to improve the noise figure of the R&S R&S FSQ26 above 3.6 GHz. The preamplifier is integrated in the micro converter module and is thus only available directly from the factory.

I/Q Bandbreiten-Erweiterung (Option R&S FSQ-B72)

The second IF (404.4 MHz) is sampled with 326.4 MHz. The data is transferred to the detector board via an LVDS connection, where it is written into the memory. The bandwidth is 120 MHz in the frequency range >3.6 GHz. In the frequency range ≤3.6 GHz, the bandwidth is limited to 60 MHz due to the IF filter in the RF converter.

3.2 Module Replacement

This section describes in detail the replacement of modules. Chapter 5 provides information on how to order spare parts; it contains the list of mechanical parts with order numbers and the illustrations for board replacement.

The numbers indicated in brackets refer to the item position in the list of mechanical parts in chapter 5.

1313.9100 (R&S FSQ Basic Model, items 10-510),

1166.1677 (Dig. Basic Unit, items 501-776),

1093.4708 (Display Unit, items 805-1000),

1144.9017 (option R&S FSU-B4, items 1100-1120).

1162.9921 (option R&S FSP-B28, items 1360-1380)

1144.9300 (option R&S FSU-B25, items 1400-1460)

1308.1986 (option R&S FSU-B18, items 1502-1610)

1129.7317 (option R&S FSP-B10, items 1610-1665)

1142.9090 (option R&S FSU-B9, items 1800-1940)

1130.2544 (8 GHz MW Converter, items 2001-2050)

1130.2815 (RELAY UNIT 8 GHz, items 2060-2080)

1166.2338 (≥26.5 GHz MW Converter , items 2100-2225)

1166.2338 (option R&S FSQ-B23, items 2106)

1130.3405 (RELAY UNIT 26,5 GHz, items 2300-2345)

1142.9361 (option R&S FSU-B12, items 2400-2445)

1157.0136 (option R&S FSQ-B71, items 2700-2780)

1157.1110 (option R&S FSU-B21, items. 2901-2980)

1130.4982 (MW-Converter Unit 40 GHz, items 3101-3295)

1155.5147.01 (Relay Unit 40 GHz, items 3400-3470)

1157.0488 (option R&S FSQ-B72 version 12, items 3705-3796)

1157.2116 (option R&S ESU-B24, items 4550-4615)

1169.5280 (option R&S FSQ-B100, items 4700-4780)

1169.5450 (option R&S FSQ-B102, item 4850)

1163.0063 (option R&S FSQ-B17, IQ data in/out, items 5000-5085)

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

3.2.1 Performing a Cold Start

A cold start has to be performed as described below each time a module containing an EEPROM has been replaced.

► Connect the power cable and press the power switch.

► While the ON key is pressed, the decimal point key must be pressed and held down until the computer responds with a beep.

After this, Windows XP starts the device firmware.

3.2.2 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		BIOS update
Lithium battery	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot
Hard disk	SYSTEM MESSAGES/ SELFTEST / CAL	I/Q frequency response (with B72)	Cold boot / FW update
LCD / DC/AC-converter			
Keyboard membrane or mat			
Power supply	SYSTEM MESSAGES/ SELFTEST / CAL		
Fan			
RF input connector	SELFTEST / CAL	Frequency response	
Motherboard	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot EEPROM entry
RF attenuator	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response with B72 additional I/Q frequency response	Cold boot
Probe Board and vol./phone	Voltage / volume		
RF Converter	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response with B72 additional I/Q frequency response	Cold boot
Detector	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot

Module	Required tests and adjustments after replacement		
	Function tests and system error correction	Adjustment	Other
IF filter	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency accuracy/ cal. source	Cold boot
MW Converter	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency accuracy/ frequency response	Cold boot
OCXO B4	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency accuracy	Cold boot
External Generator Control R&S FSP-B10	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot
Removable HD B18	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot / FW update
Electr. Attenuator -B25	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
Baseband Inputs -B71	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot
Tracking Generator -B9	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
Attenuator for Generator -B12	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot
External Mixer -B21	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
Preamplifier 26.5 GHz -B23	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
Bandwith Extension B72	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
Preamplifier B24	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
Memory Extension B100	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot
Memory Extension B102	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot
I/Q Data In/Out B17	SYSTEM MESSAGES/ SELFTEST / CAL		

3.2.3 Replacing Front Module Controller A90

(see chapter 5, spare parts list, item 573 and illustrations 1313.9100 and 1166.1677)

The front module controller is mounted behind the front panel.

Opening Instrument and Removing Front Panel

► Switch off the instrument and pull the mains plug.

► Undo the 4 screws (430) on the front handles on both sides and take off the front handles.

► Pull off the front cover (for example 270) towards the front.

- Undo 2 countersunk screws (610) in the front frame, at the top and at the bottom.
- Remove the front panel with keyboard and display (602, 970, 980, 990, 650, 1000) towards the front and turn it toward the top of the instrument.

CAUTION

Note that the connecting cables are still connected to the controller.

- Disconnect the connecting cables to the LCD, DC/AC illumination converter, keyboard membrane, rotary knob and, if required, network connector.

  Note:

  When removing the connecting cables, be careful with the cable connecting the keyboard. It is a film cable that can only be disconnected after sliding up the lock of the film cable plug.

Removing Front Module Controller

- Undo the 10 screws with washers (590) of the front module controller board and take out the front module controller as follows (see also Fig. 3-9):

CAUTION

Do not insert the tool too far into the slots and press only against the PC board !

To pull out the board, carefully it pry off at all slots alternately. The board must not be bent!

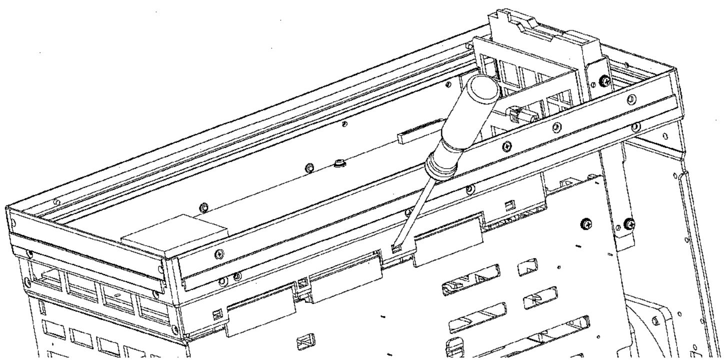


Fig. 3-9 Removing the front module controller

Installing New Front Module Controller and Completing Instrument

► Remove the additional RAM (574) from the old controller and mount it to the new controller.

► Carefully plug the new front module controller to the motherboard and fasten it in place using the 10 screws with washers (590).

Caution: Short-circuits might occur between controller components, lines and screws (590) on the FMR7, 1091.3104.00. Place an insulating mat underneath!

► Carefully plug the cable connectors to the controller board, taking care not to reverse the polarities.

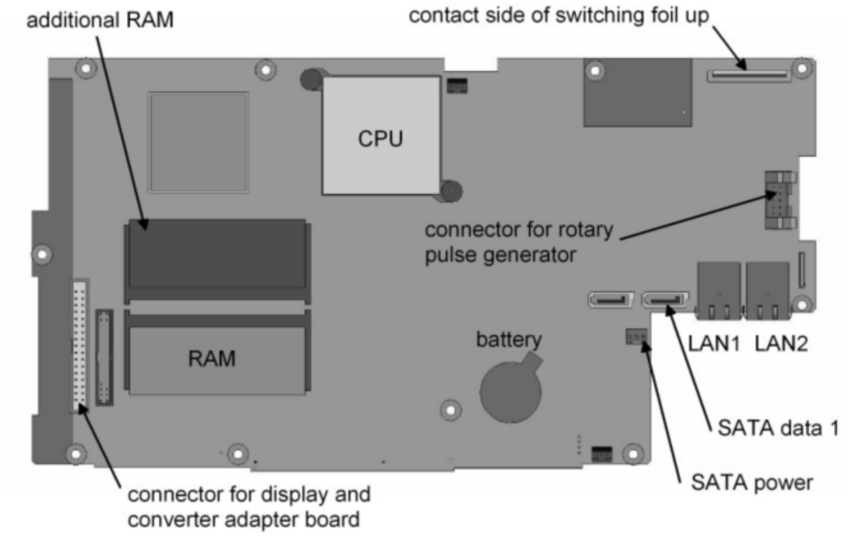


Fig. 3-10 Position of connectors on front module controller

► Rotate the front panel into the R&S FSQ and fasten in place using 4 countersunk screws (610) in the front frame.

CAUTION

Make sure to route the cables properly.

► Install the front cover (for example 270).

► Mount the 2 front handles (420) on the instrument using the 4 screws (430).

Putting Instrument into Operation

► Connect the instrument to AC supply and switch on the power switch. The instrument is now in stand-by mode.

- ► BIOS Update: 1. You can download the BIOS image from Gloris, section "Firmware/Software". 2. Select "FW by type" and choose "R&S FSQ". 3. Follow the instructions in the PDF file on how to create the boot CD-ROM.
- ► After starting the instrument, check the log file for system messages:

  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the selftest and check results:

  - [**SETUP** : SERVICE : SELFTEST] , then [SELFTEST RESULT]
- ► Start total calibration and check the results:

  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]

3.2.4 Replacing Lithium Battery on Front Module Controller

(see chapter 5, spare parts list, item 776 and illustrations 1313.9100 and 1166.1677)

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 a danger of explosion. Only replace the battery by an R&S type (see chapter 5, spare parts list, item 776 for type FMR6).

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

Opening Instrument and Removing Front Panel

- ► Switch off the instrument and pull the mains plug.
- ► Undo the 4 screws (430) on the front handles on both sides and take off the front handles.
- ► Pull off the front cover (for example 270) towards the front.
- ► Undo 2 countersunk screws (610) in the front frame at the top and at the bottom.
- ► Remove the front panel with keyboard and display (602, 970, 980, 990, 650, 1000) towards the front and rotate it to the top of the instrument.

⚠ CAUTION

Note that the connecting cables are still connected to the controller.

► Disconnect the cables to the LCD, DC/AC illumination converter, keyboard membrane and rotary knob and, if required, network connector from the front module controller.

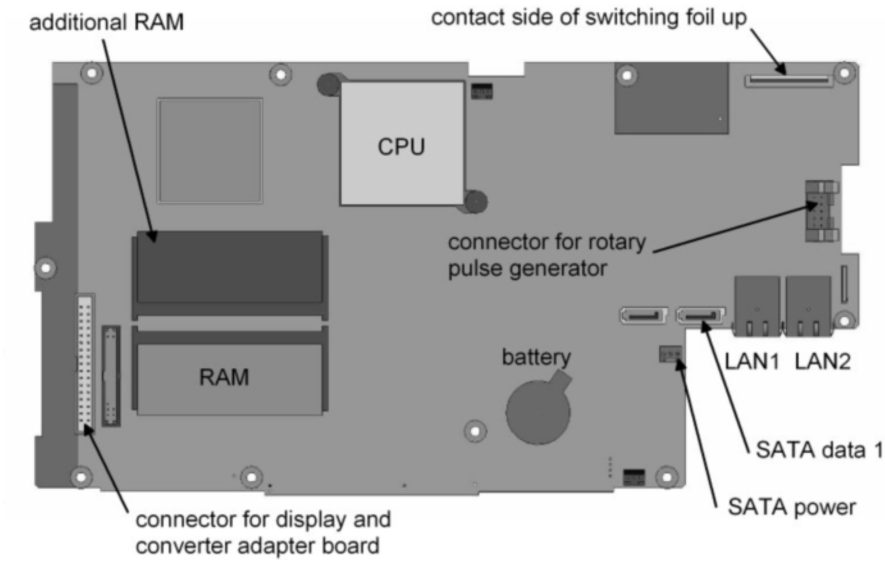


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Fig. 3-11 Position of lithium battery on front module controller

Installing New Battery and Completing Instrument

⚠ CAUTION

Do not short-circuit the battery.

► Insert battery into holder below the spring.

Note: The positive pole (+) of the battery points up.

► Rotate the front panel back into the R&S FSQ and fasten in place using 4 countersunk screws (610) in the front frame.

CAUTION

Make sure to route the cables properly.

- ► Install the front cover (for example 270).
- ► Mount the 2 front handles (420) again using the 4 screws (430).

Putting Instrument into Operation

- ► Connect the instrument to the AC supply and switch on the power switch. The instrument is now in the stand-by mode.
- ► After battery replacement, a cold boot is required. See section "Performing a Cold Start".
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check the result:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]

3.2.5 Replacing Hard Disk A60

(see chapter 5, spare parts list, item 712, and illustrations 1313.9100 and 1166.1677)

The S-ATA hard disk is located between the front module and the boards.

The spare part contains the complete software.

Before removal:

Frequency response data for option R&S FSQ-B72 (I/Q bandwidth extension)

If the R&S FSQ-B72 option is installed, the correction data for the I/Q frequency response is located on the hard disk in the following file:

D:\r_s.fw\instr\eeprom\cal\cal_freq_resp_b72.bin

If possible, this file should be saved (copied to floppy disk) and, after the hard disk is replaced, copied to the same directory on the new hard disk

In case the file can no longer be copied, the I/Q frequency response correction must be remeasured as described in the following:

Opening Instrument and Replacing Hard Disk

- ► Switch off the instrument, disconnect the AC supply plug, unscrew the 4 rear-panel feet (450) and pull off the enclosure (410) towards the back.
- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- ► Disconnect the SATA data cable (721) and the SATA power cable (722) at the hard disk.
- ► Undo the 2 countersunk screws (740) on the hard disk mounting plate (730).
- ► Take the hard disk (710) with the mounting plate (730) out of the R&S FSQ.
- ► Undo the 4 countersunk screws (750), remove the hard disk and mount a new hard disk to the mounting plate (730).

Installing New Hard Disk and Putting Instrument into Operation

- ► Mount the hard disk with the mounting plate into the instrument using 2 screws (740).
- ► **Note:** Be careful with the lower cover plate locking in the provided opening.
- ► Connect the SATA data cable (721) and the SATA power cable (722) to the hard disk.
- ► **Note:** Connect cable according to illustration 1166.1677 in chapter 5 .
- ► Place the top cover (240) onto the instrument and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Mount the enclosure (410) and fasten the 4 rear-panel feet (450) using screws.
- ► Connect the instrument to the AC supply and switch on the power switch. The instrument is now in the stand-by mode.
- ► After replacement of the hard disk, a cold boot is required. See section "Performing a Cold Start".

Without option R&S FSQ-B72:

- ► After starting the instrument, check the log file for system messages:

  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- ► Perform a firmware update to actual version if necessary. See section "Software Update/Installing Options".
- ► Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check the results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]

With Option R&S FSQ-B72:

a) I/Q frequency response file "cal_freq_resp_b72.bin "available:

- ► Copy the file to the directory D:\r_s.fw\instr\eeprom\cal.
- ► Switch the instrument off and then on again.
- ► After starting the instrument, check the log file to ensure that no errors occurred:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]
- ► Start selftest and check the result to ensure that no errors occurred:
  - [**SETUP** : SERVICE : SELFTEST], subsequently [SELFTEST RESULT]
- ► Start system error correction and check the result to ensure that no errors occurred:
  - [**CAL** : CAL TOTAL] , subsequently [CAL RESULTS]

b) I/Q frequency response file "cal_freq_resp_b72.bin" not available:

- ► Start selftest and check the result to ensure that no errors occurred:
  - [**SETUP** : SERVICE : SELFTEST], subsequently [SELFTEST RESULT]
- ► Start system error correction and check the result to ensure that no errors occurred:
- ► Run "I/Q Response Correction" software.
  <u>Do not run this software until after the system error correction reveals no errors (Total Calibration Status: Passed)!</u>
  The software and the associated manual are located on the GLORIS server under Firmware/Software → R&S FSQ-B72 (test setup, see manual).
- ► Switch the instrument off and then on again.
- ► After starting the instrument, check the log file to ensure that no errors occurred:

Note:
Every time the instrument is started without a valid I/Q frequency response file, the message "Error at reading B72 ext. freq. response fil" is entered in the log file.

3.2.6 Replacing LCD, DC/AC Converter and LST Adapter in Front Module

(see chapter 5, spare parts list, items 602, 923, 924, 872, 953 and illustrations 1313.9100, 1166.1677, 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 Instrument and Removing Front Module

- ► Switch off the instrument and pull the mains plug.
- ► Undo the 4 screws (430) of the front handles on both sides and take off the front handles.

- Pull off the front cover (for example 270) towards the front.
- Undo 2 countersunk screws (610) in the front frame at the top and at the bottom.
- Pull out the front module with keyboard and display (602, 970, 980, 990, 650, 1000) towards the front as far at it goes.

CAUTION

Note that the connecting cables are still connected to the controller.

- Disconnect the cables to the LCD, DC/AC illumination converter, keyboard membrane and rotary knob and, if required, network connector on the front module controller.

  Note:
  When removing the connecting cables, be careful with the cable connecting 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 with the keys onto a clean surface.

Removing LST Adapter Board

- Disconnect cable W31 LST Adapter – FMR (954) at LST Adapter Board (953).
- Disconnect inverter cable L=310 (908) at LST Adapter Board (953).
- Disconnect LST Adapter Board cable at the display (923 or 924).
- Unscrew 2 screws with washer (950) and remove the LST Adapter Board (953).

Removing DC/AC Converter

- Pull off the connecting cable from the display (923 or 924) to the DC/AC converter (872).
- Disconnect cable (908) to DC/AC converter (872).
- Remove the DC/AC converter (872) after undoing the 2 screws (892).

Removing LCD

- ► Unscrew 2 screws with washers (950) and lift up the LST-Adapter (953).
- ► Disconnect LST-Adapter (953) from the display (923 or 924).
- ► Undo the 4 screws with washers (930) and remove the display (923 or 924).

Installing New LCD, DC/AC Converter, LST Adapter and Putting into Operation

- ► To insert the new LCD, DC/AC converter and/or LST Adapter, proceed in the reverse order, connect all cables in the correct position and tighten all screws (drawing 1093.4708).
- ► Place the front panel with the keys on top of the instrument so that the cables can be connected to the front module controller.
- ► Carefully plug the cable connectors to the controller board without reversing the polarities.

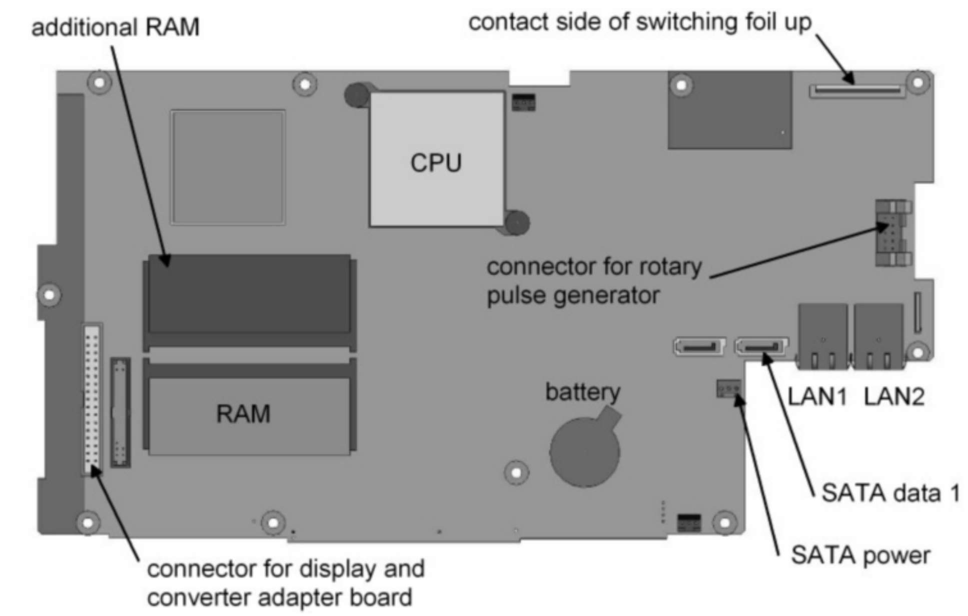


Fig. 3-12 Position of connectors on front module controller

- ► Rotate the front panel back into the instrument and fasten it in place using 4 countersunk screws (610) in the front frame.

CAUTION

Make sure to route the cables properly.

- ► Install the front cover (for example 270).

- ► Mount the 2 front handles (420) again using the 4 screws (430).
- ► Connect the instrument to the AC supply, switch on the power switch and press the ON key.

3.2.7 Replacing Keyboard Membrane or Mat on Front Module

(see chapter 5, spare parts list items 980 and 990, and illustrations 1313.9100, 1166.1677, 1093.4708).

The keyboard membrane is the contact film for the rubber keys (mat) behind the front cover and the keyboard frame.

3.2.7.1 Opening Instrument and Removing Front Panel

- ► Switch off the instrument and pull the mains plug.
- ► Undo the 4 screws (430) on the front handles on both sides and take off the front handles.
- ► Pull off the front cover (for example 270) towards the front.
- ► Undo 2 countersunk screws (610) in the front frame at the top and at the bottom.
- ► Pull out the front module with keyboard and display (602, 970, 980, 990, 650, 1000) towards the front and put it on top of the instrument with the keys facing the instrument.

CAUTION

The cables are still connected to the controller .

- ► Disconnect the connecting cables to the LCD, DC/AC illumination converter, keyboard membrane and rotary knob and, if required, the network connector.

  Note:
  When removing the cables, be careful with the cable connecting the keyboard. It is a film cable that can only be disconnected after sliding up the lock of the film cable plug.

3.2.7.2 Removing Membrane

- ► Place the front panel onto a clean surface with the keys pointing upwards.
- ► Pull off the knob (650) of the rotary knob.
- ► Undo the 10 countersunk screws (1000) and remove the keyboard frame (970).
- ► The keyboard membrane (990) as well as the mat (980) can now be replaced.

3.2.7.3 Installing New Membrane and Completing Instrument

► Insert the new mat (980) into the keyboard frame (970) from the back.

Note:
The pins of the mat must be inserted into the holes at the keyboard frame.

► Position the new keyboard membrane (990) on the back of the mat (980).

Note:
Push the foil cable of the membrane through the slot in the mounting panel.
The membrane must be positioned so that the pins of the mat are inserted into the holes in the membrane.

► Position the mounting plate with the display on the membrane (990).

Note:
The display must be positioned so that the pins of the mat are inserted in the holes in the mounting plate (805 or 806).

► Press the front panel together, turn the keys to the top and fasten in the keyboard frame using 14 countersunk screws (1000).

► Place the front panel with the keys on the top of the instrument so that the cables can be connected to the front module controller.

► Carefully plug the cable connectors to the controller board without reversing the polarities.

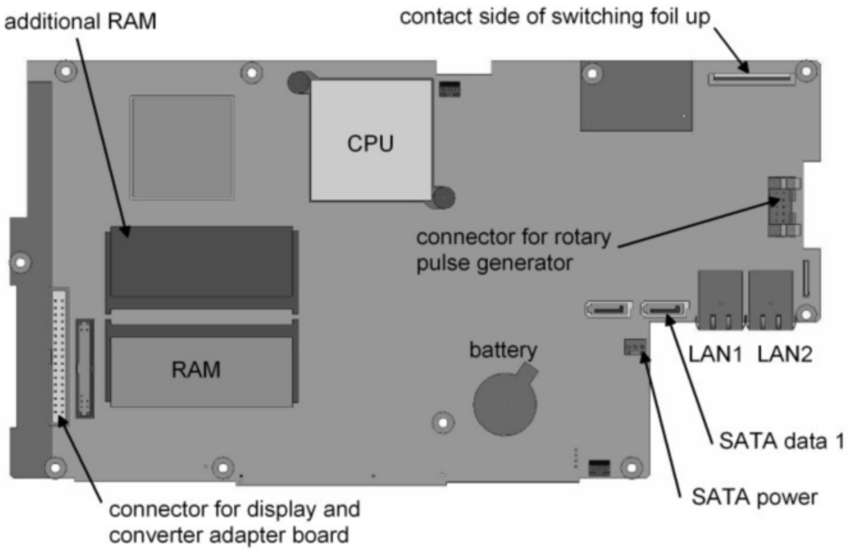


Fig. 3-13 Position of connectors on front module controller

► Rotate the front panel back into the R&S FSQ and fasten it in the front frame using 4 countersunk screws (610).

CAUTION

Make sure to route the cables properly.

- ► Install the front cover (for example 270).
- ► Mount the 2 front handles (420) using the 4 screws (430).
- ► Connect the instrument to the AC supply, switch on the power switch and press the ON key.

3.2.8 Replacing Front Cover on Front Module

(see chapter 5, spare parts list, items 270, 280, 290, 291, 292, and illustration *1313.9100*)

The front cover is the outer front panel that carries the labels. Each model has its own front cover.

- ► Switch off the instrument and pull the mains plug.
- ► Undo the 4 screws (430) on the front handles on both sides and take off the front handles.
- ► Pull off the front cover (for example 270) towards the front.
- ► Install the new front cover and reassemble the instrument in the reverse order.
- ► Connect the instrument to the AC supply, switch on the power switch and press the ON key.

3.2.9 Replacing Power Supply A20

(see chapter 5, spare parts list, item 550, and illustration *1166.1677*)

The power supply is installed at the rear of the instrument frame.

3.2.9.1 Removing Power Supply

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the rear.
- ► Undo the 10 screws (560) at the rear of the power supply.
- ► Pull out the power supply approx. 20 mm towards the rear, slightly tilt it towards the bottom and then pull it out completely.

3.2.9.2 Installing New Power Supply

- ► Place the instrument onto the front handles and install the new power supply in the reverse order.

  Note:
  Make sure that the 96-contact connector to the MOTHERBOARD locks in place correctly.

- ► Mount the enclosure (410) and the 4 rear-panel feet (450).
- ► Connect the instrument to the AC supply and switch it on.
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]

3.2.10 Replacing Fan E1

(see chapter 5, spare parts list, item 15, and illustration 1313.9100)

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

3.2.10.1 Opening Instrument and Removing Fan

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- ► Remove the fan (15) by loosening the 4 screws.
- ► Disconnect the fan cable at the motherboard connector X35 (FAN) .

3.2.10.2 Installing New Fan and Completing Instrument

- ► Connect the fan cable to the motherboard connector X35 (FAN)
- ► Mount the new fan using 4 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 cable so that it cannot get into the fan.

- ► Replace the instrument cover (240) on the top and fasten it in place using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).
- ► Connect the instrument to the AC supply, switch on the power switch and press the ON key.

3.2.11 Replacing RF Input Connector (Cable W1) R&S FSQ3/8

(see capter 5, spare parts list, item 295, and illustration 1313.9100)

The RF input connector is installed at the bottom right side of the front panel.

Depending on the frequency range, different cables W1 are available.

3.2.11.1 Opening Instrument and Removing Cable W1

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- ► Undo the 4 screws (430) on the front handles on both sides and take off the front handles.
- ► Pull off the front cover (270 or 280) towards the front.
- ► Remove 3 countersunk screws (70) at the frame and 4 countersunk screws (70) at the connector mounting plate (61).
- ► Unscrew the cable W1 (295) to 7 GHz at the RF attenuator (20).
- ► Remove the connector mounting plate (61) together with W1 and the Probe board (50) and vol./phone board (43) modules towards the front.

  Note:

  The probe board (50) and vol./phone board (43) modules are connected to X80,X81 on the motherboard by means of a flat cable.
- ► Undo the 4 countersunk screws (350) and remove cable W1 together with mounting plate (330) .

3.2.11.2 Installing New Cable and Completing Instrument

- ► Put the mounting plate (330) onto the new cable W1 and fasten it in place using 4 countersunk screws (350), insert the mounting plate (61) into the instrument and screw it to attenuator (20).
- ► Fix 3 countersunk screws (70) in the instrument frame and 4 countersunk screws (70) in the mounting plate (61).
- ► Install the front cover (270 or 280).
- ► Mount the 2 front handles (420) again using the 4 screws (430).
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).

- ► Connect the instrument to the AC supply, switch on the power switch and press the ON key.
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- ► Check frequency response according to chapter 1 and correct, if necessary.

3.2.12 Replacing RF INPUT Connector (Testport Adapter) R&S FSQ26

(see chapter 5, spare parts list, item 315, and illustration 1313.9100)

The input connector is at the bottom right of the front panel. Different connectors are used depending on the frequency range of the instrument.

Opening Instrument and Removing Testport Adapter

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the rear.
- ► Remove the 4 screws at the left and right front handles (430) and take off front handles.
- ► Pull off front cover (290) towards the front.
- ► Remove 3 countersunk screws (70) from frame and 4 countersunk screws (70) from mounting plate (61).
- ► Unscrew input cable W1 (316) from attenuator (25).
- ► Pull out mounting plate (61) together with cable W1 and the probe board (50) and vol./phone board (43) modules towards the front.

  Note:

  The probe board (50) and vol./phone board (43) modules are connected to X80, X81 on the motherboard by means of a flat cable.
- ► Remove cable W1 together with mounting plate (340) after undoing 4 countersunk screws (350).
- ► Unscrew testport adapter (315) from cable W1 (316).

Installing Testport Adapter and Completing Instrument

- ► Screw new testport adapter (315) to cable W1 (316).
- ► Connect mounting plate (340) to cable W1, fasten it with 4 countersunk screws (350), fit it into the instrument together with mounting plate (61) and screw it to the attenuator (25).

- ► Fasten mounting plate (61) to instrument frame with 3 countersunk screws (70) and to mounting plate (61) with 4 countersunk screws (70).
- ► Install the front cover (290).
- ► Remount the 2 front handles (420) by means of 4 screws.
- ► Slide on enclosure (410) and screw on the 4 rear-panel feet (450).
- ► Connect the AC supply cable, switch on power switch and press the ON key.
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- ► Check frequency response as described in Chapter 1 and correct it, if required.

3.2.13 Replacing RF-INPUT (Testport Adapter) R&S FSQ>26

(see chapter 5, spare parts list, item 320, and illustration 1313.9100)

The input is located at the bottom right of the front panel. The input design will vary depending on the frequency range of the instrument.

Opening Instrument and Removing Testport Adapter

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear panel feet (450) and remove the enclosure (410) by pulling it toward the rear.
- ► Unscrew the 4 screws located on the left and right sides of the front handle (430) and remove the front handle.
- ► Pull off the front cover (291 or 292) toward the front.
- ► Unscrew the 3 countersunk screws (70) on the instrument frame and the 4 countersunk screws (70) on the subassembly plate (61).
- ► Unscrew the input cable W1 (322) on the attenuator (23).
- ► Pull out the subassembly plate (61) toward the front together with W1 and the Probe board (50) and the Vol./Phone board (43).

  Note:

  The Probe board (50) and Vol./Phone board (43) are plugged into the motherboard X80, X81 via a flat cable.
- ► Remove cable W1 after undoing 4 countersunk screws (350) with mounting plate (340).
- ► Unscrew housing adapter (320) from cable W1 (322).

Installing Testport Adapter and Completing Instrument

► Screw the new testport adapter (320) onto cable W1 (322).

► Feed mounting plate (340) to cable W1, fasten into place with 4 countersunk screws (350), insert back into instrument together with subassembly plate (61) and screw back onto attenuator (23).

► Fasten subassembly plate (61) via 3 countersunk screws (70) on the device frame and 4 countersunk screws (70) on the subassembly plate (61).

► Install the front cover (291 or 292).

► Reassemble 2 front handles (420) using 4 screws.

► Slide enclosure (410) back on and screw on 4 rear panel feet (450).

► Connect power cable, switch on power switch and press ON key.

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

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

► Start total calibration and check results:
- [**CAL** : CAL TOTAL] , then [CAL RESULTS]

► Check frequency response as described in chapter 1 and correct if necessary.

3.2.14 Replacing Motherboard A10

(see chapter 5, spare parts list, item 513 and illustrations 1313.9100 and 1166.1677)

The motherboard is located at the bottom.
Before removing the motherboard, you must save the EEPROM entry of the motherboard for the serial number and specification version:

- Save the following files to usb stick
- D:\R_S\Instr\eeprom\motherb.bin.

3.2.14.1 Opening Instrument and Removing Motherboard

► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.

► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.

► Place the instrument on the side frame and remove all cables to the boards.

► Pull out all boards towards the top of the instrument.

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

► Remove the power supply (550).
Undo the 10 screws (560) at the rear of the power supply.
Pull out the power supply approx. 20 mm towards the rear, slightly tilt it towards the bottom and then pull it out completely.

► Undo the 4 screws (430) on the front handles on both sides and take off the front handles.

► Pull off the front cover (for example 270) towards the front.

► Undo 2 countersunk screws (610) in the front frame at the top and at the bottom.

► Remove the front panel with keyboard and display ((602, 970, 980, 990, 650, 1000) towards the front.

CAUTION

Note that the cables are still connected to the controller.

► Disconnect the cables to the LCD, DC/AC illumination converter, keyboard membrane and rotary knob and, if required, the network connector on the front module controller.

Note:

When removing the cables, be careful with the cable connecting 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 section "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) at the Monitor port. Unscrew the nuts (518) and lockwasher (519) at the 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 ports !

► Disconnect the cables at the motherboard (RF attenuator, fan, floppy, probe board, rear panel, etc).

► Undo 6 screws with washers (520) at the lower side of the motherboard (513).

► Carefully pull the motherboard (513) towards the front panel (approx. 15 mm) and take it out of the instrument by swiveling down.

3.2.14.2 Installing New Motherboard and Completing Instrument

► Reinstall the motherboard in the instrument in the reverse order.

Note:

Be careful when installing the motherboard in order not to cause damage to any components.

► Make *sure to connect* the *cables according to their labels.*

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

► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.

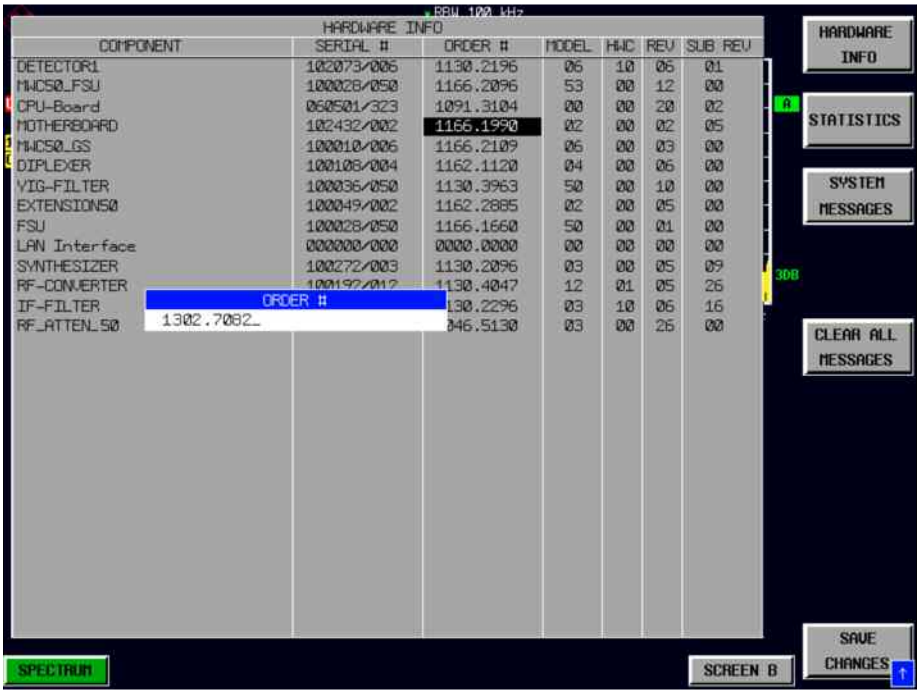
► Start the instrument. Do not perform a cold start.

► Check if file D:\R_S\Instr\eeprom\motherb.bin changed. If necessary, copy the file from usb stick back to the harddisk.

► Store the file motherboard.bin to the EEPROM using the following service functions :
- [**SETUP** : SERVICE : ENTER PASSWORT : 30473035]
- [**SETUP** : SERVICE FUNCTION : 3.2.6.1]

► Enter the motherboard data into system info:
- [SETUP : SERVICE : ENTER PASSWORT : 30473035]
- [**SETUP** : SERVICE INFO : HARDWARE INFO]

► Enter the values for ORDER#, MODEL, HWC, REV and SUB REV in the line MOTHERBOARD corresponding to the values on the barcode label of the new motherboard. The serial number cannot be changed!



- Press the soft key SAVE CHANGES
- Restart the instrument. A cold start is required after replacement (see chapter "Performing a Cold Start").
- Check the serial number of the instrument:
  [**SETUP** : SYSTEM INFO : STATISTICS]
- After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]
- Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]

3.2.15 Replacing RF Attenuator A40

(see chapter 5, spare parts list, items 20, 23, 25, and illustration 1313.9100)

The RF attenuator is installed at the bottom behind the RF input connector.

3.2.15.1 Opening Instrument and Removing RF Attenuator

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Place the instrument onto the left side and unscrew the RF cable at the output of the RF attenuator.
- R&S FSQ3/8: Undo the 2 screws with washers (40) at the instrument frame.

  Note:

  The RF attenuator is then only held via the RF cables at the front.
- R&S FSQ26 and higher: Undo the 3 screws with washers (28) at the instrument frame.

  Note:

  The RF attenuator is then only held via the RF cables at the front.
- Hold the attenuator and disconnect RF cable W1 (295) on the R&S R&S FSQ 3/8 ,cable W1 (316) on the R&S FSQ 26 or cable W1 (322) on the R&S R&S FSQ 40 from the input of the RF attenuator.
- Carefully take out the RF attenuator and unscrew the flexible RF cable from the input.
- Disconnect ribbon cable from motherboard connector X41 on the R&S R&S FSQ3/8 or at X40 on the R&S FSQ26 and higher.
- Only R&S FSQ26 and higher: Remove RF attenuator (23 or 25) by undoing 4 countersunk screws (27) from insulating plate (26).

3.2.15.2 Installing New RF Attenuator and Completing Instrument

- ► Only R&S R&S FSQ 26 and higher: fasten new attenuator (23 or 25) to insulating plate (26) with 4 countersunk screws (27).
- ► Connect ribbon cable to motherboard connector X41 on the R&S R&S FSQ3/8 or to X40 on the R&S FSQ 26.
- ► Connect the flexible RF cable to the input of new RF attenuator (see label on cable).
- ► Install the new RF attenuator in the instrument and connect cable W1 to the input.
- ► R&S FSQ3/8: Fasten the attenuator to the instrument frame using the 2 screws with washers (40).
  R&S FSQ26 and higher: Fasten the attenuator to the instrument frame using the 3 screws with washers (28).
- ► Fasten the RF cable to the RF output of the RF attenuator.
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).
- ► Connect the instrument to the mains and switch on the power switch. The instrument is now in the standby mode.
- ► After replacing the attenuator, a cold start is required. See section "Performing a Cold Start".
- ► After starting the instrument, check the log file for system messages:
  [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]

  With R&S FSQ-B72: The entry "Error at reading B72 ext. freq. response fil" is normal and refers to the I/Q frequency response data that is no longer valid.
  Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- ► Execute frequency response correction FSU-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 backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

If R&S FSQ-B72 is available:

- ► Run "I/Q Response Correction" software.
  Do not run this software until after the system error correction reveals no errors (Total Calibration Status: Passed)!
  The software and the associated manual are located on the GLORIS server under Firmware/Software → R&S FSQ-B72 (test setup, see manual).
- ► Switch the instrument off and then on again.
- ► After starting the instrument, check the log file to ensure that no errors occurred:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]

Every time the instrument is started without a valid I/Q frequency response file for R&S FSQ-B72, the message "Error at reading B72 ext. freq. response fil" is entered in the log file.

3.2.16 Replacing Probe Board Module A80 and Vol./Phone Board A191

(see chapter 5, spare parts list, items 43 and 50, and illustration 1313.9100)

The boards are located behind the front-panel connectors Probes, Headphones and the volume control knob.

3.2.16.1 Opening Instrument and Removing Boards

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take out the enclosure (410) towards the rear.
- ► Undo the 4 screws (430) of the front handles on both sides and take off the front handles.
- ► Pull off the front cover (for example 270) towards the front.
- ► Remove volume control knob (48).
- ► Pace the instrument onto the left side so that its bottom side is accessible.
- ► Remove 3 countersunk screws (70) at the frame and 4 countersunk screws (70) at the connector mounting plate (61).
- ► Unscrew the input cable W1 (295) on the R&S FSQ3/8, cable W1 (316) on the R&S FSQ26 or cable W1 (322) on the R&S FSQ40 from the input of the RF attenuator (20/23/25).
- ► Remove the mounting plate (61) completely with W1 and Probe board (50) and Vol./Phone board (43) towards the front.

  Note:

  The Probe board (50) and Vol./Phone (43) boards are connected to X80 and X81 on the motherboard via a ribbon cable.

- Disconnect the cables of the 2 boards from motherboard connectors X80 and X81.
- Undo the 3 countersunk screws (55) and remove the Probe board (50).
- Undo the 2 countersunk screws (46) and remove the Vol./Phone board (43) from the mounting plate (61).
- Undo the screw with washer (45) and the nut of the volume control at the mounting bracket (44) and remove the Vol./Phone board (43).

3.2.16.2 Installing New Boards and Completing Instrument

- Fasten the new Probe board (50) to the mounting plate (61) using 3 countersunk screws (55).
- Fasten the new Vol./Phone board (43) to the mounting bracket (44) using the nut of the volume control and 1 screw with washer (45). Mount Vol./Phone board (43) to mounting plate (61) using 2 countersunk screws (46).
- Connect the cables of the 2 boards to motherboard connectors X80 and X81.
- Carefully slide the complete mounting plate (61) back into the instrument.

CAUTION

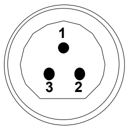
Make sure to route the cables properly.

- Screw RF the cable W1 (295)) on the R&S FSQ3/8, cable W1 (316) on the R&S FSQ26 or cable W1 (322) on the R&S FSQ40 on the input of the RF attenuator (20/23/25).
- Mount 3 countersunk screws (70) to the instrument frame and 4 countersunk screws (70) to the mounting plate (61).
- Install the front cover (for example 270).
- Mount the volume control knob (48).
- Mount the 2 front handles (420) using the 4 screws (430).
- Mount the enclosure (410) and the 4 rear-panel feet (450).

3.2.16.3 Function Test

- Connect an appropriate keyboard to the keyboard socket.
- Connect the instrument to the AC supply, switch on the power switch and press the ON key.
- Simultaneously press the CTRL and ESC keys on the keyboard. The Windows XP task bar will appear at the lower edge of the screen.
- Shift the cursor to MAINAPP using the trackball and click. The task bar will disappear.

- Measure the output voltages at the probe connector (see Fig. 3-14).



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

Fig. 3-14 Pin assignments of PROBE POWER connector

- Test the function of headphones connector and volume control. Press the *MKR* key and then the *MARKER DEMOD* softkey. Noise can be heard in the loudspeaker, and the volume can be changed using the *VOLUME* knob at the front panel. Connect headphones to the *AF OUTPUT* at the front panel. The loudspeaker is switched off and the noise can be heard in the headphones.

3.2.17 Replacing USB2.0 Board A310

(see chapter 5, spare parts list, Pos. 57 and illustration 1313.9100)

The boards are located behind the front-panel.

3.2.17.1 Opening Instrument and Removing Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take out the enclosure (410) towards the back.
- Undo the 4 screws (430) of the front handles on both sides and take off the front handles.
- Pull off the front cover (for example 270) towards the front.
- Pace the instrument onto the left side so that its bottom side is accessible.
- Remove 3 countersunk screws (70) at the frame and 4 countersunk screws (70) at the mounting plate (61).
- Unscrew the input cable W1 at the RF attenuator (20, 23 or 25).
- Remove the mounting plate (61) completely with W1 and Probe Board (50), Vol./Phone board (43) and USB Board (57) towards the front.

  Note:

  The Probe Board (50) and Vol./Phone board (43) are connected to X80 and X81 on the motherboard via a ribbon cable and the USB Board (57) is connected to the front module controller (573).
- Disconnect the cable W310 (760) on the USB Board (57).
- Undo the 2 countersunk screws (58) and remove the USB Board (57).

3.2.17.2 Installing New Board and Completing Instrument

- Fasten the new USB Board (57) to the mounting plate (61) using 2 countersunk screws (58).
- Connect the cable W310 (760) to the USB Board (57).
- Carefully slide the complete mounting plate (61) back into the instrument.

CAUTION

Make sure to route the cables properly.

- Screw RF cable W1 to the input of the RF attenuator (20, 23, or 25).
- Mount 3 countersunk screws (70) to the instrument frame and 4 countersunk screws (70) to the mounting plate (61).
- Install the front cover (for example 270).
- Mount the 2 front handles (420) using the 4 screws (430).
- Mount the enclosure (410) and the 4 rear-panel feet (450).

3.2.17.3 Function Test

- Connect the instrument to the AC supply, switch on the power switch and press the ON key.
- Connect an USB keyboard to the USB socket on the front of the unit (USB board (57).
- Simultaneously press the CTRL and ESC keys on the keyboard. The Windows XP task bar will appear at the lower edge of the screen.
- Shift the cursor to MAINAPP using the trackball and click. The task bar will disappear.
- Check also the other USB socket on the front.

3.2.18 Replacing RF Converter A100

(see chapter 5, spare parts list, item 100, and illustration 1313.9100)

The board is located in the middle of the instrument .

3.2.18.1 Opening Instrument and Removing Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the rear.

- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) on the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on its side frame and remove all cables connecting the board.
- Pull out 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.

3.2.18.2 Installing New Module and Completing Instrument

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

  Note:

  Please observe the labels on the motherboard.
- Replace the instrument cover (240) on the top and fasten it in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- A cold start is required after replacement (see chapter "Performing a Cold Start").
- After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]
- Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check frequency response according to chapter 1 and correct, if necessary, using the correction software FSU-FRQ.EXE.
  The software is on the GLORIS server.
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

3.2.19 Replacing Synthesizer A110

(see chapter 5, spare parts list, item 105, and illustration 1313.9100)

The board is located in the middle of the instrument.

Opening Instrument and Removing Board

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and pull off the enclosure (410) towards the rear.
- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) on the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- ► Place the instrument on its side and remove all connecting cables to the board.
- ► 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 New Module and Completing Instrument

- ► Plug the new board into the instrument and reconnect the cables.

  Note:

  Please observe the labeling on the motherboard.
- ► Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).
- ► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- ► A cold start is required after replacement (see chapter "Performing a Cold Start").
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]

  With R&S FSQ-B72: The entry "Error at reading B72 ext. freq. response fil" is normal and refers to the I/Q frequency response data that is no longer valid.
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- ► Check frequency response according to chapter 1 and correct, if necessary, using the correction software.
- ► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

If R&S FSQ-B72 is available:

- ► Run "I/Q Response Correction" software.
  Do not run this software until after the system error correction reveals no errors (Total Calibration Status: Passed)!
  The software and the associated manual are located on the GLORIS server under Firmware/Software → R&S FSQ-B72 (test setup, see manual).
- ► Switch the instrument off and then on again.
- ► After starting the instrument, check the log file to ensure that no errors occurred:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]

Every time the instrument is started without a valid I/Q frequency response file for R&S FSQ-B72, the message "Error at reading B72 ext. freq. response fil" is entered in the log file.

3.2.20 Replacing Detector A140

(see chapter 5, spare parts list, item 110, and illustration 1313.9100)

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

3.2.20.1 Opening Instrument and Removing Board

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the rear.
- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- ► Place the instrument on its side and remove all RF cables to the board.
- ► If the option R&S FSQ-B72 is installed, remove it together with the adjacent module A280:
  Due to the connecting cable W66 and the cable clamps, the detector module (A140) can only be removed **together** with the I/Q bandwidth extension module (A280) located behind it.
  Refer also to the chapter Exchanging the I/Q Bandwidth Extension Module A280 (Option R&S FSQ-B72).
- ► Pull out the board towards the top of the instrument.

  Note:

  The module can be disconnected from the motherboard connector by carefully pressing through the motherboard slots from the bottom.

3.2.20.2 Installing New Module and Completing Instrument

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

  Note:
  Please observe the labeling on the motherboard.

- Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- A cold start is required after replacement (see chapter "Performing a Cold Start").
- After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

3.2.21 Replacing IF Filter A130

(see chapter 5, spare parts list, item 120, and illustration 1313.9100)

The board is located in the middle of the instrument.

3.2.21.1 Opening Instrument and Removing Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the rear.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on its side and remove all RF cables to the board at the bottom of the instrument.
- Pull out 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.

3.2.21.2 Installing New Board and Completing Instrument

- ► Plug the new board into the instrument and reconnect the cables.
  Note:
  Please observe the labeling on the motherboard.
- ► Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).
- ► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- ► A cold start is required after replacement (see chapter "Performing a Cold Start").
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- ► Check frequency accuracy and the calibration source level according to chapter 1 and readjust according to chapter 2, if necessary.
- ► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").
- ► Write calibration data to the EEPROM (s. hapter 2, section "Adjustment of Module Data").

3.2.22 Replacing 8 GHz Converter Unit A160; R&S FSQ8

(see chapter 5, spare parts list, items 130 and illustration 1313.9100)

The board is located in the middle of the instrument.

3.2.22.1 Opening Instrument and Removing Board

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- ► Place the instrument on its side and remove all RF cables to the board at 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 from the bottom through the motherboard slots.

3.2.22.2 Installing New Module and Completing Instrument

► Plug the new board into the instrument and reconnect the cables.

Note:
Please observe the labeling on the motherboard.

► Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).

► Mount the enclosure (410) and the 4 rear-panel feet (450).

► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.

► A cold start is required after replacement (see chapter "Performing a Cold Start").

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

With R&S FSQ-B72: The entry "Error at reading B72 ext. freq. response fil" is normal and refers to the I/Q frequency response data that is no longer valid.

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

► Start total calibration and check results:
- [**CAL** : CAL TOTAL] , then [CAL RESULTS]

► Execute frequency response correction software FSU-FRQ.EXE.
The software is 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 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 backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

If R&S FSQ-B72 is available:

► Run "I/Q Response Correction" software.
<u>Do not run this software until after the system error correction reveals no errors (Total Calibration Status: Passed)!</u>
The software and the associated manual are located on the GLORIS server under Firmware/Software → R&S FSQ-B72 (test setup, see manual).

► Switch the instrument off and then on again.

► After starting the instrument, check the log file to ensure that no errors occurred:
- [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]

Note:
Every time the instrument is started without a valid I/Q frequency response file for R&S FSQ-B72, the message "Error at reading B72 ext. freq. response fil" is entered in the log file.

3.2.23 Replacing Diplexer A162; R&S FSQ8

(see chapter 5, spare parts list, item 2030 and illustration 1130.2544)

The board is located on the 8 GHz Converter Unit.

Removing Diplexer on MW Converter 1130.2544

► Remove the 8 GHz Converter Unit (130).
Note: See description "Replacing 8 GHz Converter Unit A160; R&S R&S FSQ8".

► Disconnect cable W1 from diplexer (2030).

► Undo 4 screws with washers (2035) from the bottom of the PCB.

► Remove diplexer (2030) 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 Instrument and Frequency Response Correction

► Put the 8 GHz Converter Unit (130) back into the instrument.
Note: See description "Replacing 8 GHz Converter Unit A160; R&S FSQ8".

► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.

► A cold start is required after replacement (see chapter "Performing a Cold Start").

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

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

► Start total calibration and check results:
- [**CAL** : CAL TOTAL] , then [CAL RESULTS]

► Execute frequency response correction software FSU-FRQ.EXE.
The software is 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 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 backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

If R&S FSQ-B72 is available:

► Run "I/Q Response Correction" software.
Do not run this software until after the system error correction reveals no errors (Total Calibration Status: Passed)!
The software and the associated manual are located on the GLORIS server under Firmware/Software → R&S FSQ-B72 (test setup, see manual).

► Switch the instrument off and then on again.

► After starting the instrument, check the log file to ensure that no errors occurred:
- [SETUP : SYSTEM INFO : SYSTEM MESSAGES]

Every time the instrument is started without a valid I/Q frequency response file for R&S FSQ-B72, the message "Error at reading B72 ext. freq. response fil" is entered in the log file.

3.2.24 Replacing 8 GHz YIG Unit A161; R&S FSQ8

(see chapter 5, spare parts list, items 2015 and 2020, and illustration 1130.2544)

The board is located on the 8 GHz Converter Unit.

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

► Remove the 8 GHz Converter Unit (130).
Note: See description "Replacing 8 GHz Converter Unit A160; R&S R&S FSQ8".

► Remove the 2 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 (2003).

► Depending on the YIG unit used, disconnect the cable from the YIG filter at X4.

► Undo 2 countersunk screws (2025).

► Remove the complete YIG unit (2015 or 2020).

Note:

YIG unit 1130.2944.04 (2015) is connected to the PCB via contacts. Remove the YIG unit towards the top perpendicularly to the PCB.

Installing 8 GHz YIG Unit

► Place the new YIG unit (2015 or 2020) on the PCB.

Note:
YIG Unit 1130.2944.04 (2015) is connected to the PCB via contacts. Plug the YIG unit into the connector contacts from the top perpendicularly to the PCB.

► Fasten the YIG unit with 2 countersunk screws (2025).

► Screw on cable W1 to the diplexer (2030) and connect cable W2 to the 8 GHz converter circuit (2003).

► Depending on the YIG unit used, connect the cable from the YIG filter at X4.

► Replace the module cover on the top of the Converter Unit (positioning by means of adjusting pins). Turn 8 GHz Converter Unit upside down, place module cover on the bottom side and refasten all screws.

Completing Instrument and Frequency Response Correction

► Place the 8 GHz Converter Unit (130) into the instrument.
Note: See description "Replacing 8 GHz Converter Unit A160; R&S R&S FSQ8".

► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.

► A cold start is required after replacement (see chapter "Performing a Cold Start").

► After starting the instrument, check the log file for system messages:

- [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]

► Start the selftest and check results:

- [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]

► Start total calibration and check results:

- [**CAL** : CAL TOTAL] , then [CAL RESULTS]

► Execute frequency response correction software FSU-FRQ.EXE.
The software is 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 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 backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

If R&S FSQ-B72 is available:

► Run "I/Q Response Correction" software.
<u>Do not run this software until after the system error correction reveals no errors (Total Calibration Status: Passed)!</u>
The software and the associated manual are located on the GLORIS server under Firmware/Software → R&S FSQ-B72 (test setup, see manual).

- ► Switch the instrument off and then on again.
- ► After starting the instrument, check the log file to ensure that no errors occurred:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]

Every time the instrument is started without a valid I/Q frequency response file for R&S FSQ-B72, the message "Error at reading B72 ext. freq. response fil" is entered in the log file.

3.2.25 Replacing Relay on the MW Converter Unit; R&S FSQ8

(see chapter 5, spare parts list, item 2060 and illustrations 1130.2544 and 1130.2815)

The relay is located on the 8 GHz Converter Unit.

Removing the Relay from the MW Converter

- ► Remove the 8 GHz Converter Unit (130).

  Note:
  See description "Replacing 8 GHz MW Converter Unit A160; R&S FSQ8".
- ► Disconnect RF cables from the relay unit (2060) to the diplexer (2030) and YIG unit (2015 or 2020).
- ► Disconnect the relay supply cable (2065).
- ► Undo 2 screws (2050) and remove the 2 relays with cables.
- ► Unscrew all cables from the relay and unsolder the supply lines (2065).

Installing the Relay on the MW Converter

- ► Solder supply lines (2065) to the relay.

  Note:
  For pin assignment see sheet 1130.2815
- ► Refasten all cables to the relay.
- ► Place the relay unit (2040) on the support (2045)and refasten it to the MW converter using 2 screws (2050).
- ► Connect relay supply cable (2065) to module X2.
- ► Reconnect cables between the relay unit (2040) and the diplexer (2030) and YIG unit (2015 or 2020).

Completing Instrument and Frequency Response Correction

- ► Place the 8 GHz Converter Unit (130) back into the instrument.
  Note: See description "Replacing 8 GHz Converter Unit A160; R&S FSQ8"*.*
- ► Connect the AC supply cable and switch on the instrument.

- After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- Start selftest and check the result to ensure that no errors occurred:
  - [**SETUP** : SERVICE : SELFTEST], subsequently [SELFTEST RESULT]
- Start system error correction and check the result to ensure that no errors occurred:
  - [**CAL** : CAL TOTAL] , subsequently [CAL RESULTS]
- Execute frequency response correction software FSU-FRQ.EXE.
  The software is 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 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.

If R&S FSQ-B72 is available:

- Run "I/Q Response Correction" software.
  Do not run this software until after the system error correction reveals no errors (Total Calibration Status: Passed)!
  The software and the associated manual are located on the GLORIS server under Firmware/Software → R&S FSQ-B72 (test setup, see manual).
- Switch the instrument off and then on again.
- After starting the instrument, check the log file to ensure that no errors occurred:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]

Every time the instrument is started without a valid I/Q frequency response file for R&S FSQ-B72, the message "Error at reading B72 ext. freq. response fil" is entered in the log file.

3.2.26 Replacing MW Converter Unit A160; R&S FSQ26/40

(see chapter 5, spare parts list, item 140, 145 or 150 and illustration 1313.9100)

The board is located in the middle of the instrument.

Opening Instrument and Removing Module

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.

- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- ► Place the instrument on its side and remove all RF cables from the module at the bottom of the instrument.
- ► Pull out the module towards the top of the instrument.

  Note
  The module can be disconnected from the motherboard connector by carefully pushing it upwards from the bottom through the motherboard slots.

Installing New Module and Completing Instrument

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

  Note:
  Please observe the labeling on the motherboard.
- ► Put the top instrument cover (240) back into place and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).
- ► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- ► A cold start is required after replacement (see chapter "Performing a Cold Start").
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]

  With R&S FSQ-B72: The entry "Error at reading B72 ext. freq. response fil" is normal and refers to the I/Q frequency response data that is no longer valid.
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- ► Execute frequency response correction software FSU-FRQ.EXE.
  The software is 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 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 backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

If R&S FSQ-B72 is available:

- ► Run "I/Q Response Correction" software.
  Do not run this software until after the system error correction reveals no errors (Total Calibration Status: Passed)!
  The software and the associated manual are located on the GLORIS server under Firmware/Software → R&S FSQ-B72 (test setup, see manual).
- ► Switch the instrument off and then on again.
- ► After starting the instrument, check the log file to ensure that no errors occurred:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]

  Note:
  Every time the instrument is started without a valid I/Q frequency response file for R&S FSQ-B72, the message "Error at reading B72 ext. freq. response fil" is entered in the log file.

3.2.27 Replacing Diplexer A161; R&S FSQ26/40

(see chapter 5, spare parts list, item 3111 and illustration 1130.4982 sheet 2)

The board is located on the MW Converter Unit R&S FSQ26/40

Removing Diplexer

- ► Remove the Converter Unit R&S FSQ26/40(140, 145 or 150).
  Note: See description "Replacing MW Converter Unit A160; R&S FSQ26/40"
- ► Disconnect all cables from diplexer (2105 or 3111).
- ► Undo 4 screws with washers from the bottom of the cover A side.
- ► Remove diplexer (2105 or 3111) perpendicularly to the PCB.

  Note:
  The diplexer is still connected to the PCB with contact pins.

Installing Diplexer

- ► Plug in new diplexer (2105 or 3111) perpendicularly to the PCB.

  Note:
  The diplexer is connected to the PCB with contact pins.
- ► Refasten 4 screws with washers to the bottom of the cover A side.
- ► Refasten all cables to the diplexer (2105 or 3111).

Completing Instrument and Frequency Response Correction

- ► Put the MW Converter Unit R&S FSQ26/40 (140, 145 or 150) back into the instrument.

  Note:
  See description "Replacing MW Converter A160; R&S FSQ26/40"

- ► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- ► A cold start is required after replacement (see chapter "Performing a Cold Start").
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- ► Execute frequency response correction software FSU-FRQ.EXE.
  The software is 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 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 backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

If R&S FSQ-B72 is available:

- ► Run "I/Q Response Correction" software.
  Do not run this software until after the system error correction reveals no errors (Total Calibration Status: Passed)!
  The software and the associated manual are located on the GLORIS server under Firmware/Software → R&S FSQ-B72 (test setup, see manual).
- ► Switch the instrument off and then on again.
- ► After starting the instrument, check the log file to ensure that no errors occurred:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]

Every time the instrument is started without a valid I/Q frequency response file for R&S FSQ-B72, the message "Error at reading B72 ext. freq. response fil" is entered in the log file.

3.2.28 Replacing YIG Unit A162; R&S FSQ 26/40

(see chapter 5, spare parts list, item 2108, 2112 or 2115 and illustration 1166.2338, sheet 2)

(see chapter 5, spare parts list, item 3124 or 3126 and illustration 1130.4982, sheet 2)

The board is located on the MW Converter Unit R&S FSQ26/40.

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 YIG Unit

► Remove the MW Converter Unit (140, 145 or 150).
Note: See description "Replacing MW Converter Unit A160; R&S FSQ26/40"

► Disconnect cable W1 from the diplexer (2105 or 3111) and cable W2 from the relay unit (2170 or 3260).

► Disconnect cable from YIG filter at X4.

► Undo 3 cover screws holding the YIG unit (2108, 2112, 2115, 3124 or 3126) from the bottom of the module.

► Undo 2 countersunk screws (2120 or 3140).

► Remove the complete YIG unit (2108, 2112, 2115, 3124 or 3126).

Installing YIG Unit

► Put the new YIG unit (2108, 2112, 2115, 3124 or 3126) on the PCB.

► Fasten YIG unit with 2 countersunk screws (2120 or 3140).

► Refasten 3 cover screws holding the YIG unit (2108, 2112, 2115, 3124 or 3126) to the bottom of the module.

► Reconnect cable W1 to the diplexer (2105 or 3111) and cable W2 to the relay unit (2170 or 3260).

► Connect cable from the YIG filter to X4.

Completing Instrument and Frequency Response Correction

► Put the Converter Unit (140, 145 or 150) back into the instrument.
Note: See description "Replacing MW Converter Unit A160; R&S FSQ26/40".

► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.

► A cold start is required after replacement (see chapter "Performing a Cold Start").

► After starting the instrument, check the log file for system messages:

- [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]

► Start the selftest and check results:

- [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]

► Start total calibration and check results:

- [**CAL** : CAL TOTAL] , then [CAL RESULTS]

► Execute frequency response correction software FSU-FRQ.EXE.
The software is 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 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 backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

If R&S FSQ-B72 is available:

► Run "I/Q Response Correction" software.
Do not run this software until after the system error correction reveals no errors (Total Calibration Status: Passed)!
The software and the associated manual are located on the GLORIS server under Firmware/Software → R&S FSQ-B72 (test setup, see manual).

► Switch the instrument off and then on again.

► After starting the instrument, check the log file to ensure that no errors occurred:
- [SETUP : SYSTEM INFO : SYSTEM MESSAGES]

Note:
Every time the instrument is started without a valid I/Q frequency response file for R&S FSQ-B72, the message "Error at reading B72 ext. freq. response fil" is entered in the log file.

3.2.29 Replacing Extender A163; R&S FSQ 26/40

(see chapter 5, spare parts list, item 2125 and illustration 1166.2338, sheet 2)
(see chapter 5, spare parts list, item 3148 and illustration 1130.4982, sheet 2)
The board is located on the MW Converter Unit R&S FSQ26/40.

Removing Extender

► Remove the MW Converter Unit (140, 145 or 150).

Note: See description " Replacing MW Converter Unit A160; R&S FSQ26/40".

► Disconnect all cables from Extender (2125 or 3148).

► Undo all cover screws from the bottom side of the module and remove cover A side (2570 or 3250).

Note: The cover on the top (2580 or 3240) thus comes off.

► Undo 7 screws with washers (2130) from the Extender 26 (2125) or undo 6 screws with washers (3160) from the Extender 46 (3148) at the bottom side of the module.

CAUTION!

The Extender (2125 or 3148) may drop out.

► Remove the Extender (2125 or 3148) perpendicularly to the PCB.

Note:
The Extender is still connected to the PCB with contact pins.

Installing Extender

► Plug in the new Extender (2125 or 3148) perpendicularly to the PCB.
Note: The Extender is connected to the PCB by means of connector contacts.

► Refit 7 screws with washers (2130) to the Extender 26 (2125) or refit 6 screws with washers (3160) to the Extender 46 (3148) at the bottom of the module.

► Fit the module cover B side (2580 or 3240) onto the top of the MW Converter Unit (positioning by means of adjusting pins). Turn the MW Converter Unit upside down, fit module cover A side (2570 or 3250) to the bottom side and refit all screws.

► Reconnect all cables to the Extender (2125 or 3148).

Completing Instrument and Frequency Response Correction

► Put MW converter (140, 145 or 150) back into the instrument.
Note: See description " Replacing MW Converter Unit A160; R&S FSQ26/40".

► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.

► A cold start is required after replacement (see chapter "Performing a Cold Start").

► After starting the instrument, check the log file for system messages:

- [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]

► Start the selftest and check results:

- [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]

► Start total calibration and check results:

- [**CAL** : CAL TOTAL] , then [CAL RESULTS]

► Execute frequency response correction software FSU-FRQ.EXE.
The software is 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 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 backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

If R&S FSQ-B72 is available:

► Run "I/Q Response Correction" software.
Do not run this software until after the system error correction reveals no errors (Total Calibration Status: Passed)!
The software and the associated manual are located on the GLORIS server under Firmware/Software → R&S FSQ-B72 (test setup, see manual).

► Switch the instrument off and then on again.

► After starting the instrument, check the log file to ensure that no errors occurred:
- [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]

Note:
Every time the instrument is started without a valid I/Q frequency response file for R&S FSQ-B72, the message "Error at reading B72 ext. freq. response fil" is entered in the log file.

3.2.30 Replacing Relay on the MW Converter Unit; R&S FSQ26/40

(see chapter 5, spare parts list, item 2300 and illustrations 1166.2338, sheet 2, and 1130.3405)

(see chapter 5, spare parts list, item 3400 and illustrations 1130.4982, sheet 2, and 1155.5147)

The relay is located on the MW Converter Unit R&S FSQ26/40.

Removing the Relay from the MW Converter

► Remove the MW Converter Unit (140, 145 or 150).

Note: See description " Replacing MW Converter Unit A160; R&S FSQ26/40".

► Disconnect cables from the relay unit (2170 or 3260) to the diplexer (2105 or 3111), YIG unit (2108, 2112, 2115, 3124 or 3126) and Extender (2125 or 3148).

► Disconnect the relay supply cable (2305 or 3410) on module X2 and route the cable through the module slot and connect it to the rear.

► Undo the screw (2195 or 3294) at the rear of the module to remove the clamp (2190 or 3292).

► Undo 2 screws (2180 or 3270) and remove the 2 relays with cables.

► Unscrew all cables from the relay and unsolder the supply lines (2305 or 3410).

Installing the Relay on the MW Converter

► Solder supply lines (2305 or 3410) to the relay.

Note: For pin assignment see sheet 1130.3405 or sheet 1155.5147.

► Refasten all cables to the relay.

► Refasten the relay unit (2170 or 3260) to the MW converter using 2 screws (2180 or 3270) .

► Route relay supply cable (2305 or 3410) through the module slot from the rear and connect it to module X2.

- Connect the cable (2305 or 3410) with clamp (2190 or 3292) and screw (2195 or 3294) to the rear of the module.
- Refasten cables between the relay unit (2170 or 3260) and diplexer (2105 or 3111) , YIG unit (2108, 2112, 2115, 3124 or 3126) and Extender (2125 or 3148).

Completing Instrument and Frequency Response Correction

- Place the MW Converter Unit (140, 145 or 150) back into the instrument.

  Note:
  See description " Replacing MW Converter Unit A160; R&S FSQ26/40".
- Connect the AC supply cable and switch on the instrument.
- After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]
- Start selftest and check the result to ensure that no errors occurred:
  - [**SETUP** : SERVICE : SELFTEST], subsequently [SELFTEST RESULT]
- Start system error correction and check the result to ensure that no errors occurred:
  - [**CAL** : CAL TOTAL] , subsequently [CAL RESULTS]
- Execute frequency response correction software FSU-FRQ.EXE.
  The software is 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 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.

If R&S FSQ-B72 is available:

- Run "I/Q Response Correction" software.
  Do not run this software until after the system error correction reveals no errors (Total Calibration Status: Passed)!
  The software and the associated manual are located on the GLORIS server under Firmware/Software → R&S FSQ-B72 (test setup, see manual).
- Switch the instrument off and then on again.
- After starting the instrument, check the log file to ensure that no errors occurred:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]

Note:
Every time the instrument is started without a valid I/Q frequency response file for R&S FSQ-B72, the message "Error at reading B72 ext. freq. response fil" is entered in the log file.

3.2.31 Replacing Tracking Generator A170 (Option: B9)

(see chapter 5, spare part list, item 1800, and illustrations 1313.9100 and 1142.9090)

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

Opening Instrument and Removing Board

► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.

► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.

► Place the instrument on its side and remove all connecting cables to board at 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 from the bottom through the motherboard slots.

Installing New Module and Completing Instrument

► Plug the new board into the instrument and reconnect the cables.

Note:
Please observe the labeling on the motherboard.

► Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).

► Mount the enclosure (410) and the 4 rear-panel feet (450).

► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.

► A cold start is required after replacement (see chapter "Performing a Cold Start").

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

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

► Start total calibration and check results:
- [**CAL** : CAL TOTAL] , then [CAL RESULTS]

► Check according to chapter 1, option Tracking Generator –B9.

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

3.2.32 Replacing Generator Attenuator A171 (Option: B12)

(see chapter 5, spare part list, item 2400, and illustrations 1313.9100 and 1142.9361)

The board is installed in the rear part of the instrument (behind the fan).

Opening Instrument and Removing Attenuator

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- ► Place the instrument on its side and remove all connecting cables W41 - X2 and W49 - X1 to tracking attenuator (2400).
- ► Disconnect flat cable of tracking attenuator (2400) on motherboard connector X270.
- ► Undo the 3 screws with washers (2420) and remove attenuator with holder.
- ► Undo the 2 screws M3 (2415) and remove the tracking attenuator (2400).

Installing New Attenuator and Completing Instrument

- ► Mount Tracking Attenuator (2400) with 2 screws M3 (2415) to attenuator holder (2410).
- ► Insert Tracking Attenuator with attenuator holder into unit and mount 3 screws with washers (2420).
- ► Connect flat cable of Tracking Attenuator (2400) to motherboard connector X270.
- ► Connect cable W41 - X2 and W49 – X1 to Tracking Attenuator.
- ► Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).
- ► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- ► A cold start is required after replacement (see chapter "Performing a Cold Start").
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- ► Check according to chapter 1, option Tracking Generator –B9 and Option Attenuator –B12.

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

3.2.33 Replacing OCXO A200 (Option: B4)

(see chapter 5, spare parts list, item 1100, and illustrations 1313.9100 and 1144.9017)

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

3.2.33.1 Opening Instrument and Removing Board

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- ► Place the instrument on 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.

3.2.33.2 Installing New Module and Completing Instrument

- ► Plug the new board into the instrument and reconnect the cables.

  Note:
  Please observe the labeling on the motherboard.
- ► Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).
- ► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- ► A cold start is required after replacement (see chapter "Performing a Cold Start").
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- ► Check frequency accuracy according to chapter 1 and readjust according to chapter 2, if necessary.

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

3.2.34 Replacing Removable Harddisk A381 (Option: B18)

(see chapter 5, spare parts list, item 1500, and illustrations 1313.9000 and 1308.1986)

The board is located on the top right of the front panel.

Opening Instrument and Removing Module

► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) toward the rear.

► Remove the installed Compact Flashdisk with software (1515).

► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.

► Disconnect sata data cable (1550) and sata power cable (1560) from Compact Fl-board (1500). Undo 4 screws with washers (1505) and take Compact Fl-board (1500) from the Holder flash board (1507).

Installing New Module and Completing Instrument

► Plug Compact Fl-board (1500) to Holder flash board (1507) And fix it with 4 screws with washers (1505).

► Carefully insert Compact Fl-board (1500) into the instrument and fasten it to frame using 3 screws with washers (1508).

► Connect sata data cable (1550) and sata power cable (1560) back to Compact Fl-board (1500).

► Place top cover on instrument (240) and fasten it with 10 countersunk screws (260) and 3 screws with washers (250).

► Push enclosure (410) back in place and fasten 4 rear-panel feet (450) by means of screws.

► Mount Compact Flashdisk with software (1515).

► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.

► A cold start is required after replacement (see chapter "Performing a Cold Start").

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

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

► Start total calibration and check results:
- [**CAL** : CAL TOTAL], then [CAL RESULTS]

3.2.35 Replacing External Generator Control A210 (Option: B10)

(see chapter 5, spare parts list, item 1640, and illustrations 1313.9100 and 1129.7317)

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

Opening Instrument and Removing Board

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- ► Pull out External Generator Control board (1640) with adapter plate (1660) towards the top of the instrument.
- ► Unscrew 4 screws with washer (1665) und remove the External Generator Control board (1640).

Installing New Module and Completing Instrument

- ► Mount the new External Generator Control board (1640) with 4 screws (1665) to the adapter plate (1660).
- ► Plug the new board into the instrument.
- ► Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).

Functional Check

- ► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- ► A cold start is required after replacement (see chapter "Performing a Cold Start").
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]
- ► For the functional check, connect the generator with R&S FSQ via an IEC/IEEE-bus cable (IEC2 interface) and a TTL cable (AUX CONTROL interface). Connect the generator output with the R&S FSQ RF Input.

NOTICE

Open IEC/IEEE-bus connection to controller.

Activate the generator as follows:

► Press PRESET

► Set FREQ – CENTER – 100 MHz

► Set SPAN 10 MHz

► Press NETWORK hotkey

► Press EXT SOURCE softkey

► Press GENERATOR softkey:

► Select generator type

► Set IEC/IEEE? to TTL

► Set GPIB address to address of generator

► Select remote mode

► Press FREQUENCY SWEEP softkey:

► Set state to ON

► Set EXT SRC softkey to ON
R&S FSQ carries out a single sweep. The resulting trace is displayed as a horizontal line at –30 dBm.

3.2.36 Replacing Baseband Input 1 A270 (Option: B71)

(see chapter 5, spare parts list, item 2701, and illustrations 1313.9100 and 1157.0136)

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

Opening the Instrument and Removing the Board

► Switch off unit, disconnect from power supply, unscrew 4 rear-panel feet (450) and pull off enclosure (410) towards rear.

► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.

► Remove 4 screws (430) at left and right front handles (420) and take off front handles.

► Pull off front cover (for example 270) towards the front.

► Place the instrument on its side and remove all connecting cables to board A270.

- ► Disconnect flat cable of A270 on motherboard connector X82.
- ► Undo the 3 screws (2760) on mounting plate (61)
- ► Pull out the board towards the top of the instrument.

Installing the New Module and Completing the Instrument

- ► Insert the new A270 'Baseband Input 1' (2700) into subassembly plate (61) and mount 3 screws (2760).

  Note:
  the component side of A270 is beside the right side of the instrument.
- ► Connect flat cable of A270 to motherboard connector X82.
- ► Reconnect the cables to A270

  Note:
  Please observe the labeling on the board.
- ► Mount front cover (for example 270).
- ► Remount 2 front handles (420) by means of 4 screws (430).
- ► Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).
- ► Connect the instrument to the mains, switch on the power switch and press the ON key.
- ► After starting the instrument check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- ► Check according to chapter 1, option Baseband Input –B71.

3.2.37 Replacing Baseband Input 2 A260 (Option: B71)

(see chapter 5, spare parts list, item 2711, and illustrations 1313.9100 and 1157.0136)

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 take off the enclosure (410) towards the back.
- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.

- ► Place the instrument on its side and remove all connecting cables to board at 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 from the bottom through the motherboard slots.

Installing the New Module and Completing the Instrument

- ► Plug the new board into the instrument and reconnect the cables.

  Note:
  Please observe tue labelling on the motherboard.
- ► Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).
- ► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- ► A cold start is required after replacement (see chapter "Performing a Cold Start").
- ► After starting the instrument check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the self test and check results:
- ► - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- ► Check according to chapter 1, option Baseband Input –B71.

3.2.38 Replacing I/Q Bandwidth Extension A280 (Option B72)

(see chapter 5, spare parts list, pos. 3705, and illustrations 1313.9100 and 1157.0488)

The module is located in the front part of the instrument

3.2.38.1 Opening the Instrument and Removing the Module

- ► Switch off the instrument, disconnect it from power supply, unscrew 4 rear-panel feet (450) and pull off enclosure (410) towards rear.
- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.

⚠ CAUTION

Due to the connecting cable W66 and the cable clamps, the I/Q bandwidth extension module A280 (3705) can only be removed **together** with the detector module A140 (110) located behind it.

► Place the instrument onto its side and remove all connecting RF cables to modules A280 and A140. Module A140 also has RF cables at the top.

Note:
The 26-pin connecting cable between the two modules cannot be disconnected!

► Pull modules A280 (3705) and A140 (110) out towards the top of the instrument.

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

► Undo 3 screws (3793) and remove cable clamp (3792).

► Disconnect the 26-pin cable W66 (3770) on the I/Q bandwidth extension module (3705).

► Exchange module, reconnect 26-pin cable (3770), fasten cable clamp (3792) with 3 screws (3793).

3.2.38.2 Installing the Module and Reassembling the Instrument

► Insert new module A280 (3705) **together** with detector A140 (110) into instrument.

► Reconnect all RF cables to modules A280 and A140.
Module A140 also has RF cables at the top.

Note:
Please observe the labelling on the module.

► Mount top cover (240) and fasten it using 10 countersunk screws (260) and 3 screws with washers (250).

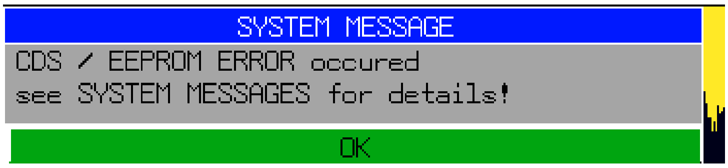
► Slide on enclosure (410) and screw on 4 rear-panel feet (450).

► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.

3.2.38.3 Function Test

► A cold boot is required after replacing the module (see chapter “Performing a Cold Start”).

The following error message appears after booting the instrument, since the I/Q frequency response data is no longer valid as a result of the replaced module:



- ► Acknowledge the message by pressing the ENTER key
- ► Check log file to ensure that no errors occurred:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]

The entry "Error at reading B72 ext. freq. response file" is normal and refers to the I/Q frequency response data that is no longer valid (see error message above).

- ► Start system error correction and check the result to ensure that no errors occurred:
  - [**SETUP** : SERVICE : SELFTEST], subsequently [SELFTEST RESULT]
- ► Start total calibration and check the result:
  - [**CAL** : CAL TOTAL] , subsequently [CAL RESULTS]
- ► Run "I/Q Response Correction" software.

Do not run this software until after the system error correction reveals no errors (Total Calibration Status: Passed)!

- ► The software and the associated manual are located on the GLORIS server under Firmware/Software → R&S FSQ-B72 (test setup, see manual).
- ► Switch the instrument off and then on again.
- ► After starting the instrument, check the log file to ensure that no errors occurred:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]

  Note:
  Every time the instrument is started without a valid I/Q frequency response file for R&S FSQ-B72, the message "Error at reading B72 ext. freq. response fil" is entered in the log file.
- ► Test according to chapter 1, optional I/Q Bandwidth Extension R&S FSQ-B72

3.2.39 Replacing External Mixer Board A180 (Option B21)

(see chapter 5, spare parts list, item 2901, and illustrations 1313.9100 and 1157.1110)

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

Opening Instrument and Removing Board

- ► Switch off instrument, disconnect from mains, unscrew 4 rear panel feet (450) and pull off enclosure (410) toward rear.

- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- ► Undo RF cable W39 at the top of the external mixer board.
- ► Place the instrument on its side and remove all RF cables to the board at the bottom of the instrument.
- ► Pull the board out toward the bottom of the instrument.
  Do not damage RF cable W39 on the top!

  Note:
  The board can be loosened from the motherboard connector by carefully applying pressure from the bottom through the motherboard slots.

Installing Board and Completing Instrument

- ► Insert new board into instrument and reconnect all RF cables.

  Note:
  Do not forget RF cable W39 at the top of the board. Note the labeling on the motherboard.
- ► Mount top cover (240) and fasten it using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Slide on the enclosure (410) and screw on the 4 rear panel feet (450).
- ► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- ► A cold start is required after replacement (see chapter "Performing a Cold Start").
- ► After starting the instrument, check the log file for any errors:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the self test and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start the system error correction and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- ► Check characteristics as defined in chapter 1,Test Sequence for Option External Mixer B21 and correct, if necessary, using the correction software FSU-FRQ.EXE. The software is on the GLORIS server..
- ► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

3.2.40 Replacing Diplexer Board with Preamplifier A161; (Option B23)

(see chapter 5, spare parts list, item 2106 and illustration 1166.2338.01 sheet 4)

The board is installed on MW Converter Unit R&S FSQ26/40.

Removing Diplexer

- ► Remove the MW Converter Unit (140).
  Note: See description " Replacing MW Converter Unit A160; R&S FSQ26/40"
- ► Undo all cables on the diplexer (2106).
- ► Unscrew 3 screws with washers (2110) at the bottom of the PCB.
- ► Remove the diplexer (2106) perpendicularly to the PCB.

  Note:
  The diplexer is still connected to the PCB with contact pins.

Installing Diplexer

Plug in the new diplexer (2106) perpendicularly to the PCB.
Note: The diplexer is connected to the PCB with contact pins.

- ► Screw on 3 screws with washers (2110) at the bottom of the PCB.
- ► Screw on all cables to the diplexer (2106).

Completing Instrument and Correcting Frequency Response

- ► Plug the MW converter unit (140) back into instrument.

  Note:
  See description " Replacing MW Converter Unit A160; R&S FSQ26/40"
- ► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- ► A cold start is required after replacement (see chapter "Performing a Cold Start").
- ► After starting the instrument check if the protocol file is correct:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► Start selftest and check if the result is correct:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start system error correction and check if the result is correct:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]
- ► Run the "FSU-FRQ.EXE" frequency response software program.
  The software is located on the GLORIS server.
  - Test setup in accordance with menu item "Schematic" (connect external reference). Check IEC addresses and configurations of the instruments.
  - Press the Autoselect button and perform measurement with Run.
  - Select YIG to perform the frequency correction of the YIG filter.
  - After calibration, the frequency response is corrected for the entire frequency range.
- ► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

If R&S FSQ-B72 is available:

- Run "I/Q Response Correction" software.
  Do not run this software until after the system error correction reveals no errors (Total Calibration Status: Passed)!
  The software and the associated manual are located on the GLORIS server under Firmware/Software → R&S FSQ-B72 (test setup, see manual).
- Switch the instrument off and then on again.
- After starting the instrument, check the log file to ensure that no errors occurred:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]

  Note
  Every time the instrument is started without a valid I/Q frequency response file for R&S FSQ-B72, the message "Error at reading B72 ext. freq. response fil" is entered in the log file.

3.2.41 Replacing Electronic Attenuator A50 (Option B25)

(see chapter 5, spare parts list, item 1400, and illustrations 1313.9100 and 1144.9300)

Opening Instrument and Removing Module

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Place instrument on its side and remove RF cables on both sides of the electronic attenuator (1400).
- Undo 4 screws with washers (1460) from the trough.
- Carefully remove electronic attenuator (1400).
- Connect flat cable (1410) to electronic attenuator (1400).

Installing Module and Completing Instrument

- Refit flat cable (1410) to new electronic attenuator (1400).
- Carefully reassemble new electronic attenuator (1400) and screw it to trough using 4 screws with washers (1460).
- Refit RF cables to both sides of electronic attenuator (1400).
- Push enclosure (410) back in place and fix 4 rear-panel feet (450) by means of screws.
- Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- A cold start is required after replacement (see chapter "Performing a Cold Start").

- ► After starting the instrument check if the protocol file is correct:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► Start self test and check if the result is correct:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start system error correction and check if the result is correct:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]
- ► Run the "FSU-FRQ.EXE" frequency response software program.
  The software is located on the GLORIS server.
  - Test setup in accordance with menu item "Schematic" (connect external reference). Check IEC addresses and configurations of the instruments.
  - Press the Autoselect button and perform measurement with Run.
  - Select YIG to perform the frequency correction of the YIG filter.
  - After calibration, the frequency response is corrected for the entire frequency range.
- ► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data")

With R&S FSQ-B72:

- ► The entry "Error at reading B72 ext. freq. response fil" is normal and refers to the I/Q frequency response data that is no longer valid.
- ► Start the self test and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check the result:
  - [CAL : CAL TOTAL] , then [CAL RESULTS]
- ► Check frequency response of the R&S FSQ (correction program can be obtained on GLORIS) according to Performance Test and correct, if necessary.
- ► Check the data of the complete instrument according to the Performance Test.

3.2.42 Replacing I/Q Memory Extension A250 (Option B100)

(see chapter 5, spare parts list, item 4700, and illustrations 1313.9100 and 1169.5280)

The module is located in the front part of the instrument.

Opening the instrument and removing the module

- ► Switch off instrument, disconnect it from mains, unscrew 4 rear-panel feet (450) and pull off enclosure (410) toward rear.
- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.

CAUTION

The I/Q memory module can be installed with and without the R&S FSQ-B72 I/Q bandwidth extension module (A280). With option R&S FSQ-B72, the I/Q memory module must be removed together with the I/Q bandwidth extension module (A280), which, in turn, can only be removed in conjunction with the detector module (A140) located behind it. This is because of the connecting cables W253, W254 and W255. Without option R&S FSQ-B72, the module can be separately removed halfway, and fully after disconnecting the connecting cables.

- Place the instrument onto its side and remove all connecting RF cables to the I/Q memory modules (R&S FSQ-B100) A280 and A140.

  Note:
  The 26-pin connecting cable and the flat cables are partially secured by means of holders screw-connected to the connector.

- Pull the I/Q memory module out toward the top of the instrument.

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

- Undo 2 screws (4740 or 4752) and remove connector mounting plates (4772 or 4750).
- Disconnect the flat cables W253 (4710) and W255 (4770) from the I/Q memory module if option R&S FSQ-B100 is present. Disconnect 26-pin cable W66 (3720) and flat cable W253 (4710) from the I/Q memory module if option R&S FSQ-B100 is not present.
- Replace module, reconnect 26-pin cable and flat cables, fasten cable clamp with associated screws.

Installing the module and reassembling the instrument

- Insert new I/Q memory module **together** with I/Q bandwidth extension (A280), if present, into the instrument.
- Reconnect all RF cables to modules A280 and A140.
  Module A140 also has RF cables at the top.

  Note:
  Observe the labeling on the module**.**

- Mount top cover (240) and refasten it using 10 countersunk screws (260) and 3 screws with washers (250).
- Slide on enclosure (410) and screw on 4 rear-panel feet (450).
- Connect the AC supply cable and switch on the power switch.

Function check

- ► A cold boot is required after replacing the module (see chapter "Performing a Cold Start").
- ► After starting the instrument, check the log file to ensure that no errors occurred:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]
- ► Start selftest and check results to ensure that no errors occurred:
  - [**SETUP** : SERVICE : SELFTEST], next [SELFTEST RESULT]
- ► Start system error correction and check results to ensure that no errors occurred:
  - [**CAL** : CAL TOTAL] , next [CAL RESULTS]

3.2.43 Replacing Memory Modules (Option B102)

(see chapter 5, spare parts list, item 4850, and illustrations 1313.9100 and 1169.5450.00)

The memory modules are installed in the I/Q memory extension module (R&S FSQ-B100).

Opening the instrument and removing the module

- ► Switch off instrument, disconnect it from power supply, unscrew 4 rear-panel feet (450) and pull off enclosure (410) toward rear.
- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.

  CAUTION!

  The I/Q memory extension module (R&S FSQ-B100) must first be removed (see chapter "Replacing I/Q memory extension A250 (option: R&S FSQ-B100)").
- ► Undo 14 screws of bottom cover.
- ► Remove top cover and disconnect the fan.

Installing the module and reassembling the instrument

- ► Insert four memory modules (4850).
- ► Mount top cover and connect the fan.
- ► Use 14 screws to screw bottom cover to printed board and top cover.
- ► Mount top cover (240) and refasten it using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Slide on enclosure (410) and screw on 4 rear-panel feet (450).
- ► Connect the AC supply cable and switch on the power switch.

Function check

- ► A cold boot is required after replacing the module (see chapter "Performing a Cold Start").
- ► After starting the instrument, check the log file entry for available memory:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES], value must correspond to built-in memory capacity

3.2.44 Replacing Trigger Ports W67 (Option B28)

(see chapter 5, spare parts list, item 1360, and illustrations 1313.9100 and 1162.9921)

The cable is at the rear panel.

Opening the Instrument and Removing the Cable

- ► Switch off the instrument and disconnect it from power supply.
- ► Unscrew 6 screws (180).
- ► Move rear panel (170) with cables carefully outside.
- ► Disconnect cable W67 Trigger Port (1360) on motherboard and move on the rear panel.

Installing the Cable and Completing the Instrument

- ► Mount supplied cable W67 Trigger Port (1360) locking bolt (1365) spring (1370) and nuts (1375).
- ► Connect cable W67 onto motherboard X67.
- ► Fasten rear panel (170) again with 6 screws (180).
- ► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]

3.2.45 Replacing Preamplifier A50 (Option B24)

(see chapter 5, spare parts list, item 4500, and illustrations 1313.9100 and 1157.2116)

Opening Instrument and Removing Module

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) toward the rear.
- ► Place instrument on its side and remove RF cable W2 (4610 or 4615), RF cable W52 (4614) and RF cable W28 (4600) on preamplifier (4500).
- ► If option FSU-B5 is installed, remove RF cable W73.
- ► Remove ribbon cable on motherboard X50.

- ► Undo 2 screws (4612) from the bottom side of the bracket (4611).
- ► Disconnect the preamplifier (4500) from the attenuator (23 or 25).
- ► Carefully remove preamplifier (4500).

Installing Module and Completing Instrument

- ► Carefully reassemble new preamplifier (4500) and connect it to attenuator (23 or 25).
- ► Screw preamplifier (4500) back on bracket (4611) with two screws (4612).
- ► Connect ribbon cable to motherboard X50.
- ► Refit RF cable W2 (4610 or 4615), RF cable W52 (4614) and RF cable W28 (4600) back to preamplifier (4500).
- ► Refit cable W73 back to Preamplifier X49, if option FSU-B5 is installed.
- ► Slide on enclosure (410) and screw on 4 rear-panel feet (450).
- ► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- ► A cold start is required after replacement (see chapter "Performing a Cold Start").
- ► After starting the instrument check if the protocol file is correct:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► Start selftest and check if the result is correct:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start system error correction and check if the result is correct:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]
- ► Run the "FSU-FRQ.EXE" frequency response software program.
  The software is located on the GLORIS server.
  - Test setup in accordance with menu item "Schematic" (connect external reference). Check IEC addresses and configurations of the instruments.
  - Press the Autoselect button and perform measurement with Run.
  - Select YIG to perform the frequency correction of the YIG filter.
  - After calibration, the frequency response is corrected for the entire frequency range.
- ► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

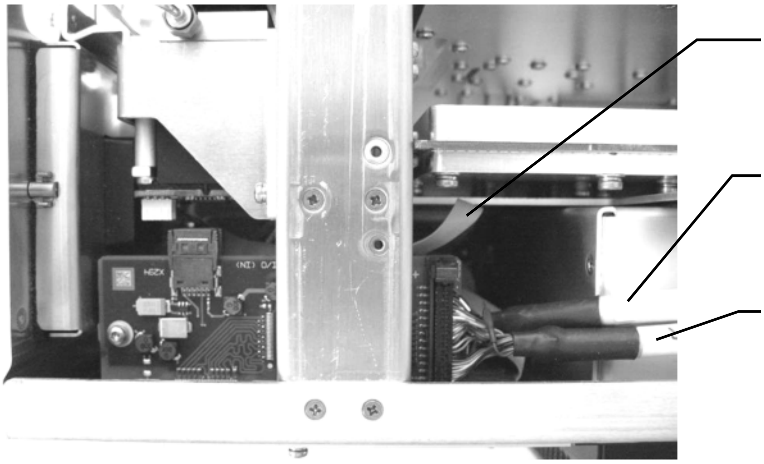
3.2.46 Replacing IQ DATA IN/OUT A290 (Option B17)

(see chapter 5, spare parts list, item 5000, and illustration 1313.9100)

Opening Instrument and Removing Module

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) toward the rear.

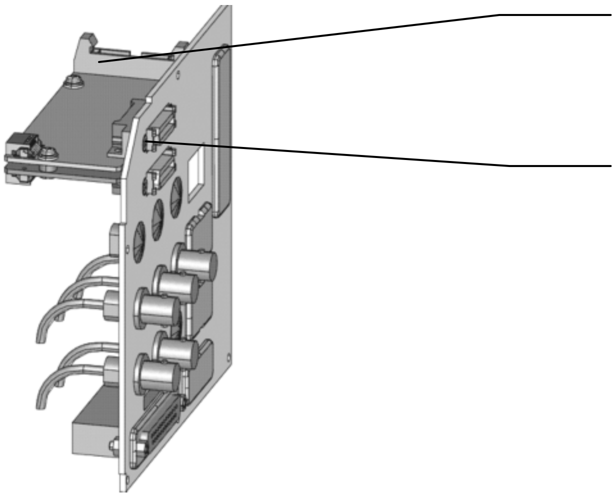
► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left .



► Remove ribbon cable (5020) on IQ data in/out (5000).

► Remove both LVDS cables (5030) on IQ data in/out (5000).

► Remove the rear panel:
Unscrew the 6 screws (180) and carefully take off the rear panel (170) with IQ data in/out (5000).



► Dismount 4 screws (5010) and remove the IQ data in/out (5000)

Installing Module and Completing Instrument

► Put the new IQ DIGITAL I/O board (5000) with the connectors into the designated slots in the rear panel and mount it with 4 screws (5010).

► Connect the ribbon cable W258 (5020) with X294 / X296 at the IQ DIGITAG I/O board.

► Put the rear panel (170) back onto the instrument and tighten it with 6 screws (180).

► Connect the cable W257 (5030) with X295 at the IQ DIGITAL I/O board.

- Connect the cable W256 (5030) with X293 at the IQ DIGITAL I/O board.
- Mount top cover (240) and refasten it using 10 countersunk screws (260) and 3 screws with washers (250).
- Slide on enclosure (410) screw on 4 rear-panel feet (450.
- Connect the AC supply cable and switch on the power switch.

Function Test

- Interconnect both connectors of option R&S FSQ-B17 (IQ DATA I/O) with MDR cable (e.g. R&S Order No. 1130.1302.00).
- Perform a cold start
  Connect the power cable and press the power switch. The instrument is now in the standby mode.
  While the ON key is pressed, the decimal point key must be pressed and held down until the computer responds with a beep.
- [SETUP: SERVICE: ENTER PASSWORD: 894129 ENTER[
- [SETUP: SERVICE FUNCTIONS: 2.39.10.2.1 : ENTER[
- [SETUP: SERVICE: ENTER PASSWORD: 0 ENTER[(→ service password disabled)
- [SETUP: SERVICE: SELFTEST]
- [SELFTEST RESULTS]: check status = passed
- The R&S FSQ-B17 self test result is listed at the end of test block "wideband detector board VSA tests":
  - without option R&S FSQ-B100: Det LVDS loopback 1 PASSED
  - with option R&S FSQ-B100: B100 LVDS loopback 1 PASSED
- Check if the protocol file is correct:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- Start selftest and check if the result is correct:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start system error correction and check if the result is correct:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]

3.3 Troubleshooting

Malfunctions may have simple causes but may also be caused by faulty components.

These troubleshooting instructions can be used to locate error causes down to board level and make the instrument ready for use again by means of board replacement. For troubleshooting and diagnostics, a selftest is available that polls diagnostic voltages of the modules and displays limit value violations.

We recommend shipping the instrument to our experts in the service centers (see address list at the beginning of this manual) for module replacement and further error elimination.

WARNING

Do not plug or unplug boards prior to disconnecting them from the AC supply!

Be careful not to cause short-circuits when measuring voltages!

The following utilities are provided in the R&S FSQ for diagnostic purposes:

Permanent monitoring of levels and frequencies in the instrument

- Selftest
- System error correction

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

3.3.1 Measuring Equipment and Accessories

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S-Order No.	Use
1	DC meter		R&S URE	0350.5315.02	Troubleshooting
2	Spectrum analyzer	Frequency range 0 to 7 GHz	R&S 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

3.3.2 Troubleshooting Switch-on Problems

- **Error: The R&S FSQ 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
At the bottom of the motherboard, check which of the voltages is short-circuited: Computer, hard disk, EEPROMs : X20.A7 to A10: rated value: +5 V2 Wideband detector unit: 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	One voltage is missing or very low: Remove the respective boards from the instrument one by one and repeat the measurement. If the voltage is supplied, the error is probably located on the module removed. ***Note:*** *The power supply switches off all voltages after a short time in the 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 7V	If there is no voltage, the fan is defective: Replace fan. If the voltage is too low, the fan is blocked or the power consumption is too high.

3.3.3 Troubleshooting Problems with Booting

- **Error: The R&S FSQ does not start the measurement application.**

Following switch-on, the R&S FSQ 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 a start-up program. Simultaneously, selftests are performed at various locations and error messages, if any, are output. The messages are disabled with normal operation, but can be enabled for troubleshooting purposes. When troubleshooting, it is advisable to connect a keyboard to the keyboard socket.

Normal action	Error and error cause
► Start the R&S FSQ.	
After the R&S FSQ is switched on, 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 V2.0-17-2** **02/12/2002-io815E-LPC47B2-6A69REFC2C-00**	
After the first beep, the computer starts the hardware test and the following message is briefly displayed at the lower edge of the screen:	
, ESC to skip Memory test...	
ıre usually not displayed. If errors occur during the boot procedure, may indicate defects.	
► The messages can be made visible by pressing the "DISP" key following the beep. The keystroke is acknowledged by a second beep.	
► Then, all messages are displayed.	
Award Modular BIOS v6.00PG, An Energy Star Ally **Copyright (C) 1984-2000, Award Software, Inc.** **R&S ANALYZER BIOS V2.0-17-2** **Main Processor : Intel Pentium III 700 MHz (100x7.0)** **Memory Testing: 261120K OK + 1024 Shared Memory** ***(= result of memory test)*** **02/12/2002-io815E-LPC47B2-6A69REFC2C-00**	If no result of the memory test is indicated, the memory is defective.
The memory test yields the memory capacity of the front module controller. The basic version of FMR6 provides 256 Mbyte. BIOS then starts to check the controller hardware. All PCBs found are displayed.	

Normal action	Error and error cause
► This procedure may be interrupted using the "PAUSE" key on the connected external keyboard, any other key continues the program execution.	
Award Modular BIOS v6.00PG, An Energy Star Ally **Copyright (C) 1984-2000, Award Software, Inc.** **R&S ANALYZER BIOS V2.0-17-2** **Main Processor : Intel Pentium III 700 MHz (100x7.0)** **Memory Testing: 261120K OK + 1024 Shared Memory** **Primary Memory Clock is 100 MHz** **Primary Master : IBM-DJSA-205 JS100AB0A** *(depending on installed hard disk))* **Primary Slave : None** **Secondary Master : None** **Secondary Slave : None** **02/12/2002-io815E-LPC47B2-6A69REFC2C-00**	If this hard disk entry is missing, the hard disk may be faulty
SETUP is then displayed. ► This procedure can also be interrupted using the "PAUSE" key.	
The contents partly depend on the hardware provided:	

Award Software Inc.
System Configurations

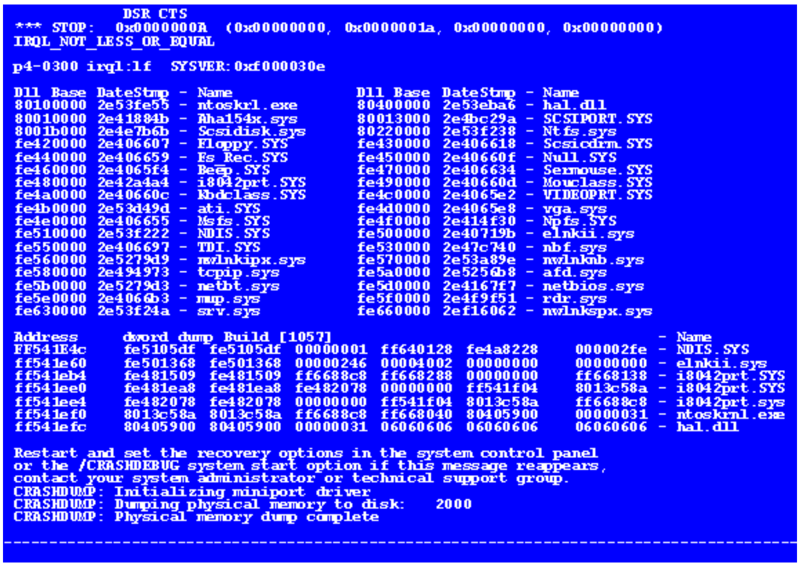
CPU Type	Intel Pentium III	Base Memory	640K
Co-processor	Installed	Extended Memory	260096K
CPU Clock	700 MHz	Cache Memory	256
Diskette Drive A	1.44M, 3.5 in.	Display Type	EGA/VGA
Diskette Drive B	None	Serial Port(s)	3F8
Hard Disk Drive C	LBA ,ATA 66, 5001MB	Parallel Port(s)	378
Hard Disk Drive D	None	EDO DRAM at Row(s)	None
		SDRAM at Row(s)	2 3
		Display Cache Size	None

PCI device listing.....

Bus No.	Device No.	Funct No.	Vendor /	Device ID	Class	Device Class	IRQ
0	2	0	8086	1132	0300	Display Cntrlr	10
0	31	1	8086	244B	0101	IDE 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	1212	FF00	Unknown PCI Device	11

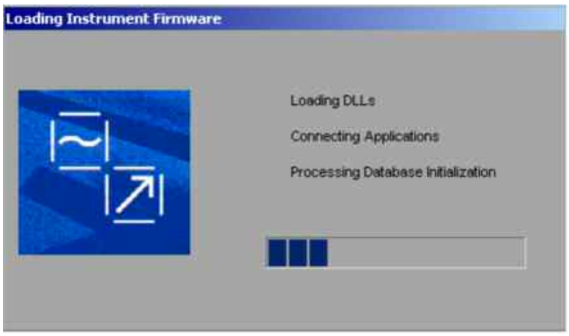
Normal action	Error and error cause
The PCI hardware test is displayed in the lower half of the screen. All modules found during the test are displayed with their names and PCI device IDs. The Device Class column lists the types of PCI devices. The wideband detector unit of the R&S FSQ is indicated as "Unknown PCI Device".	If the line "Unknown PCI Device" is missing, the wideband detector unit has not been identified and the measuring application cannot be started. If the remaining PCI devices have all been identified, the wideband detector unit 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 successful installation of Windows NT, 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.** The Windows XP start screen will appear in a few seconds.	If the instrument has started correctly so far, there is most probably no fault in the computer; the boot problem presumably results from a defective system file on the hard disk.

Normal action	Error and error cause
	If the operating system on the hard disk has been destroyed and cannot be loaded correctly, Windows XP displays a "bluescreen". This bluescreen contains all essential information about the internal states of the computer which are displayed as follows (by way of example):

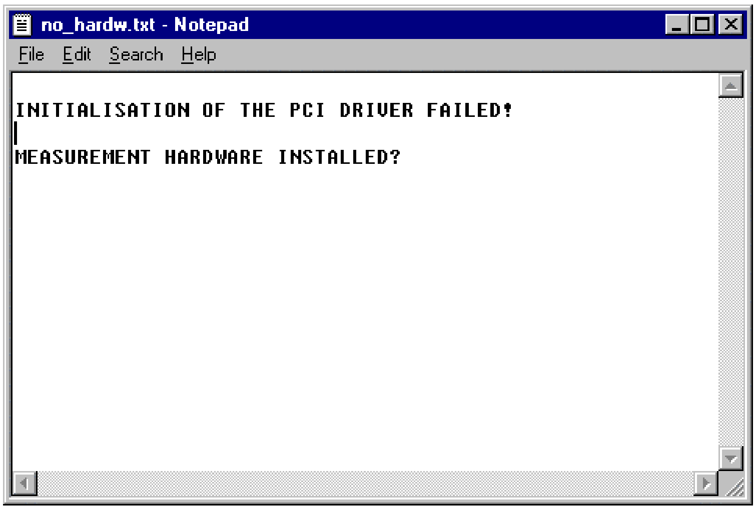


Windows XP and the instrument firmware must then be updated from the back-up partition (see chapter 4, section "Software Update").

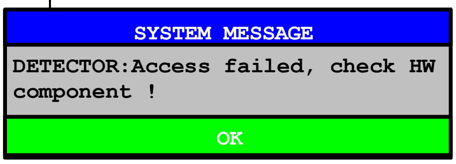
Before the operating system is started, the application for the R&S FSQ is loaded in a start-up program. The program start is initiated automatically and generates a window that displays information about the start-up procedure.

Normal action	Error and error cause
	If a "bluescreen" is displayed when loading, a cold start may be necessary. Proceed as follows in this case: ► Cold start (see section "Performing a Cold Start") ► Firmware update from the backup partition if cold start is not successful (see chapter 4).

Normal action	Error and error cause
While booting, the wideband detector unit is identified again.	If the wideband detector board is not identified, the following message is issued:



Normal action	Error and error cause
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 R&S FSQ (RF converter).	If there is an error on the detector board or the clock is missing, the following message is displayed:



After passing the function tests, the analog boards are initialized and the correction data EEPROMs are loaded.

The reference is generated on the synthesizer. This 128 MHz reference is necessary for proper functioning of the detector board.

► In this case, first check the clock generation in the instrument.

The following measurements are appropriate to check the reference supply:

Measurement:	**Result:**
Synthesizer A100, X114: rated value 128 MHz, 0 dBm ⇓	No signal: replace synthesizer.
Synthesizer A100, X114: rated value 32 MHz, 0 dBm	No signal:replace synthesizer.

If no error occurs with the clock generation, booting can be continued by acknowledging the error message using "OK"

If no error message or any other information on the error source is issued during booting, the error can only be determined by replacing the wideband detector unit or the front-module controller.

3.3.4 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 to the RAM of the computer. The calibration data of a module is either read from the EEPROM (in the case of a cold start from EEPROM only) or from the associated binary file. The module information is read from the module EEPROMs in the case of a cold start. Otherwise the binary data is read from the hard disk during starting (e.g. motherb.bin).	
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. motherb.bin).	If the binary data cannot be read out without error, an error message will be output, e.g.: 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 is 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 are faulty (e.g. check sum of header block incorrect), the calibration data of the respective module is read from the associated file. The firmware assumes that the module is available. The information read from the file is entered into the array for storage of the module information. 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 compared with the module header of the associated binary file. If the module header can be read from the file and complies with the header read from the EEPROM, the assumption is made that the contents of the module EEPROM have 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
After loading the calibration data from the EEPROMs and files, the data collected during the last calibration is loaded from the 'rdf_cal.bin' file into the calibration data memory. This process takes place only if valid calibration data (and the 'rdf_cal.bin' file) is available.	If there is no valid calibration data, the status message "UNCAL " is output informing the user that the instrument is uncalibrated.

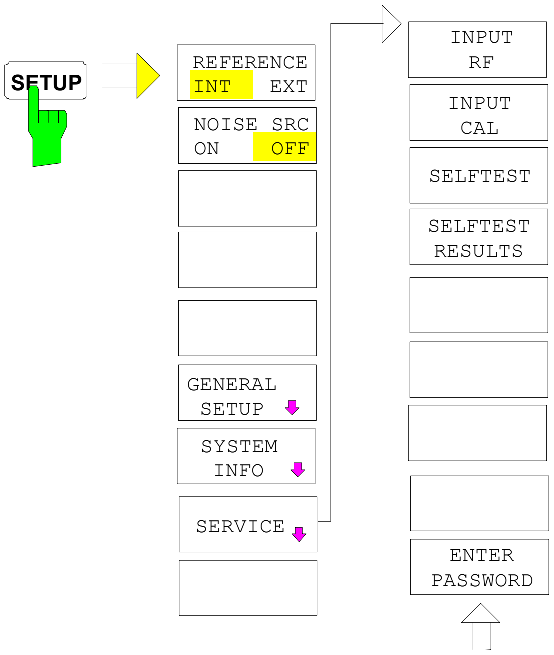
3.3.5 Troubleshooting via Selftest

The selftest is provided for identification of instrument errors and tolerance violations that cannot be corrected by 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 that are used for the self-calibration with regard to a sufficient setting range including reserves.

Service Level 1 - 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.

The selftest can be called in the *SETUP - SERVICE* menu:



- ▶ Enter the password 894129 with *ENTER PASSWORD*.
- ▶ Initiate the selftest of the instrument modules using the *SELFTEST* softkey.
- ▶ While the selftest is running, a message box is displayed that 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***, look not only for entries marked with FAILED** but also those marked with SKIPPED. These entries indicate that a test item was not carried out, because the conditions had not been met. In this case, an error is present only if the instrument cannot be calibrated.

The selftest with password returns FAILED as the overall status, because the instrument will no longer be able to be calibrated in the near future due to temperature drift or aging.

The selftest without password returns the overall status of PASSED; in this case as well, however, the skipped test items are marked with SKIPPED as an aid for the service technician.

Running Selftest and Error Messages

Overview

The calibration source on the IF filter module is used as a signal source for testing the signal path.

1. Measurement of the operating voltages of the power supply 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. Synthesizer test
5. Lock test YIG oscillator and LO level test on RF converter
6. Testing of the signal paths on RF converter, IF filter and detector
7. Test of optional modules

All measurements on the analog boards are independent of the gate arrays on the wideband detector unit, since individual A/D converters are provided for them on the analog boards. The interface section in the FPGA of the wideband detector unit must function properly to read these A/D converters. This is always tested when the instrument is switched on.

The signal path via the gate arrays on the wideband detector unit is tested using a known, analog signal at the input of the A/D converter on the wideband detector unit. 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 not required by the selftest has failed, this is correctly signaled 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.

Testing Operating Voltages

When an operating voltage fails, the selftest is aborted to avoid subsequent errors.

The test is not aborted after entry of the password. All subsequent errors are then listed in the result record. Errors that have occurred irrespective of the voltage failure can then still be detected.

The error message indicates the error source (power supply, IF filter, wideband detector unit) and the voltage that has 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 wideband detector unit.	
	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 are within the tolerance limits, the error must be located in the selftest: ► Replace the wideband detector unit.
Regulated voltages on the boards **Wideband detector unit**	
	FATAL ERROR! Detector: DC FAIL -5V. Selftest aborted.
	► If no faults have been found in the preceding tests, the wideband detector unit has to be replaced.

Power supply channels:

Channel	Nominal voltage
1	+6 V
2	+8 V
3	+12V
4	-12 V
5	+28 V
7	-6 V

Wideband detector unit channels:

Channel	Nominal voltage
6	-5 V

Temperature Measurement on IF Filter

Normal action	Error and error cause
The **temperature** is measured first.	WARNING! IF FILTER: Operating temperature xx °C - out of range ► If the temperature does not lie within the permissible range of 0° to 70°C, the warning will be output. ► Check the temperature data for plausibility. The fan might be defective or the ventilation slots might be covered. ► If the indicated temperature data is not plausible, e.g. 120° C when the instrument is cold, the temperature sensor or the selftest may be faulty.
Subsequently the operating voltages are measured.	► If, in the following, the *first* operating voltage (or all operating voltages after entering the password) is measured incorrectly, the selftest will obviously be defective.

Channel	Nominal voltage	Expression displayed in the error message
74	- 5 V	UREF-5
77	+2.5 V	UREF+2.5
76	+3.3 V	+3.3 V
73	+5 V	+5 V
72	+10.6 V	+10 V
71	-5 V	-5 V
70	-10.6 V	-10 V
75	+5 V	+5 VR

► The IF filter board must always be replaced if an error message occurs that 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 4-fold D/A Converter on Wideband Detector Unit

Normal action	Error and error cause
Wideband Detector Unit Pretune-DAC Test The 4-fold D/A-converter on the wideband detector unit 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.	
	FATAL ERROR! Detector: Pretune DAC FAIL - check DCON and pretune DAC Selftest aborted.
	► Replace the wideband detector unit

Channel	Nominal voltage
8	666 mV

Testing Synthesizer

Normal Action	Error and error cause

Channel	Voltage nominal	Expression displayed in the error message
11	- 5 V	-5 V
01	+5 V	+5 V
21	+7 V	+7 V
60	+12 V	+12 V
41	+28 V	+28 V

► If there is an error message referring to these operating voltages, the synthesizer is always to be replaced.

Temperature Measurement:

The synthesizer accommodates a temperature sensor for the module temperature and one monitoring the heater of the 128 MHz reference oscillator.

Test channel 71

WARNING!
Synthesizer: Temperature out of range

Test channel 51

WARNING!

► Synthesizer: Temperature 128 MHz reference range

► In the case of an impermissible temperature, tuning the 128 MHz oscillator to the correct frequency may not be possible since the SC cut crystal used is specified for a temperature of 70 °C.

Reference signals on the synthesizer
The control loops on the synthesizer are checked for the locking status and the set control voltage.

10 MHz OCXO level:
Level detector channel 00.

FATAL ERROR!
10 MHz OCXO defective !

► Replace the synthesizer in case of error.

128 / 384 MHz oscillators:
Testing the 128 MHz crystal oscillator and the third LO.

ERROR!
Reference 128 MHz / 3rd LO unlocked !
Reference 128 MHz / 3rd LO out of tuning range !

► The instrument may still work properly, but the tuning voltages are almost at the limit or the frequency accuracy is out of tolerance.

► Replace/adjust the synthesizer.

Normal action	Error and error cause
Sweep synthesizer: Testing the tuning voltage at the sweep VCO 600 (595) - 620 MHz	ERROR! Sweep synthesizer unlocked ! Sweep synthesizer out of tuning range ! ► If the sweep VCO fails, the YIG oscillator does not lock or it locks at an incorrect frequency and also signals unlock. ► Replace synthesizer.
Second local oscillator Testing the tuning voltage at the 4224 MHz oscillator	FATAL ERROR! 2nd LO tuning voltage out of range ! ► If the second local oscillator fails, it is possible that the YIG oscillator does not lock or it locks at an incorrect frequency and also signals unlock. ► Replace synthesizer
Calibration signal control voltage: Checking the detector voltage in the level control of the Cal signal	ERROR! Calibration signal error ► If the control voltage is out of tolerance, the level control loop unlocks and the level becomes inaccurate. In the case of a small level error, the selftest of the signal path is possible. However, the level measuring accuracy will be out of tolerance after instrument calibration. ► Replace synthesizer.

Testing RF Converter

Normal action	Error and error cause

Channel	Voltage nominal	Expression displayed in the error message
60	+5 V	+5 V
61	2.5 V	DAC Reference
62	+7 V	+7 V
63	+11 V	+11 V
64	+28 V	+28 V

- ► The RF converter is always to be replaced if there is an error message referring to these operating voltages.

Temperature Measurement:

The RF Converter accommodates a temperature sensor for the module temperature.
Test channel 67

WARNING!
RF Converter: Temperature out of range

- ► Check air supply and fan for proper functioning.

Test LO level

The level detectors of the second and third LO are read:

Channel	Oscillator	Expression displayed in the error message
3	LO 3	Level 3rd Local
2	LO 2	Level 2nd Local

- ► In the the voltage is too low, also check the level at the module input in the selftest poll! Setting Center, Zero Span
- ► + 10 dBm / 384 MHz at X 101
- ► + 7 dBm / 4224 MHz at X105
- ► If the levels are correct, replace the RF converter. If the levels are not okay (deviation > 3 dB), measure the signals at the synthesizer again and replace the synthesizer, if necessary!

YIG oscillator test:

The YIG oscillator is tuned throughout the entire frequency band. The pretuning (with upper and lower limit) is also tuned with a small offset from the actual frequency. If the current flowing through the YIG coil and set by the PLL reaches one of these limits, the unlock detector will respond. This is a test both for the pretuning values and for functioning of the PLL.

FATAL ERROR!
YIG Oscillator unlocked !

- Replace the RF converter in the case of error.

Test input mixer

The mixer diodes both rectify part of the LO power. The two voltages can be polled via the selftest channels 0 and 1.

- If the two voltages are missing or too low, the LO level is presumably missing, which is why an error message appears:

FATAL ERROR!
1st LO level low or 1st mixer defective !

- If the two voltages differ (>20 %), the mixer is asymmetric, i.e. one of the two diodes is damaged.

FATAL ERROR!
1st Mixer symmetry out of tolerance !

- In both cases:
- Replace RF converter

Testing Signal Path via Attenuator

The internal source for the test signal (CAL signal) has already been tested when testing the reference signals. The first and second mixer feature sufficient LO power, i.e. the conversion from the RF to the second IF should therefore work properly.

Normal action	Error and error cause
Signal path via RF attenuator The measurement is made at the second IF using a logarithmic detector on the RF converter. The 0 dBm test signal is measured with the following attenuator settings:	

RF-Att	Coupling	Test
0	DC	Reference measurement
0	AC	AC/DC switch +-5 dB
5	DC	5-dB attenuator +- 5 dB
10	DC	10-dB attenuator +- 5 dB
20	DC	20-dB attenuator +- 5 dB
40	DC	40-dB attenuator +- 10 dB

- If there is **no** measured value within the tolerance range, the error is likely to be located in the subsequent signal path. It is not likely that all attenuator stages and the 0-dB position are faulty; therefore, the following error message appears.

FATAL ERROR!
Input level RF converter out of tolerance !

- Before replacing the RF converter, measure the input level at X108 in any case. For this purpose, the input is connected to the Cal source with 0 dBm and 0 dB attenuator DC coupling. The level should lie at 128 MHz and 0 dBm. Otherwise, check level at X125.
- If the level is okay, replace the RF converter.
- If the signal is not applied at the synthesizer either, replace the synthesizer.
- If only individual measurements are out of tolerance, the RF attenuator is defective.

FATAL ERROR!.
RF Attenuator xx dB pad failed !

CAUTION! '
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 IF Filter Board

Normal action	Error and error cause
Input level of IF filter / calibration amplifier (CAL-Amps 1 + 2)	FATAL ERROR! IF board: IF input level / CALAMP Selftest aborted Possible error causes: • Signal path interrupted in the RF converter. • Erroneous EEPROM data in the RF converter leading to incorrect setting of CAL_Amp1. • CAL_Amp1 or 2 faulty. Troubleshooting ► Check the level applied at X132 with 0 dBm mixer level: Nominal –3 dBm, production tolerance ± 3 dB, max. permissible ± 4.5 dB; ► Replace the RF converter if the deviation exceeds this value. If the level lies within the tolerance, a defective CAL_Amp may have caused the error. The setting ranges of the CAL_Amps are later tested during the selftest. The selftest is not interrupted after entry of a password. ► Note whether the result file contains any error messages concerning the CAL_Amps. If there is no CAL_Amp error, the CAL_Amps will be set incorrectly. The EEPROM data in the RF converter are obviously incorrect.
LC filter I and XTAL filter The level measurement is performed with wide and narrow bandwidths of the LC filter. Subsequently, an additional measurement is performed 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
StepGain (IF amplifier) 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 simultaneously amplified by means of the StepGain by the same amount. 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 bypassed (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. **CAUTION!** If the RF attenuator test has already caused 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.

Signal Paths on Wideband Detector Unit

Normal action	Error and error cause
Various settings of the wideband detector unit are checked via the normal display function, i.e. FFT mode, digital filters and analog filters. Possible error messages:	
	ERROR! Detector Board: FFT Detector Board: FIR Detector Board: Video

3.3.5.1 OPTION: I/Q Baseband Input Board R&S FSQ-B71

Baseband Signal Input on Wideband Detector Board

Normal action	Error and error cause
Baseband input X144 (I channel) is checked for continuity. Baseband input X145 (Q channel) is checked for continuity. To this end the baseband input 2 board applies a DC voltage >1 V to inputs X144 and X145. The voltage is typically higher than the measurement range of the A/D converter so that the result corresponds to the full-scale value 1.42 V. Compliance with >0.6 V is checked. For a second measurement in each channel, the input is switched off. For the I channel, this is done by switching to the IF path; for the Q channel by switching to GND. The typical value measured is 0 V. Compliance with <0.2 V is checked.	See under SELFTEST RESULTS: detector board: baseband input path tests I channel IF FAILED and / or Q channel GND FAILED Possible error sources: • Input switch or A/D converter on the wideband detector board defective • Input switch or A/D converter on the wideband detector board defective. • The baseband input 2 board does not provide the DC voltage required for the selftest.

Baseband Input Board

Normal action	Error and error cause
Signal path All switchable signal paths will be checked for compliance with a level tolerance of ±10%. These are: I channel, high I channel, low Q channel, high Q channel, low In each of these four paths, the 0 dB range, the two -5/-10 dB attenuators and the three +5/+10/+15 dB amplifiers are checked. An additional measurement is performed in the I and Q paths with the filter switched on. If an error is detected in the 0 dB range, all other amplifier/attenuator stages and the filter are not checked as they would inevitably produce a FAILED.	See under SELFTEST RESULTS: baseband board: signal path tests I/Q path high/low x dB FAILED and / or I/Q path filter FAILED urces: Switch or amplifier on the baseband input 2 board. Special case: I/Q path high, 0 dB, FAILED If this error occurs, all other tests in the respective channel are skipped. The cause may also be a defective cable to the wideband detector board: W57 (I channel) or W58 (Q channel). First check the cables or replace them for a test. If the cables are OK, replace the baseband input 2 board.
Other components Dither The peak-peak voltage of each channel (I and Q) is measured first with and then without dither signal (internal noise only). DC offset DAC Function and setting range of the two DACs are checked. (The DACs are required to compensate for the I/Q offset.) Pulse source Check level of pulse source. (The pulse source is required to determine the frequency response correction.)	See under SELFTEST RESULTS: baseband board: components

	I/Q path dither FAILED and / or I/Q DC offset DAC FAILED and / or pulse source FAILED
	Possible error sources: Failure of components (dither, DC offset, DAC, pulse source) on the baseband input 2 board.
	I/Q path noise FAILED
	Possible error sources: Strong noise on the baseband input 2 board (e.g. because the amplifier is defective) or on the wideband detector module (e.g. stuck bit). Troubleshooting: ► Disconnect cables from X144 and X145 on the wideband detector board and terminate the inputs X144 and X145 with 50 Ω or short-circuit them. Repeat selftest, with password, so that the test is not interrupted. ► Observe only the measured I/Q path noise: If a PASSED is obtained → replace the baseband input 2. If a FAILED is obtained → replace the wideband detector board.

3.3.5.2 OPTION: I/Q Bandwidth Extension R&S FSQ-B72

Normal action	Error and possible error sources
Signal path All switchable signal paths of the optional module are checked for compliance with a level tolerance of ±6 dB (absolute tolerance, RF converter included). The measurement is entered in the SELFTEST RESULTS as a factor relative to the rated value (rated value = 1). The 128 MHz CAL source, 0 dBm, is used as a test signal. The measurement is ececuted via the normal measurement A/D converter of the optional module and via the LVDS data input of the wideband detector module.	See under SELFTEST RESULTS: `wideband (B72) tests`

	`if amp on, filter on xxx FAILED`
	`and/or`
	`if amp on, filter of xxx FAILED`
	`and/or`
	`if amp off, filter on xxx FAILED`

Normal action	Error and possible error sources
	Possible error sources: • The selector or amplifier on the I/Q bandwidth extension module is defective. This is most likely the cause if not all three results failed. • If all three results failed, the cause may also lie outside the module. A correct level display of the instrument when RBW = 20 MHz is a precondition for the error-free operation of the R&S FSQ-B72, for in this case the same IF signal is evaluated. This may have to be repaired first. The LVDS data cable W66 to the wideband detector module must also be checked.
Dither The peak-to-peak voltage of the dither signal (without input signal) is measured.	`dither level xxx FAILED` Possible error sources: A defect on the I/Q bandwidth extension module.

Normal action	Error and possible error sources
PLL The PLL control voltage is tested. The PLL controls the 326.4 MHz clock of the A/D converter.	`ADC clock unlocked FAILED` Possible error sources: • A defect on the I/Q bandwidth extension module. 128 MHz reference is not available. Test on reference input X283 of the I/Q bandwidth extension module. The same signal is also measurable on the reference output X284. Level > -6 dBm (128 MHz). Test cable or synthesizer module, if necessary.

3.3.6 Troubleshooting RF Converter 1

Depending on the kind of error, a few measurements should be performed on the RF converter before the module is replaced:

- IP3 too high
- Signal level too low
- LO feedthrough too high
- Spurious signals

These errors may be caused by a defective input mixer. Since this mixer is directly connected to the input connector, it may be easily destroyed by the user.

A defective mixer can be recognized from a very high display of > -10 dBm at the frequency 0 Hz with 0 dB input attenuation.

Action	Error and error cause
Measure with diode tester at X101: rated value: approx. 0.6 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 RF converter

- **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 cause/remedy
Measure function of the 1st LO in zero span. check signal at X107: rated value: 4628.4.4 MHz above the current input frequency (between 0 Hz and 3.6 GHz) and the signal level is approx. –5 dBm.	The frequency is considerably higher or lower or the signal is not stable replace RF converter

3.3.7 Troubleshooting MW Converters

The most common error on MW converters is that the displayed signal level on the signal analyzer
> 3.6 GHz is too low or missing altogether.

Level ratios on MW converter

Action	Error cause/remedy
Apply a high-frequency signal (f > 3.6 GHz) at the MW converter input with a level of -20 dBm and measure the IF level at the output connector with a spectrum analyzer. The center frequency of the R&S FSQ must be set to the frequency of the signal generator, and the span must be set to 0 Hz. If the instrument is operated on an adapter, the LO (connector X102 RF converter) must be taken out to the MW converter (connector X167 / X1611). **R&S FSQ 8:** - Diplexer input connector: X169 - Output connector: X161 **R&S FSQ 26/40:** - Diplexer input connector: X168 - Output connector: X162 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 following items). If the measured level is within tolerances, the attenuator or a subsequent module in the signal path is defective.

Level ratios on diplexer

Action	Error cauase/remedy
Apply a high-frequency signal (f > 3.6 GHz) at the diplexer input with a level of -20 dBm and measure the level at the output connector. **R&S FSQ 8:** - Diplexer input connector: X169 - Diplexer output connector: X8 **R&S FSQ 26:** - Diplexer input connector: X168 - Diplexer output connector: X5 **R&S FSQ 40:** - Diplexer input connector: X168 - Diplexer output connector: X7 Output level: >-27 dBm	If the level is missing or too low, replace the diplexer (see "Replacing the Diplexer Module"). If the measured level is within tolerances, one of the subsequent modules on the MW converter is defective.

Level ratios on YIG filter unit

Action	Error cause/remedy
Apply a high-frequency signal (f > 3.6 GHz) at the YIG filter input with a level of -25 dBm and measure at the output connector. Set the R&S FSQ 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 diplexer (see "Replacing the YIG Filter Unit Module"). If the measured level is within tolerances, one of the subsequent modules on the MW converter is defective.

Level ratios on RF extension

Action	Error cause/remedy
Apply a high-frequency signal (f > 3.6 GHz) at the RF extension input with a level of -10 dBm and measure at the output connector. Set the R&S FSQ to the center frequency of the signal generator and a span of 0 Hz. If the instrument is operated on an adapter, the LO (connector X102 RF converter) must be taken out to the MW converter (connector X167). **R&S FSQ 26:** - Input connector: X1 - Output connector <26.5 GHz: X3 <u>Output level at 404.4 MHz:</u> f = 3.6 GHz to 26.5 GHz: >-26 dBm **R&S FSQ 40:** - Input connector: X1 - Output connector: X4 Output level at 404.4 MHz: f = 3.6 GHz to 26.5 GHz: >-26 dBm - Input connector: X1 - Output connector: X5 Output level at_404.4 MHz: f = 29.6 GHz to 42.3 GHz: >-30 dBm Output level at 4.6284 GHz: f = 27 GHz: >-30 dBm f = 45 GHz: >-35 dBm	If the level is missing or too low, replace the diplexer (see "Replacing the RF Extension Module").

3.3.8 Troubleshooting - Wideband Detector Unit

The extensive selftest will detect most of the faults that may occur on the wideband detector unit.

Selftests performed

- complete signal path for analog filters, digital filters and FFT
- detectors
- PCI interface, data transfer from and to main processor
- signal processing chain (resampler, wideband DDC, RAM, DSP)
- clock synthesizer
- Pretune DAC
- frequency and time sweep
- supply voltages

Any "failed" in the test results of the detector board indicates a fault in this unit, provided the tests of the preceding boards (RF converter, synthesizer, IF filter) have all been passed. For example, the tests of the detector board signal path rely on a correct IF or video input signal.

Part of the signal path is tested only functionally. Performance testing is restricted from the analog input (IF/Video) via the A/D converter to the correction RAM. For example, a blocked bit (except one of the most significant ones) cannot be detected, as there is no test pattern available from ADC.

If the selftest has been passed but the instrument shows unexpected response in the spectrum display such as spikes, strong noise, pumping noise floor, spurious, stepped curves and so on, some additional tests should be performed to prove that the fault is actually in the detector unit.

To ensure that the detector board receives an error-free signal, a signal generator must be used to substitute the IF/video signal.

3.3.8.1 Test Setup

Connect signal generator (50 Ω output impedance) to X149 of the detector board.

Video Path, Differential Linearity Test

This is a sensitive test for blocked bits.

Signal generator settings

- Frequency 1 kHz
- Level -1.7 dBm

R&S FSQ settings

- Preset
- Zero Span
- Sweep time 300 µs
- AMPT Range Linear
- CAL Cal Corr Off
- Trigger Video

Expected display

Continuous sinewave-like trace without significant steps (very small steps are due to noise and pixel resolution)

Why use a linear display? The instrument expects a logarithmic signal at the ADC input. In case of a linear display, the signal is therefore log/lin converted. In the test case, a linear signal is used instead at the ADC input. The log/lin conversion then considerably magnifies differential errors at high levels, yet the whole level range is displayed.

Fig. 3-15 shows the trace of an error-free unit.

In the trace shown in Fig. 3-16, there is an error at the seventh highest bit (differential error = 1/128 of range). Due to the log/lin conversion the effect is extremely magnified at higher levels.

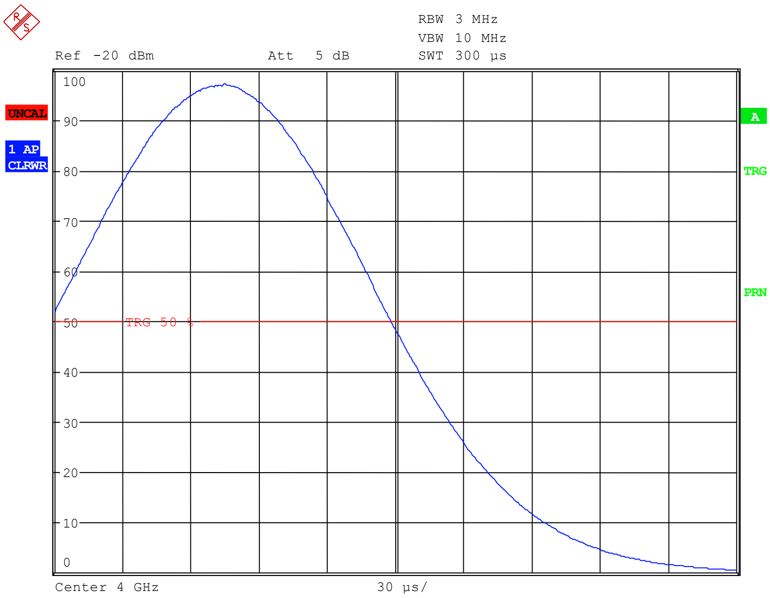


Fig. 3-15 Video path differential linearity test, error-free unit

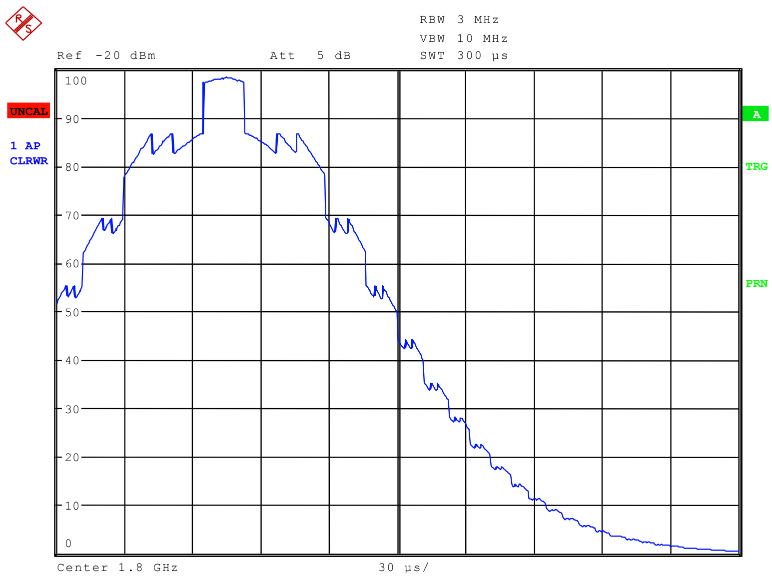


Fig. 3-16 Video path differential linearity test, faulty unit (blocked bit).

3.3.8.2 FFT Path Performance Test

R&S FSQ settings

- Preset
- Span 50 kHz
- RBW 100 Hz
- Filter Type FFT
- AMPT Log Range Manual 120 dB
- CAL:Cal Corr Off

3.3.8.3 Noise floor

Signal generator setting

- Level OFF (50 Ω termination alternatively)

Expected display

Noise at the bottom line of the display (see Fig. 3-17).

Possible errors:

Higher noise (more than 10 dB compared to Fig. 3-17)

Higher noise in single sweeps (needs some observation time)

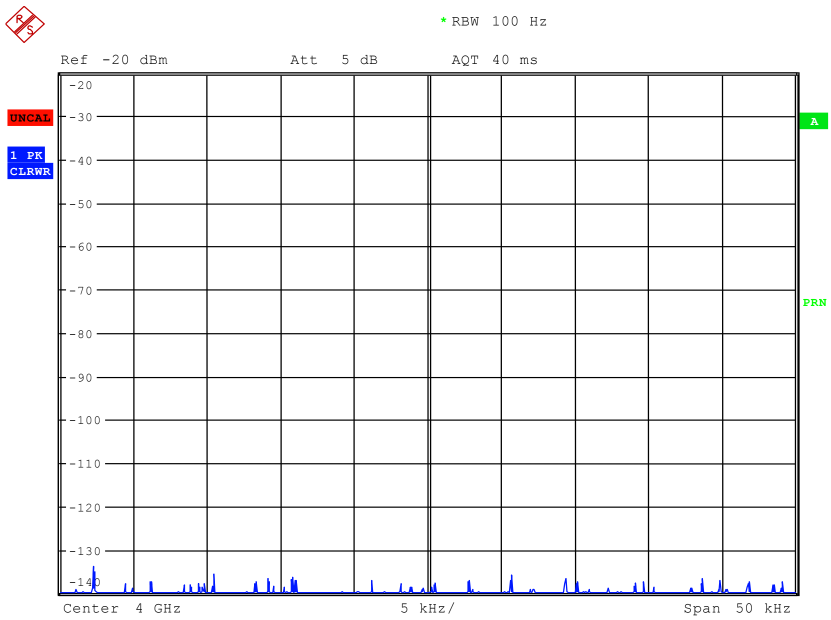


Fig. 3-17 FFT test, noise floor, error-free unit

Full Scale Test

Signal generator settings

- Frequency 20.4 MHz
- Level -2.9 dBm

R&S FSQ setting

Marker to peak

Expected display

Spectrum of clean CW signal at center frequency (see) , level -20 dBm ±2 dB (marker readout)

Possible errors:

- level out of tolerance
- distorted spectrum
- spurious
- extreme noise

The signal generator sets the limits for spurious and phase noise!

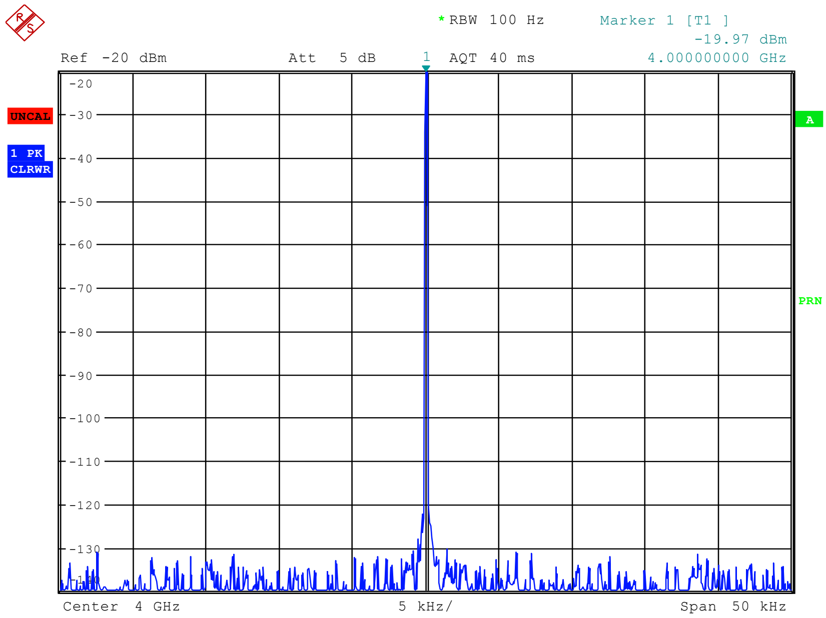


Fig. 3-18 Full-scale test, error-free unit

Linearity test

Signal generator settings

- Frequency 20.4 MHz
- Level -2.9 dBm

R&S FSQ settings

Marker to peak, reference fixed

Signal generator settings

- Frequency 20.4 MHz
- Level -12.9 dBm to –52.9 dBm in 10 dB steps

Delta marker readout

Signal generator	-12.9 dBm	-22.9 dBm	-32.9 dBm	-42.9 dBm	-52.9 dBm
Delta marker	-10 ±0.5 dB	-20 ±0.5 dB	-30 ±0.5 dB	-40 ±0.5 dB	-50 ±1 dB

Use step attenuator if the signal generator's level linearity is worse than 0.2 dB.

Phase noise test

Signal generator setting

- Frequency 20.4 MHz
- Level -42.9 dBm

Expected display

Spectrum of clean CW signal at center frequency, level approx. -60 dBm.

The noise level must not be higher than the noise level measured in the noise floor test.

Presumption: Signal generator phase noise ≤-100 dBc / Hz at >1 kHz offset

Possible errors:

- Phase noise higher than thermal noise floor (example:)
- Distorted spectrum
- Spurious

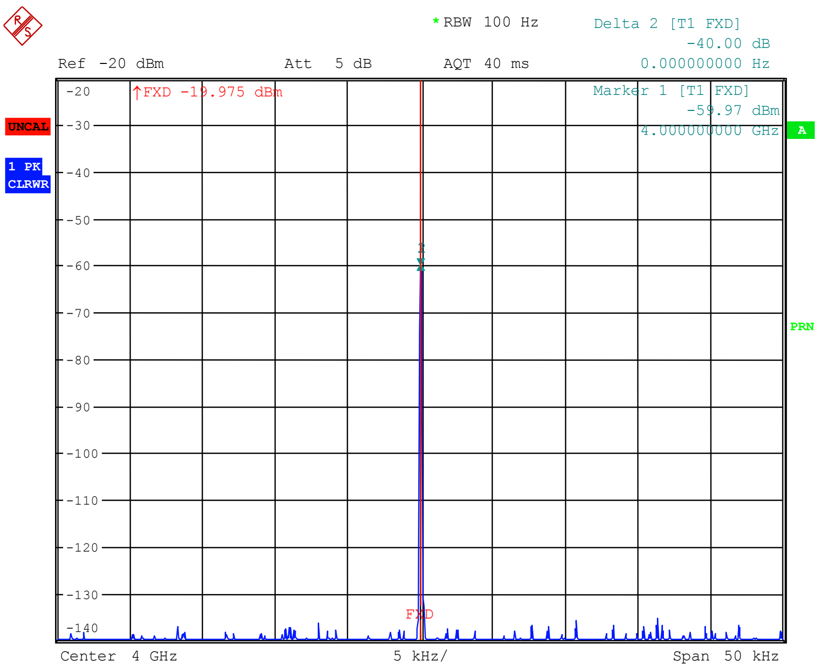


Fig. 3-19 Phase noise test, error-free unit

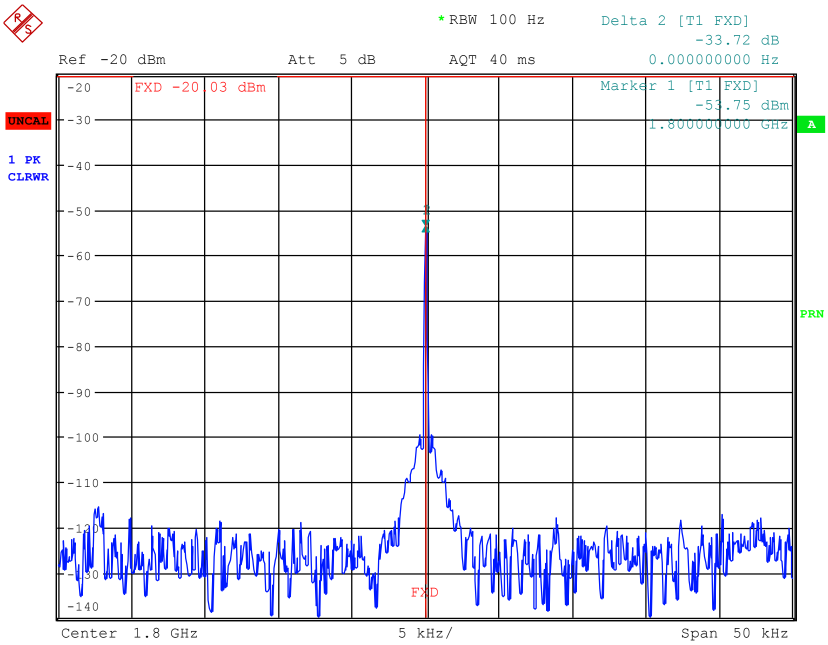


Fig. 3-20 Phase noise test, faulty unit (high phase noise)

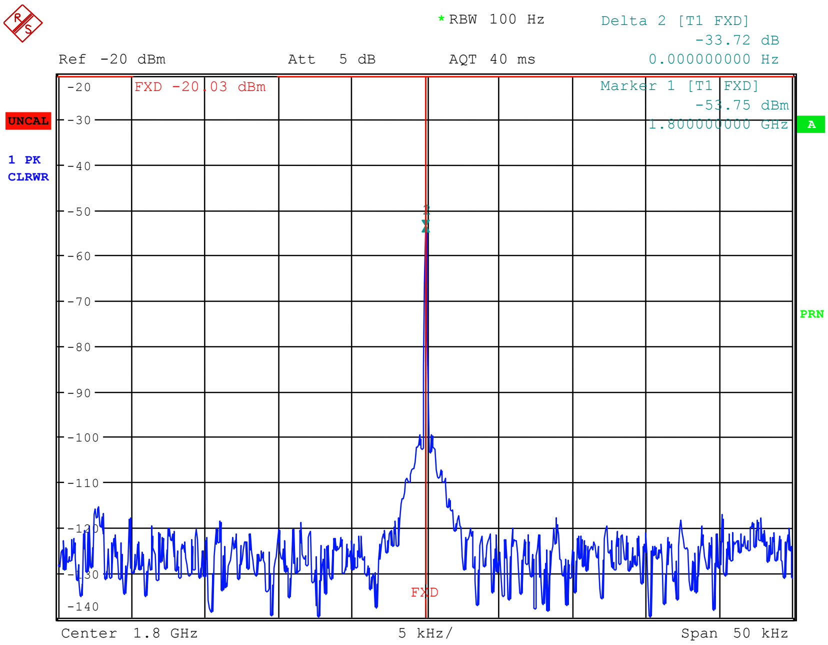


Fig. 3-21 Phase noise test, faulty unit (high phase noise)

4 Software Update / Installing Options

This chapter contains information on updating software, restoring the operating-system installation and installing options to the R&S FSQ. Additional manuals obtained together with a software/firmware update or with subsequently acquired options can be filed here.

4.1 Installation of new R&S FSQ Software

A new firmware version can be installed using the built-in diskette drive. The firmware update kit contains several diskettes.

The installation program is called up in the *SETUP* menu.

SETUP sidemenu:

FIRMWARE UPDATE

The *FIRMWARE UPDATE* softkey starts the installation program and leads the user through the remaining steps of the update.

`Remote: --`

Performing the update:

► Insert diskette 1 into the drive.
Call *SETUP* side menu [**SETUP**][**NEXT**]
Start update [FIRMWARE UPDATE]

RESTORE FIRMWARE

The *RESTORE FIRMWARE* softkey restores the previous firmware version.

`Remote: --`

4.2 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:

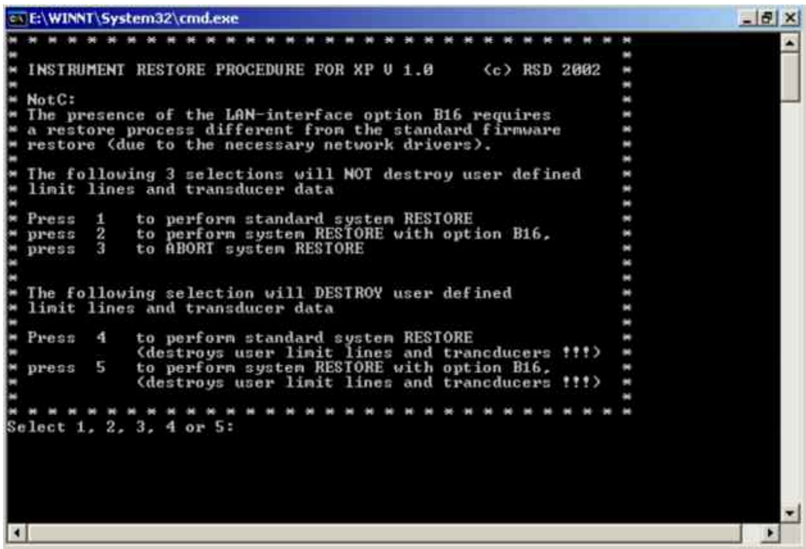
Analyzer Firmware
Analyzer Firmware Backup

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.

4.3 Installing the Options

The following options are available with the R&S FSQ:

OCXO Reference	R&S FSP-B4	1129.6740.02
Tracking Generator	R&S FSP-B9	1129.6991.02
External Generator Control	R&S FSP-B10	1129.7246.03
Attenuator for Tracking Generator	R&S FSU-B12	1142.8994.02
Digital Baseband Interface	R&S FSQ-B17	1163.0063.02
LO/IF ports for external mixers	R&S FSP-B21	1155.1758.03
30 dB Preamplifier	R&S FSU-B24	1157.2100.50
Electronic Attenuator	R&S FSU-B25	1144.9298.02
Option I/Q Baseband Input	R&S FSQ-B71	11570113.02
Option I/Q Bandwidth Extension	R&S FSQ-B72	1157.0336.02

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

Danger of shock hazard

Disconnect the instrument from the mains before opening the casing. Also pay close attention to the safety instructions at the beginning of this manual.

Risk of damage to the instrument

The components used in the instrument are sensitive to electrostatic discharges which is why they are to be handled in accordance with the ESD regulations.

When installing hardware options note the following:

► Switch off instrument and pull the mains plug.

► After installing the option replace the tube and fasten the rear panel feet again.

⚠ CAUTION

Risk of damage to the cable

When replacing the tube, be sure not to damage or pull off cables.

► Switch on R&S FSQ (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.

5 Documents

This chapter contains the spare parts list and the documents for the complete R&S FSQ unit. For general information about spare parts for our products please refer to the sheet “Procedure in Case of Service and Ordering of Spare Parts” at the beginning of this manual.

5.1 Spare Parts

The stock numbers necessary for ordering replacement parts and modules can be found in the component lists further down.

CAUTION

Risk of shock hazard and instrument damage

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.
Measures to avoid the situation.
When shipping a module be careful to provide for sufficient mechanical and antistatical protection.

5.2 Available Power Cables

Table 2 List of power cables available

Stock No.	Earthed-contact connector	Preferably used in
DS 0006.7013.00	BS1363: 1967' 10 A 250 V complying with IEC 83: 1975 standard B2	Great Britain
DS 0006.7020.00	Type 12 , 10 A 250 V complying with SEV-regulation 1011.1059, standard sheet S 24 507	Switzerland
DS 0006.7036.00	Type 498/13 10 A 250 V complying with US-regulation UL 498, or with IEC 83	USA/Canada
DS 0041.4752.00	GB2099 , GB1002 10 A 250 V approvals CCC	China
DS 0041.6232.00	JIS C 8303 7A 125V AC approvals PSE (JET)	Japan
DS 0006.7107.00	Type SAA3 10 A, 250 V, complying with AS C112-1964 Ap.	Australia
DS 0025.2365.00 DS 0086.4400.00	DIN 49 441, 10 A, 250 V, **straight** approvals VDE,ÖVE,CEBEC,KEMA,S,D,N,FI,LCIE,IMQ,UCIEE DIN 49 441, 10 A, 250 V, **angular** approvals VDE,ÖVE,CEBEC,KEMA,S,D,N,FI,LCIE,IMQ,UCIEE	Europe (except Switzerland)

Spare Part List

Mechanical Drawings

List of FSQ parts including spare parts

The R&S FSQ is constructed in accordance with R&S design 2000.

Overall dimension: W x H x L, 426,7 x 176,5 x 517

Rackmount: 4E 1/1 T450

Accessories: 19"-Adapter ZZA-411, Stock no. 1096.3283.00

The recommended spare parts are marked x in the like column.

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
Document 1313.9100.01 (R&S FSQ-instrument)					
10	Basic Unit	1166.1677.13	1 S		
12	Screening shield	5011.7510.00	1 S		
15	Fan	1130.0070.00	1 S	E1	x
17	Speaker	1129.9332.00	1 S	B1	x
20	Attenuator R&S FSQ 3/8	1137.0599.02	1 S	A40	x
23	Attenuator R&S FSQ 40	1170.0059.03	1 S	A40	x
25	Attenuator R&S FSQ 26	1046.5130.02	1 S	A40	x
26	Insolating plate	1129.9690.00	1 S		
27	DIN965-M2,5X6-A4-PA	1148.3288.00	4 S		
28	DIN6900-M2,5X6 -A2	1148.3059.00	3 S		
30	Ribbon cable W40	1130.2515.00	1 S	W40	
40	DIN6900-M2,5X6 -A2	1148.3059.00	2 S		
43	VOL/PHONES BOARD	1093.7094.02	1 S	A191	x
44	HOLDING BRACKET AF-OUT	1129.9326.00	1 S		
45	DIN6900-M2,5X6 -A2	1148.3059.00	1 S		
46	DIN965-M2,5X6-A4-PA	1148.3288.00	2 S		
48	Rotary knob 13 ACHS-RD4T-GR	0852.1211.00	1 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
49	Ring for rotary knob	0852.1228.00	1 S		
50	PROBE BOARD	1302.7101.03	1S	A80	x
55	DIN965-M2,5X6-A4-PA	1148.3288.00	3 S		
57	USB 2.0 ADAPTOR	1302.7253.02	1 S	A310	x
58	965/ISR-M2.5X6-A4-PA	1148.3288.00	2 S		
61	Mounting plate with USB	1313.9581.00	1 S		
70	DIN965-M2,5X6-A4-PA	1148.3288.00	7 S		
72	3,5 MM GROUND SPRING	1142.8242.00	1 S		
81	Adhesive foil 30X20 SW	1093.9051.00	6 S		
82	Adhesive foil 33X68 SW	1300.0597.00	1 S		
91	Cover RD15,9	0009.9200.00	2 S		
100	RF CONVERTER	1130.4647.02	1 S	A100	x
102	ATTENUATION BLOCK	1129.9284.00	1 S		
105	SYNTHESIZER	1166.3170.02	1 S	A110	x
110	WIDEBAND DETECTOR UNIT	1130.3086.11	1 S	A140	x
120	IF-FILTER	1130.2296.03	1 S	A130	x
130	CONVERTER UNIT(8 GHZ)	1130.2544.03	1 S	A160	x
135	Angle bracket MW converter	1129.9384.00	1 S		
136	DIN965-M2,5X6-A4-PA	1148.3288.00	2 S		
140	MW-CONVERTER UNIT R&S FSQ26	1166.2338.23	1 S	A160	x
145	MW-CONVERTER UNIT R&S FSQ40	1130.4982.39	1 S	A160	x
150	MW-CONVERTER UNIT R&S FSQ40	1130.4982.41	1 S	A160	x
160	Air cover	1129.9355.00	2 S		
161	Air cover	1129.9355.00	1 S		
170	Rear panel	1163.0092.00	1 S		
180	DIN6900-M2,5X6 -A2	1148.3059.00	6 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
182	Cover I/Q DATA	1130.0006.00	1 S		
183	DIN7985-M2.5x6-A4-PA	1143.5630.00	2 S		
190	Cover 9-pin SUB-D	1093.8990.00	1 S		
200	Cover 25-pin SUB-D	1093.9000.00	1 S		
210	Cover RD11,1/9,9	0009.9217.00	4 S		
220	Cover f. LAN-connector	0852.0467.00	2 S		
225	Cover f. IEC-BUS	0852.0450.00	1 S		
230	RJ45 COUPLER	1093.9122.00	1 S	X220	
231	CABLE 2xRJ45	1066.1819.00	1 S	W32	
232	SILICON CORD RD4X8MM	1130.0164.00	1 S		
240	Instrument top cover	1129.9261.00	1 S		
250	DIN6900-M2,5X6 -A2	1148.3059.00	3 S		
260	DIN965-M2,5X6-A4-PA	1148.3288.00	10 S		
270	Printed front panel R&S FSQ3	1313.9146.00	1 S		
280	Printed front panel R&S FSQ8	1313.9152.00	1 S		
290	Printed front panel R&S FSQ26	1313.9169.00	1 S		
291	Printed front panel R&S FSQ40	1313.9930.00	1 S		
292	Printed front panel R&S FSQ40	1313.9175.00	1 S		
295	RF-cable W1 8GHZ	1129.9503.00	1 S	W1	x
315	TESTPORT GEH. ADAPTER	1021.0493.00	1 S	X1	x
316	RF-CABLE W1 26.5GHZ	1129.9555.00	1 S	W1	x
320	TESTPORT ADAPTER FSQ40	1036.4702.00	1 S	X1	x
322	RF-CABLE W1 46GHZ FSQ40	1302.6363.00	1 S	W1	x
330	MOUNTING PLATE	1093.4750.00	1 S		
340	MOUNTING PLATE	1093.4772.00	1 S		
350	DIN965-M2,5X6-A4-PA	1148.3288.00	4 S		
400	HOLDER	0794.5214.00	2 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
405	CABLETIE	0015.9038.00	2 S		
410	BW2-HOUSING 4E1/1T450 R&S FSU	1166.1760.00	1 S		
420	BW 2 - FRONT HANDLE	1096.1480.00	2 S		
430	Screw M4X14	1096.4896.00	4 S		
450	BW2-rear panel foot 50MM	1096.2493.00	4 S		
455	BW2-foil f. rear panel foot	1096.2435.00	1 S		
500	Label Gigabit Lan	1303.3022.00	1 S		
510	Adhesive foil 30X20 SW	1093.9051.00	1 S		
Document 1166.1677.01 sheet 2 (Basic unit)					
501	Instrument frame 2	1155.5576.00	1 S		
509	PROTECTION	0001.9447.00	0.06 M		
513	MOTHERBOARD	1302.7082.07	1 S	A10	x
518	HEX 14 NUT ½-28 UNEF	3583.1561.00	2 S		
519	SERRATED LOCKWASHER	3583.1578.00	2 S		
520	DIN6900-M2,5X6 -A2	1148.3059.00	6 S		
522	SPACER TUBE 3.2MM	0033.1241.00	2 S		
523	DIN6900-2.5x10-A2	0041.1660.00	2 S		
525	DIN965-M2,5X6-A4-PA	1148.3288.00	2 S		
530	Locking bolt M3	0009.6501.00	4 S		
540	Locking bolt H=4,5-40	1093.9180.00	2 S		
550	Power supply unit 230W	1091.2320.00	1 S	A20	x
560	DIN6900-M2,5X6 -A2	1148.3059.00	10 S		
573	CONTROLLER 7/3	1091.3104.00	1 S	A90	x
574	1GB DDR RAM FOR FMR7	1091.3210.00	1 S		
590	DIN6900-M2,5X6 -A2	0071.5040.00	10 S		
602	Display unit	1093.4708.09	1 S	A1	
610	DIN965-M2,5X6-A4-PA	1148.3288.00	4 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
650	Rotary knob RD28 ACHS-RD6	0852.1086.00	1 S		
712	SATA HARDDISK WITH SOFTWARE	1302.6240.05	1 S	A60	x
721	SATA DATA CABLE 265	1091.3440.00	1 S	W29	x
722	SATA POWER CABLE 285	1091.3427.00	1 S	W30	x
730	HARDDISK MOUNT	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		
760	Cable 4x2 shielded 280 mm length	5500.0213.00	1 S	W310	x
762	Grommet 14X24X7	0099.1440.00	1 S		
776	LITHIUM-BATTERIE CR2032	0858.2049.00	1 S		
Document 1093.4708.01 sheet 7 (Display Unit with Display Toshiba)					
Document 1093.4708.01 sheet 8 (Display Unit with Display AUO)					
805	Assembly tray	1129.9426.00	1 S		
806	Mountingtrough FSU AUO Display	1303.3345.00	1 S		
810	Shielded filter glass	1091.1753.00	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		
865	Dust sealing	1129.9449.00	1 S		
866	Dust Protection AUO Display	1141.2440.00	1 S		
868	Support AUO Display	1141.2457.00	4 S		
869	DIN6900-M2.5x5-A2	0041.1630.00	4 S		
872	STEP UP CONVERTER	1313.3080.02	1 S	T10	x
892	DIN6900-M2,5X6 -A2	1148.3059.00	2 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
908	CABLE FOR TOSHIBA-FMR7	1303.3239.00	1 S	W100	x
911	Rotary Puls-Generator	0852.2760.00	1 S	B10	x
912	Nut for Pulse Generator	0852.2660.00	1 S		
923	SVGA LVDS DISPLAY 8.4 INCH (LED)	3583.2145.00	1 S	A70	x
924	TFT 8.4 SVGA LVDS LED AUO	3587.6274.00	1 S	A70	x
930	DIN6900-M2,5X6 -A2	0071.5040.00	4 S		
932	Space	1129.9432.00	4 S		
934	DIN965-M2,5X5-A4-PA	1148.2752.00	4 S		
935	DISPLAY CABLE	1303.3222.00	1 S	W101	x
936	Cable Backlight AUO Display	1141.2463.00	1 S	W101	x
950	DIN6900-M2,5X6 -A2	1148.3059.00	2 S		
951	LSA Board FSU	1311.1577.00	1 S		x
953	LST ADAPTER TOSHIBA-FMR (LVDS)	1303.2961.00	1 S		x
954	CABLE W31 LST BOARD - FMR	1307.9425.00	1 S		
960	Slip on spring	1166.1783.00	1 S		
970	Keyboard frame	1093.5127.00	1 S		
980	Keyboard mat	1093.5133.00	1 S	A16	x
990	Keyboard membrane	1093.5140.00	1 S	A15	x
995	Adhesive Tape	0002.3036.00	0,08M		
1000	DIN965-M2X6-A4-PA	0041.1599.00	14 S		
Document 1144.9017.00 (Option R&S FSU-B4 1144.9000.02)					
1100	OCXO	1093.7871.03	1 S	A200	x
1120	RF-cable W21	1129.9926.00	1 S	W21	
Document 1162.9921.00 (Option R&S FSP-B28 1162.9915.02)					

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
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		
Document 1144.9300.00 (Option R&S FSU-B25 1144.9298.02)					
1400	ATTENUATOR FSP/FSU/FSQ	1137.0724.02	1 S	A50	x
1410	Ribbon cable 10 POL	1129.7823.00	1 S		
1420	RF-CABLE W 27	1144.9330.00	1 S	W27	
1425	RF-CABLE W27 (26,5 GHz)	1144.9323.00	1 S	W27	
1430	RF-CABLE W28 (RF-CON)	1144.9346.00	1 S	W28	
1440	RF-CABLE W28 (MW-CON)	1144.9352.00	1 S	W28	
1460	DIN6900-M2,5X8 -A2	0041.1653.00	4 S		
Document 1308.1986.00 (Option R&S FSU-B18 1303.0400.13)					
1500	COMPACT FI-BOARD S_ATA	1164.5046.02	1 S	A381	x
1505	DIN6900-M2,5X6 -A2	1148.3059.00	4 S		
1506	COMBINATION SCREWS	0041.1630.00	1 S		
1507	HOLDER FLASH-BOARD FSUP	1309.3276.00	1 S		
1508	COMBINATION SCREWS	1148.3059.00	3 S		
1509	LABEL FLASH-BOARD FSUP	1309.3282.00	1 S		
1515	FLASHDISK MIT SOFTWARE FSQ	1303.0417.03	1 S	A380	x
1550	SATA DATA CABLE 420	1091.3456.00	1 S	W30	
1560	SATA POWER CABLE 440	1091.3433.00	1 S	W29	
1610	965/ISR-M2.5X4-A4-PA	1148.3271.00	1 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
Document 1129.7317.00 (Option R&S FSP-B10 1129.7246.03)					
1610	IEC-BUS cable W21	1129.7252.00	1	W21	x
1612	DIN125-A3.2-A4	0082.4670.00	2		
1614	DIN137-A3-A2	0005.0296.00	2		
1620	Aux control cable W22	1129.7269.00	1	W22	x
1622	Locking bolt M3	0009.6501.00	2		
1624	DIN137-A3-A2	0005.0296.00	2		
1626	DIN934-M3-A4	0016.4398.00	2		
1640	IEC-BUS Controller	1164.5200.02	1	A210	x
1660	Adapterplate for R&S FSP-B10 (FSQ)	1130.0064.00	1		
1665	DIN6500/ISR-M2.5X6-A2	1148.3059.00	4		
Document 1142.9090.00 (Option R&S FSU-B9 Tracking Generator 1142.8994.02)					
1800	Tracking Generator	1130.3605.02	1 S	A170	x
1810	RF-CABLE W41	1142.9003.00	1 S	W41	
1820	RF-CABLE W42 (RF-Con)	1142.9010.00	1 S	W42	
1830	RF-CABLE W42 (8GHz)	1142.9026.00	1 S	W42	
1840	RF-CABLE W43	1142.9032.00	1 S	W43	
1850	RF-CABLE W44	1142.9049.00	1 S	W44	
1860	RF-CABLE W45	1142.9055.00	1 S	W45	
1870	RF-CABLE W46	1142.9061.00	1 S	W46	
1880	RF-CABLE W47	1142.9078.00	1 S	W47	
1890	RF-CABLE W48	1142.9084.00	1 S	W48	
1895	ADAPTOR	0343.0257.00	1 S	X2	x
1900	MOUNTING PLATE	1093.4750.00	1 S		
1910	DIN965-M2,5X6-A4-PA	1148.3288.00	4 S		
1920	LABEL R&S FSU-B9 FRONT	1142.9132.00	1 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
1930	LABEL R&S FSU-B9 REAR	1142.9126.00	1 S		
1940	RF-CABLE W26	1142.9161.00	1 S	W26	
Document 1130.2544.01 (Converter Unit 8GHz)					
2001	A-SIDE COVER MW8 FSU	1130.2580.00	1 S		
2002	B-SIDE COVER MW8 FSU	1130.2573.00	1 S		
2003	8 GHZ CONVERTER	1130.2550.03	1 S	A160	x
2015	YIG-UNIT 8GHz (MICRO LAMBDA)	1130.2944.04	1 S	A161	x
2020	YIG-UNIT 8GHz (FILTRONIC)	1130.2944.05	1 S	A161	x
2025	DIN965-M2,5X6-A4-PA	1148.3288.00	2 S		
2030	DIPLEXER 8GHZ	1132.6501.02	1 S	A162	x
2035	DIN6900-M2,5X5 -A2	0071.6830.00	4 S		
2040	RELAY UNIT 8GHz	1130.2815.02	1 S	A164	
2045	RELAY HOLDER	1130.2644.00	1 S		
2050	DIN7985-M3x40 –A2	0071.7714.00	2 S		
Document 1130.2815.01 (RELAY UNIT 8 GHz)					
2060	RELAY SMA 12V	1130.1254.00	2 S	K1 / K2	x
2065	RELAY CABLE	1130.2838.00	1 S		
2070	RF CABLE W1 RELAY	1130.2844.00	1 S	W1	
2075	RF CABLE W4 RELAY	1130.2873.00	1 S	W4	
2080	RF CABLE W5 RELAY	1130.2880.00	1 S	W5	
Document 1166.2338.01 page 2 (MW-Converter Unit 26.5 GHz)					
Document 1166.2338.01 page 4 (OPTION R&S FSQ-B23 PREAMP 26.5 GHz 1157.0907.03)					
2100	26 GHz CONVERTER	1166.2344.02	1 S	A160	
2105	DIPLEXER26	1162.1120.05	1 S	A161	x
2106	DIPLEXER 26 (OPTION B23)	1151.5520.23	1 S	A161	x
2108	YIG UNIT (R&S)	1166.1854.23	1 S	A162	x

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
2110	DIN6900-M2,5X6 –A2	1148.3059.00	3 S		
2112	YIG UNIT (FILTRONIC)	1130.3492.23	1 S	A162	x
2115	YIG UNIT (MICRO LAMBDA)	1130.3311.23	1 S	A162	x
2120	DIN965-M2,5X8-A4-PA	1148.3294.00	2 S		
2125	EXTENDER 26	1132.8504.03	1 S	A163	x
2130	DIN6900-M2,5X6 –A2	1148.3059.00	7 S		
2135	RF-CABLE W3	1130.3340.00	1 S	W3	
2140	RF-CABLE W4	1130.3357.00	1 S	W4	
2142	RF-CABLE W4	1157.0971.00	1 S	W4	
2145	RF-CABLE W5	1130.3363.00	1 S	W5	
2150	HOLDER LO CABLE	1130.3292.00	1 S		
2155	DIN6900-M2,5X6 –A2	1148.3059.00	2 S		
2175	RELAY	1137.4788.00	1 S		
2170	RELAY UNIT 26,5 GHz	1130.3405.02	1 S	A164	
2180	DIN965-M2,5x6-A4-PA	1148.3288.00	2 S		
2190	CLAMP	0080.3653.00	1 S		
2195	DIN6900-M2,5X6 –A2	1148.3059.00	1 S		
2205	HF-Kabel W1 MW-Con26	1130.0129.00	1 S		
2215	HF-Kabel W1 B23-Relais	1157.0936.00	1 S		
2225	Protection cap	1066.2095.00	1 S		
2350	ATTENUATOR 2DB 2W	1021.2615.00	1 S		
Document 1130.3405.01 (RELAY UNIT 26,5 GHz)					
2300	RELAY SMA 12 V	1137.4788.00	2 S	K1 / K2	x
2305	RELAY CABLE	1130.2838.00	1 S		
2310	RELAY HOLDER	1130.3392.00	1 S		
2315	DIN7985-M2,5x30-A4	0455.5966.00	2 S		
2320	RELAY SHIELDING	1130.3470.00	1 S		

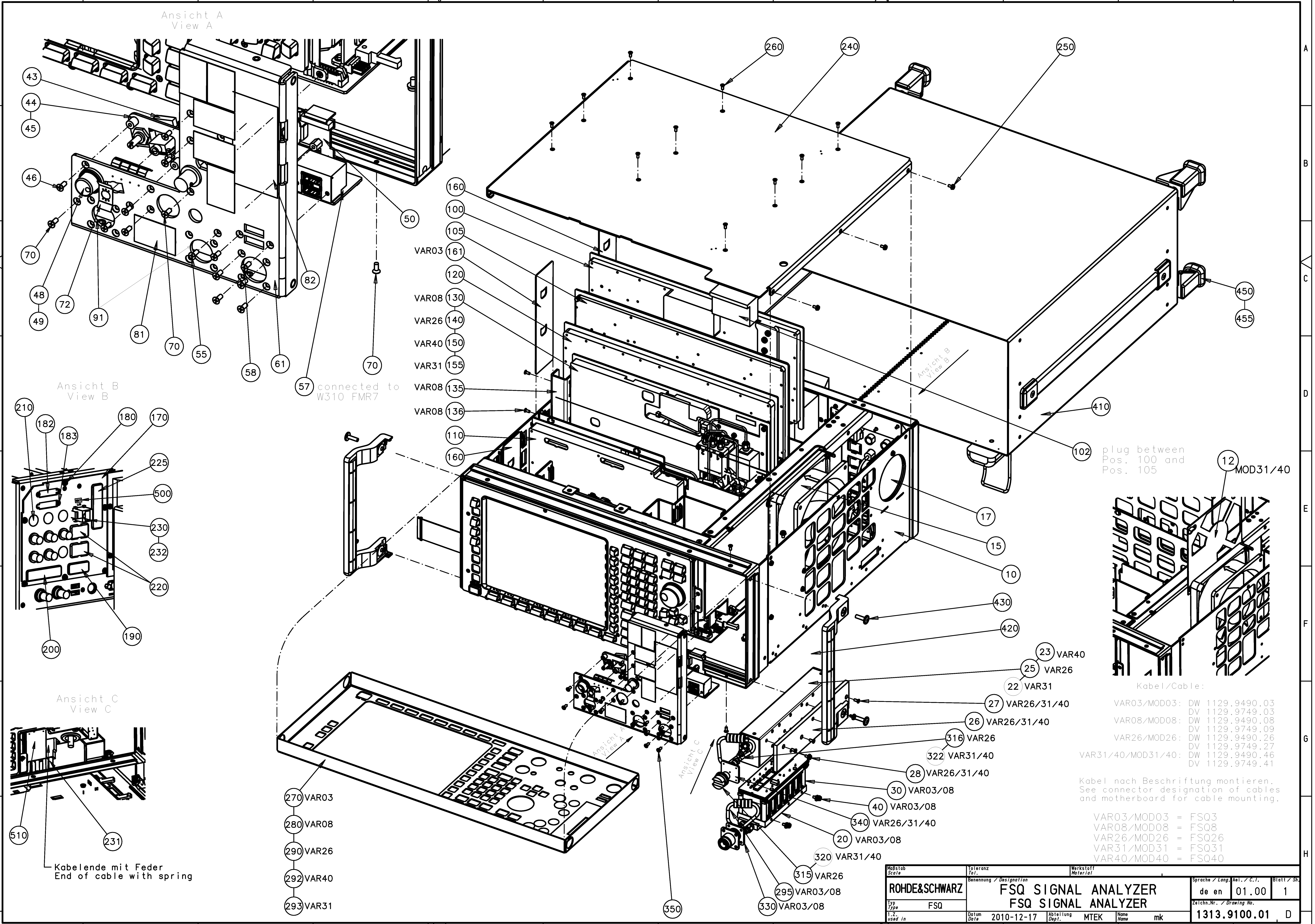
Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
2340	RF CABLE W7	1130.3457.00	1 S		
2345	RF CABLE W8	1130.3463.00	1 S		
Document 1142.9361.00 (Option R&S FSU-B12 Tracking Attenuator 1142.9349.02)					
2400	STEP ATTENUATOR (FSU-B12)	1067.8380.04	1 S	A171	x
2410	ATTENUATOR HOLDER	1129.9455.00	1 S		
2415	DIN6900-M3x8-A2	0071.6853.00	2 S		
2420	DIN6900-M2,5x6-A2	1148.3059.00	3 S		
2430	RF CABLE W41	1142.9378.00	1 S	W41	
2440	RF CABLE W49	1142.9384.00	1 S	W49	
2445	ADAPTER CABLE	1142.9390.00	1 S		
Document 1157.0136.00 (Option FSQ-B71 Baseband Input 1157.0113.03)					
2701	BASEBAND INPUT 1A (50Ω/1MΩ)	1155.6089.03	1 S	A270	x
2711	BASEBAND INPUT 2 (50Ω/1MΩ)	1130.3686.03	1 S	A260	x
2720	RF CABLE W51	1157.0142.00	1 S	W51	
2725	RF CABLE W52	1157.0159.00	1 S	W52	
2730	RF CABLE W53	1157.0165.00	1 S	W53	
2735	RF CABLE W54	1157.0171.00	1 S	W54	
2740	RF CABLE W55	1157.0188.00	1 S	W55	
2745	RF CABLE W56	1157.0194.00	1 S	W56	
2750	RF CABLE W57	1157.0207.00	1 S	W57	
2755	RF CABLE W58	1157.0213.00	1 S	W58	
2757	RF CABLE W65	1157.0407.00	1 S	W65	
2760	DIN965-M2,5x6-A4-PA	1148.3288.00	3 S		
2775	LABEL FRONT FSQ-B71 (50Ω/1MΩ)	1157.0259.00	1 S		
2780	MOTHERBOARD LABEL	1157.0236.00	1 S		
Document 1157.1110.00 (Option FSU-B21 1157.1090.03)					

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
2901	EXT MIXER	1157.1126.03	1 S	A180	x
2910	RF-CABLE W36	1157.1178.00	1 S	W36	x
2920	RF-CABLE W37	1157.1184.00	1 S	W37	x
2930	RF-CABLE W38	1157.1190.00	1 S	W38	
2940	RF-CABLE W39	1157.1203.00	1 S	W39	
2942	RF-CABLE W39	1157.1232.00	1 S	W39	
2945	PROTECTION CAP	1066.2095.00	1 S		
2950	HOLDER EXT MIXER	1157.1103.00	1 S		
2960	DIN965-M2,5X6-A4-PA	1148.3288.00	2		
2980	LABEL	1157.1226.00	1 S		
Document 1130.4982.01 Sheet 2 (MW-Converter Unit 40 GHz)					
3101	50 GHz Converter	1130.4999.07	1 S	A160	x
3111	Diplexer	1162.1120.04	1 S	A161	x
3124	YIG-Unit 40GHz	1130.3963.42	1 S	A162	x
3126	YIG-Unit 40GHz	1130.3963.41	1 S	A162	X
3140	DIN965-M2,5X8-A4-PA	1148.3294.00	2 S		
3148	EXTENDER 46	1151.6010.02	1 S	A163	X
3160	DIN6900/ISR-M2,5X6-A2	1148.3059.00	6 S		
3170	CLAMP LO-KABEL	1130.3292.00	1 S		
3180	DIN6900-M2,5X6 -A2	1148.3059.00	2 S		
3190	RF-CABLEL W3	1130.3892.00	1 S	W3	
3200	RF-CABLEL W4	1130.3905.00	1 S	W4	
3210	RF-CABLE W5	1130.3911.00	1 S	W5	
3220	RF-CABLE W6	1130.3928.00	1 S	W6	
3230	PROTECTION CAP	1066.2095.00	1 S		
3240	B-SIDE-COVER	1130.3870.00	1 S		
3250	A-SIDE-COVER	1166.2167.00	1 S		

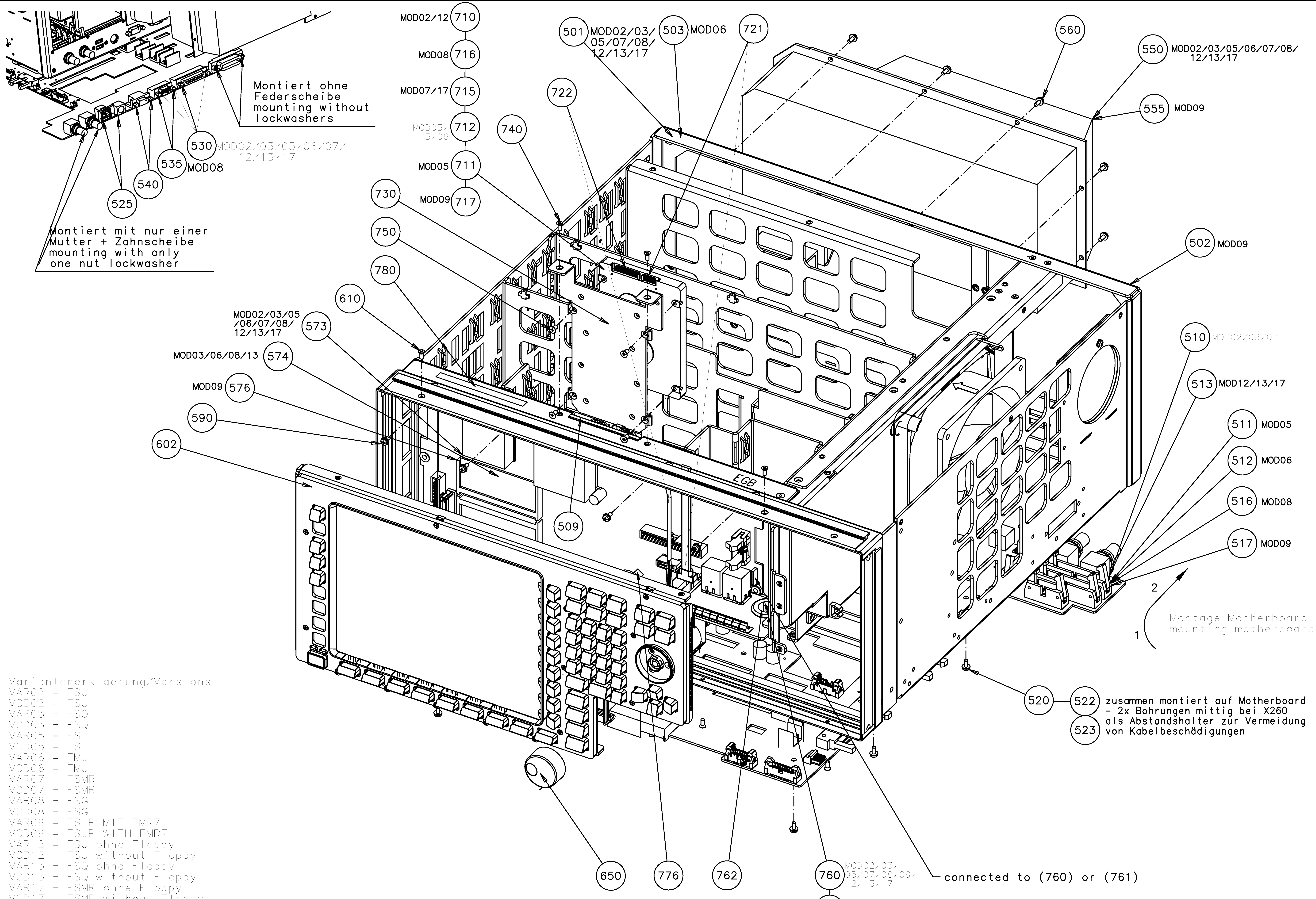
Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
3260	RELAIS UNIT 40 GHz	1155.5147.02	1 S	A164	
3270	DIN965-M2,5x6-A4-PA	1148.3288.00	2 S		
3292	Clamp	0080.3653.00	1 S		
3294	DIN6900-M2,5X6 -A2	1148.3059.00	1 S		
3295	LABEL MW-CONVERTER	1130.3940.00	1 S		
Document 1155.5147.01 (Relais Unit 40 GHz)					
3400	Koax Relais 3xK 28V 40GHZ	1088.4003.00	2 S	K1 / K2	x
3410	Relais CABLE	1130.2838.00	1 S		
3420	Relais mount	1155.5201.00	1 S		
3430	DIN7985-M2,5x30-A4	0455.5966.00	2 S		
3440	Relais shielding	1130.3470.00	1 S		
3450	RF CABLE W7	1155.5153.00	1 S	W7	
3460	RF CABLE W8	1155.5160.00	1 S	W8	
3470	RF CABLE W1	1155.5182.00	1 S	W1	
Document 1157.0488.00 (Option FSQ-B72 , Bandwith Extension 1157.0336.12)					
3705	I/Q Bandwidth Extension-12	1155.6150.12	1 S	A280	x
3708	RF Converter	1130.4647.02	1 S	A100	x
3710	RF CABLE W60	1157.0359.00	1 S	W60	
3720	RF CABLE W61	1157.0365.00	1 S	W61	
3730	RF CABLE W62	1157.0371.00	1 S	W62	
3740	RF CABLE W63	1157.0388.00	1 S	W63	
3770	LVDS CABLE	1155.5230.00	1 S	W66	
3772	Bracket B100-B72	1157.0471.00	1 S		
3780	Clamp	0041.3704.00	1 S		
3782	CABLE Holder	1130.0941.00	1 S		
3790	DIN6900/ISR-M3.0X6-A2	0041.1682.00	1 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
3791	Support	1157.0442.00	1 S		
3792	Support	1169.5296.00	1 S		
3793	DIN6900/ISR-M2.5X6-A2	1148.3059.00	5 S		
3796	Label FSQ-B72	1157.0436.00	1 S		
Document 1157.2116.00 (Option R&S FSU-B24 1157.2100.50)					
4500	PREAMP 50GHZ UNIT	1157.2080.50	1 S		x
4600	RF CABLE W28 (FSU-B24)	1169.5115.00	1 S	W28	
4610	RF CABLE W2	1129.9626.00	1 S	W2	
4611	BRACKET FSU-B24	1157.2097.00	1 S		
4612	DIN6900/ISR-M2.5X6-A2	1148.3059.00	4 S		
4614	RF CABLE W52	1305.8944.00	1 S	W52	
4615	RF CABLE W2	1302.7353.00	1 S	W2	
Document 1169.5280.00 (Option R&S FSQ-B100, I/Q MEMORY EXTENSION 1169.5244.02)					
4700	I/Q MEMORY EXTENSION	1155.6520.02	1 S	A250	x
4710	CABLE WDU – I/Q MEM	1168.5250.00	1 S	W253	
4720	LVDS CABLE	1155.5230.00	1 S	W254	
4730	SUPPORT	1169.5296.00	1 S		
4740	DIN6900/ISR-M2.5x6-A2	1148.3059.00	3 S		
4750	CABLE HOLDER	1169.5267.00	1 S		
4752	DIN6900/ISR-M2.5x8-A2	0041.1653.00	2 S		
4760	CLAMP RD 8.0 BR 10	0041.3704.00	1 S		
4762	DIN6900/ISR-M2.5x8-A2	0041.1653.00	1 S		
4770	CABLE I/Q MEM - R&S FSQ-B72	1169.5273.00	1 S	W255	
4772	BRACKET B72-B100	1157.0465.00	1 S		
Position	**Designation**	**Stock No.**	**Number**	**Electrical**	**Recommended**

				designation	Spare Parts
4780	Power supply 250W UL/CSA	1091.1982.00	1 S		x
Document 1169.5450.00 (Option R&S FSQ-B102, MEMORY EXTENSION 1169.5444.04)					
4850	M470T2953BY3 DDR2 1GB 533MHz	3587.5184.00	4 S		x
Option R&S FSQ-B17, IQ DATA IN/OUT 1163.0063.02					
5000	IQ DIGITAL I/O	1163.0134.02	1 S	A290	x
5010	DIN7985/ISR-M2,5X8-A4-PA	1148.2730.00	4 S		
5020	CABLE POWER IQ DIGITAL	1163.0128.00	1 S	W258	
5030	LVDS CABLE 26PIN 1 M	1155.5224.00	2 S	W256/257	
5040	HOLDER	0794.5214.00	6 S		
5050	CABLETIE	0086.8340.00	10 S		
5060	BRACKET FOR CABLE	1163.0205.00	1 S		
5065	DIN6900/ISR-M2.5x6-A2	1148.3059.00	5 S		
5070	BRACKET FOR CABLE (FSQ-B72)	1163.0211.00	1 S		
5080	BRACKET FOR CABLE (FSQ-B100)	1163.0228.00	1 S		
5085	DIN7985/ISR-M2,5X4-A4-PA	1148.2717.00	2 S		



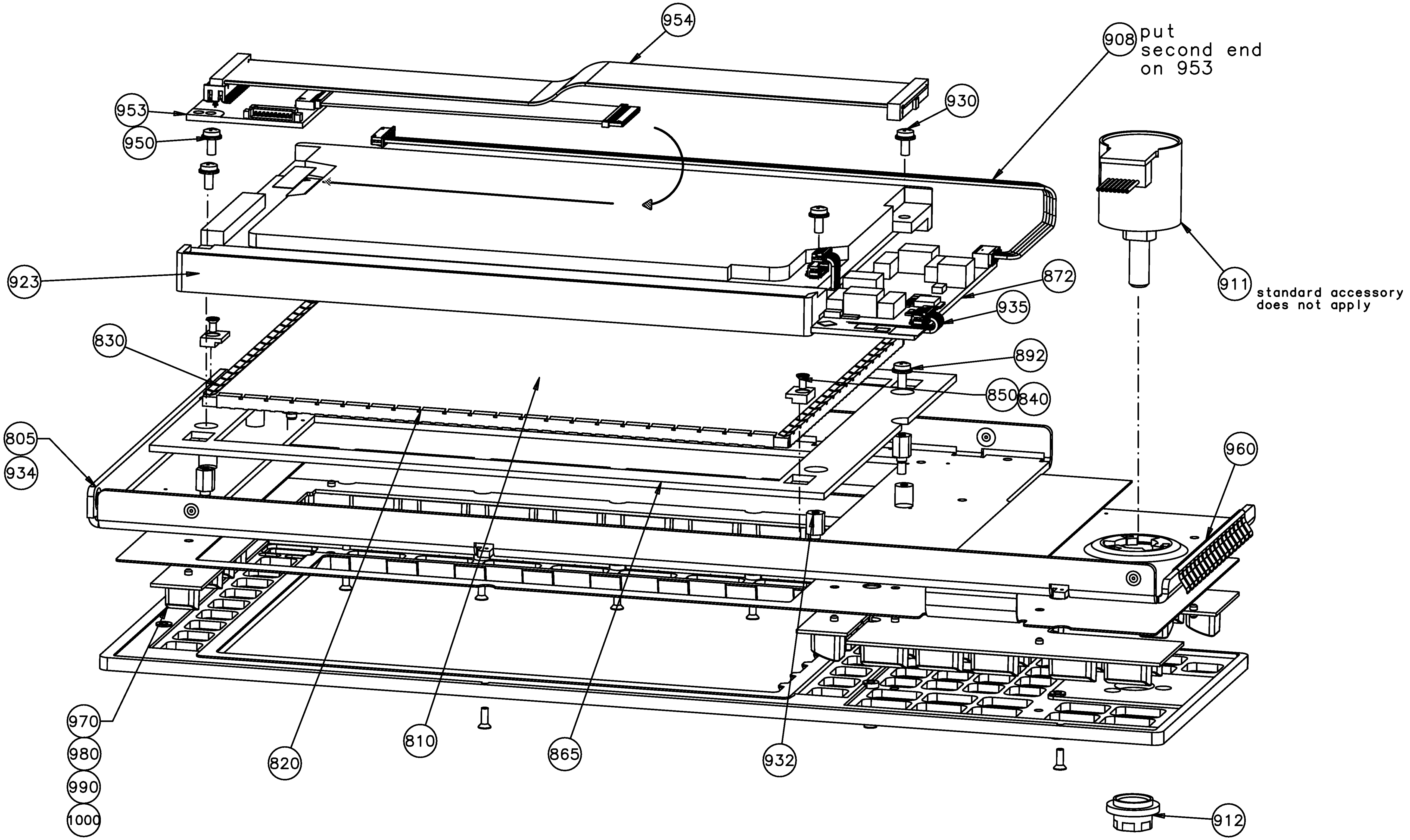
Ansicht A
View A
Ansicht B
View B
Ansicht C
View C
43
44
45
46
70
48
49
72
91
81
70
55
58
61
57 connected to W310 FMR7
82
50
70
260
240
250
160
100
105
VAR03 161
120
VAR08 130
VAR26 140
VAR40 150
VAR31 155
VAR08 135
VAR08 136
110
160
102
plug between Pos. 100 and Pos. 105
410
450
455
17
15
10
12 MOD31/40
430
420
23 VAR40
25 VAR26
22 VAR31
27 VAR26/31/40
26 VAR26/31/40
316 VAR26
322 VAR31/40
28 VAR26/31/40
30 VAR03/08
40 VAR03/08
340 VAR26/31/40
20 VAR03/08
320 VAR31/40
315 VAR26
295 VAR03/08
330 VAR03/08
350
270 VAR03
280 VAR08
290 VAR26
292 VAR40
293 VAR31
210
182
183
180
170
225
500
230
232
220
190
200
510
231
Kabelende mit Feder
End of cable with spring
Kabel/Cable:
VAR03/MOD03: DW 1129.9490.03
DV 1129.9749.03
VAR08/MOD08: DW 1129.9490.08
DV 1129.9749.09
VAR26/MOD26: DW 1129.9490.26
DV 1129.9749.27
VAR31/40/MOD31/40: DW 1129.9490.46
DV 1129.9749.41
Kabel nach Beschriftung montieren.
See connector designation of cables and motherboard for cable mounting.
VAR03/MOD03 = FSQ3
VAR08/MOD08 = FSQ8
VAR26/MOD26 = FSQ26
VAR31/MOD31 = FSQ31
VAR40/MOD40 = FSQ40
Projektionsmethode
Projection Method
Maßstab Scale
Toleranz Tol.
Werkstoff Material
ROHDE&SCHWARZ
Benennung / Designation
FSQ SIGNAL ANALYZER
FSQ SIGNAL ANALYZER
Sprache / Lang. de en
Ånd. / C.I. 01.00
Blatt / Sh. 1
Typ Type FSQ
Datum Date 2010-12-17
Abteilung Dept. MTEK
Name mk
Zeichn.Nr. / Drawing No. 1313.9100.01 D



Variantenerklaerung/Versions
VAR02 = FSU
MOD02 = FSU
VAR03 = FSQ
MOD03 = FSQ
VAR05 = ESU
MOD05 = ESU
VAR06 = FMU
MOD06 = FMU
VAR07 = FSMR
MOD07 = FSMR
VAR08 = FSG
MOD08 = FSG
VAR09 = FSUP MIT FMR7
MOD09 = FSUP WITH FMR7
VAR12 = FSU ohne Floppy
MOD12 = FSU without Floppy
VAR13 = FSQ ohne Floppy
MOD13 = FSQ without Floppy
VAR17 = FSMR ohne Floppy
MOD17 = FSMR without Floppy

Projektionsmethode / Projection Method

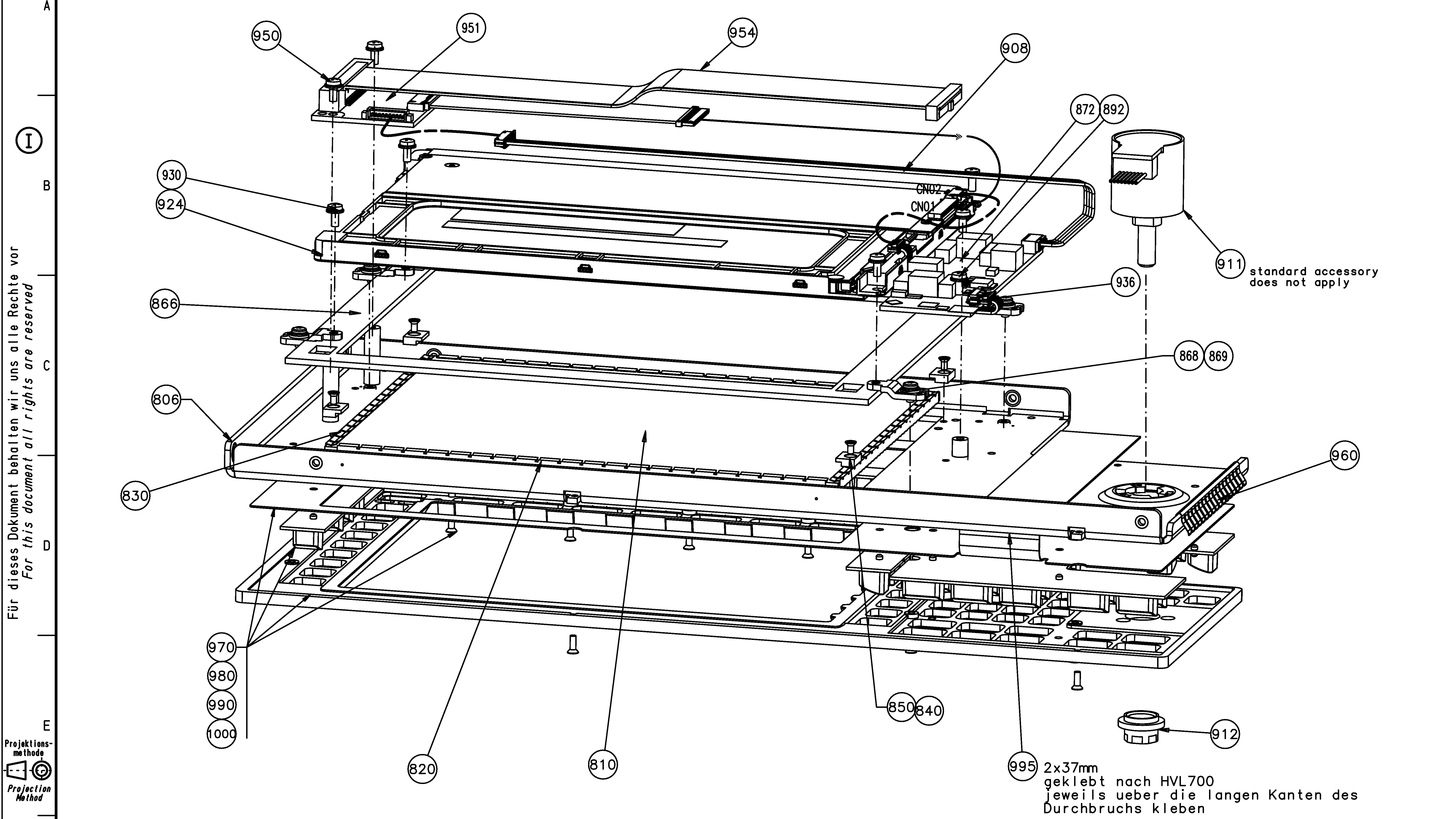
Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material	Sprache / Lang.	Änd. / C.I.	Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation: GRUNDEINHEIT Basic Unit		de en	11.00	2
Typ / Type: FSU	Datum / Date: 2011-01-21	Abteilung / Dept.: MTEK; Name: mk	Zeichn.Nr. / Drawing No.: 1166.1677.01 D		
I.Z. / used in					



Projektions-methode
Projection Method

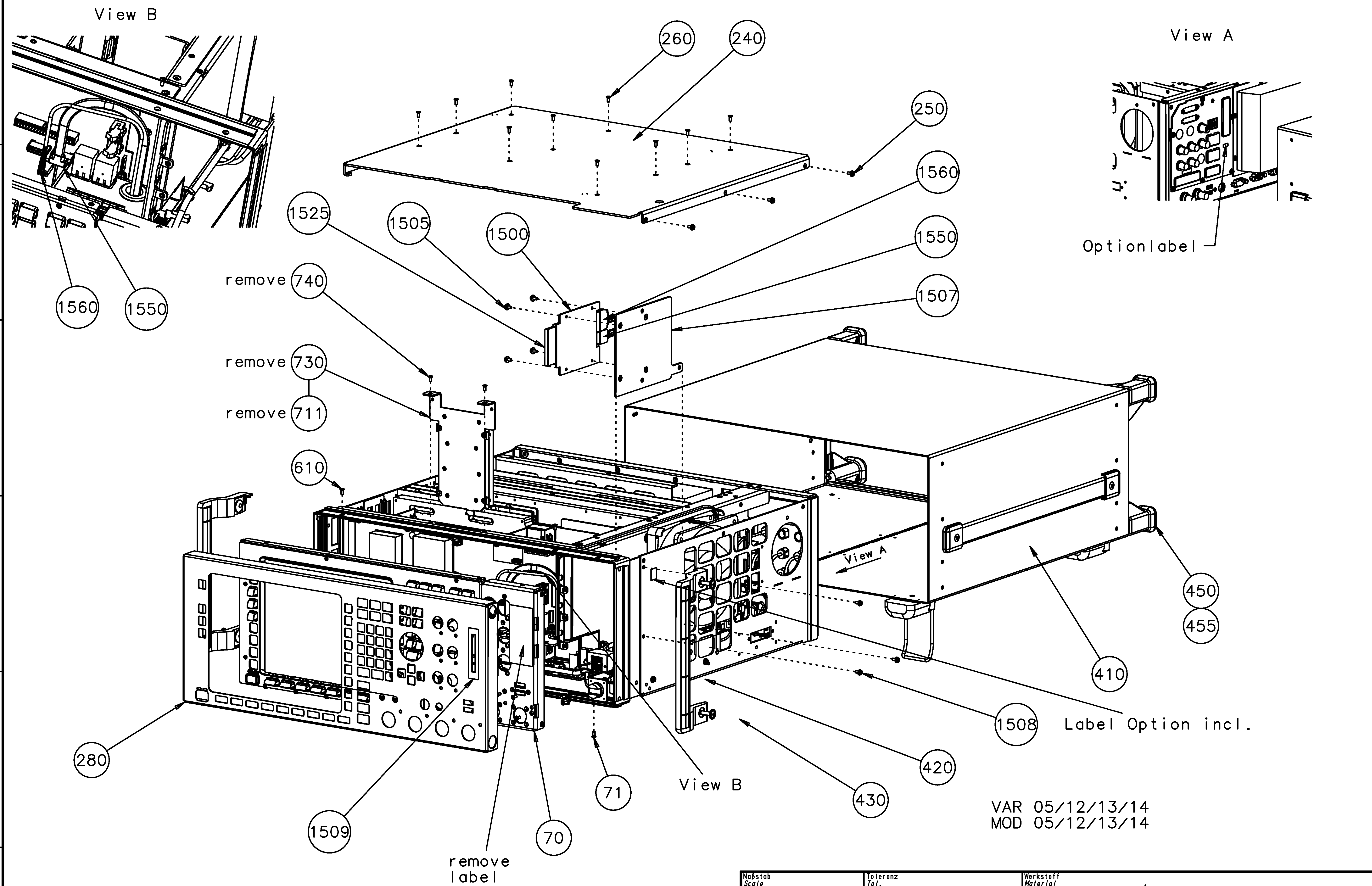
MOD 08 = Display Toshiba 084C271F with LED BACK LIGHT

Maßstab / Scale	Toleranz / Tol. ISO2768-m	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: DISPLAYEINHEIT DISPLAY UNIT		Sprache / Lang.: de en	Aei. / C.I.: 02.00	Blatt / Sh.: 7
	Datum / Date: 2010-01-12	Abteilung / Dept.: MTEK	Name / Name: mk	Zeichn.Nr. / Drawing No.: 1093.4708.01 D	



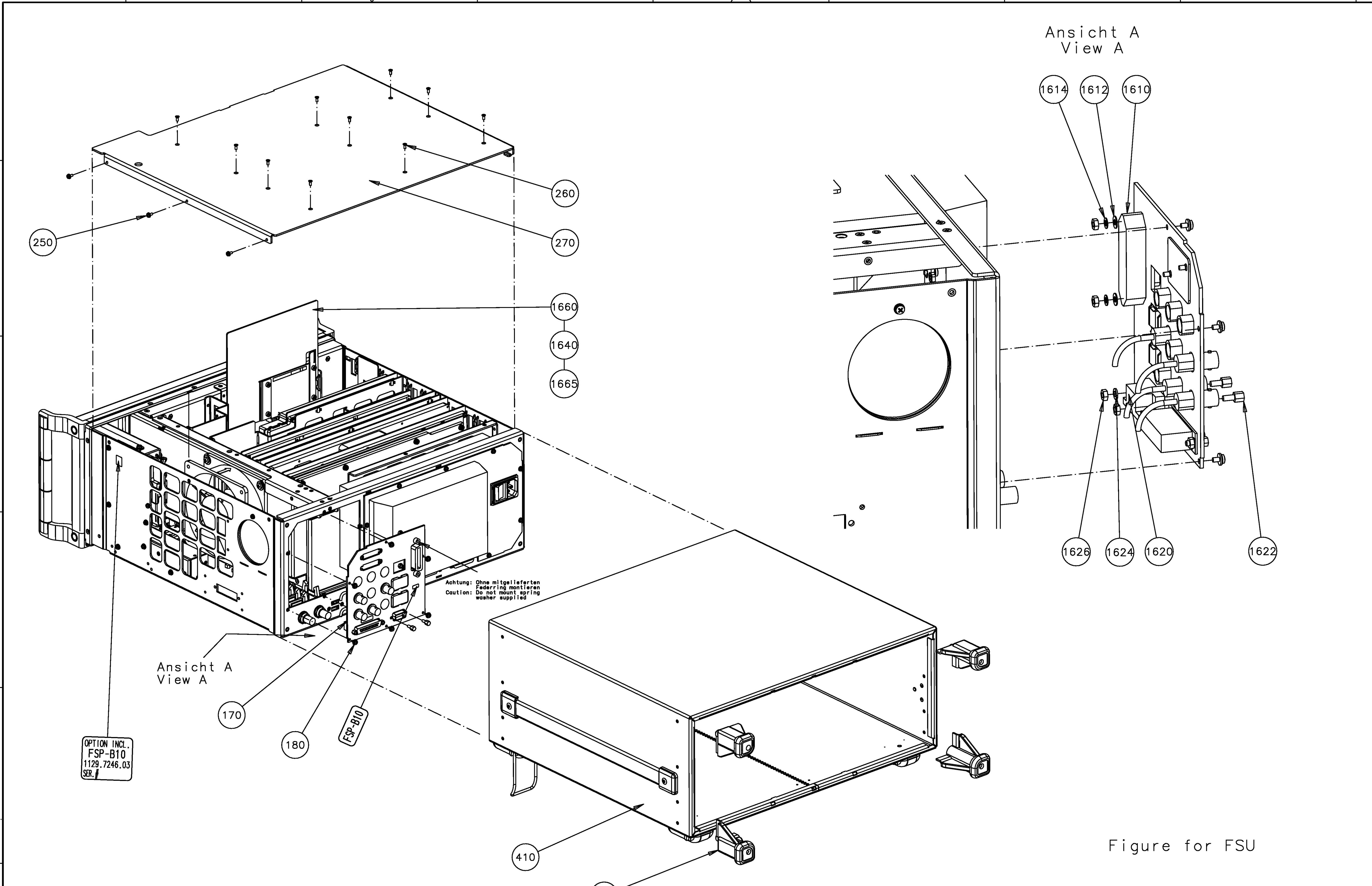
MOD 09 = Display AUO with FMR7

Maßstab / Scale	Toleranz / Tol. ISO2768-m	Werkstoff / Material		
ROHDE&SCHWARZ	Benennung / Designation: DISPLAYEINHEIT / DISPLAY UNIT		Sprache / Lang.: de en	Aei. / C.I.: 02.00
	Datum / Date: 2011-04-27	Abteilung / Dept.: MTEK	Name / Name: hm	Blatt / Sh.: 8
			Zeichn.Nr. / Drawing No.: 1093.4708.01 D	



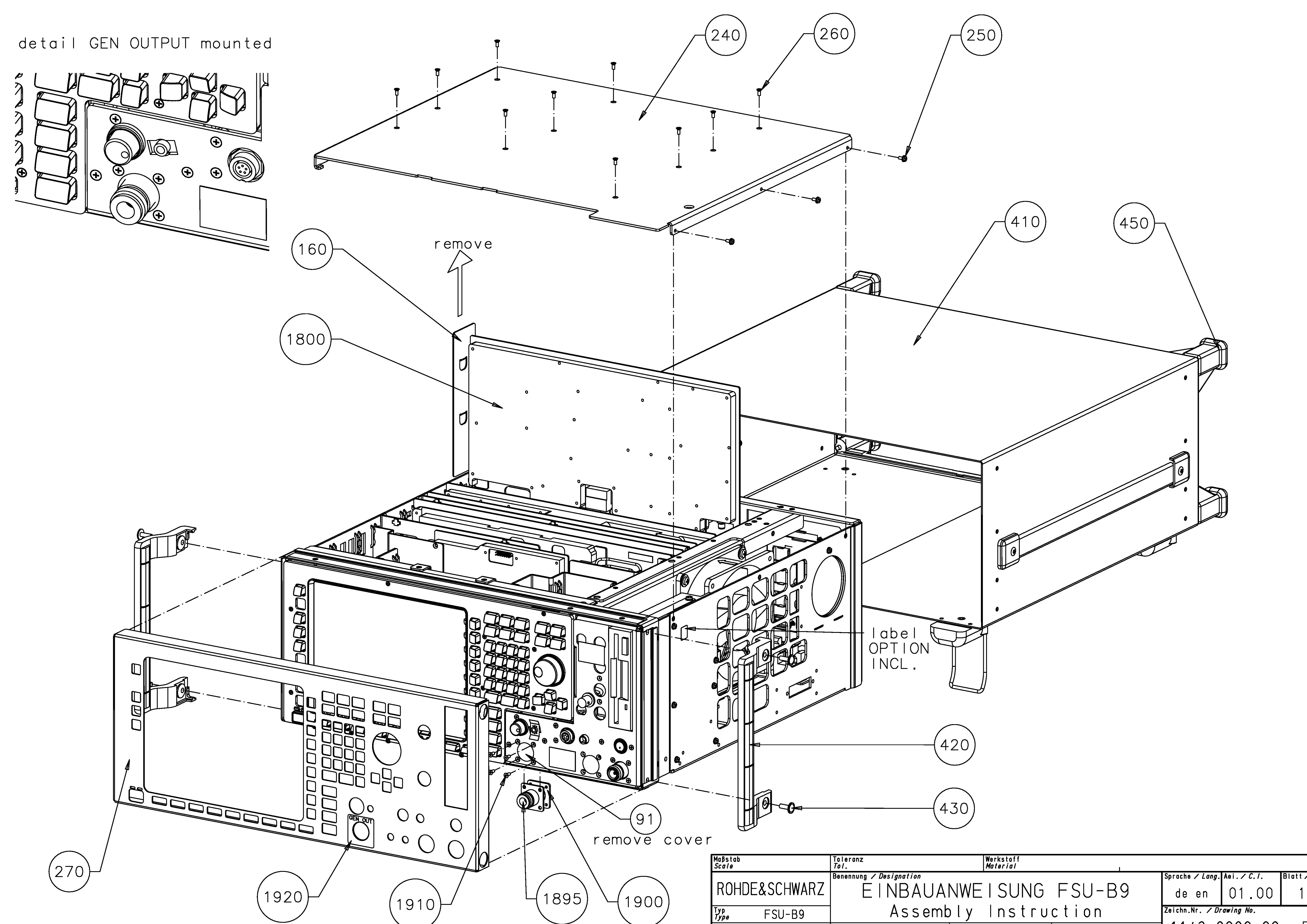
Projektions-methode / Projection Method

Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: EINBAUANWEISUNG ASSEMBLY INSTRUCTION		Sprache / Lang.: de en	Aei. / C.I.: 02.00	Blatt / Sh.: 1
FSUP-B18	Datum / Date: 2011-01-27	Abteilung / Dept.: MTEK; Name / Name: mk	Zeichn.Nr. / Drawing No.: 1308.1986.00 D		



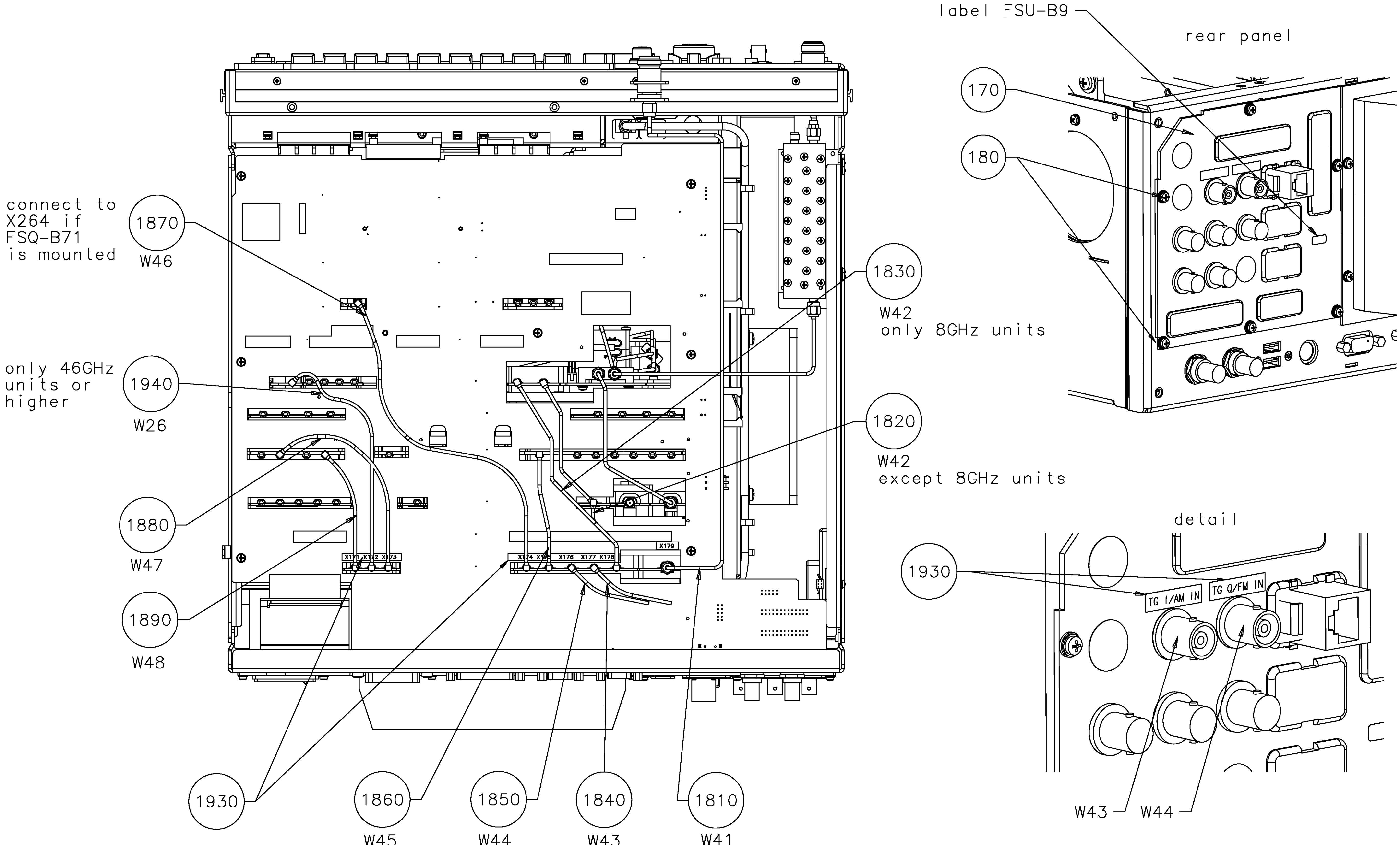
Projektionsmethode
Projection Method

Maßstab / Scale	Toleranz / Tol.		Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: EINBAUANWEISUNG FSP-B10 INSTALLATION INSTRUCTION			Sprache / Lang.: de en	Aei. / C.I.: 02.00	Blatt / Sh.: 1
FSP-B10	Datum / Date: 2007-03-27	Abteilung / Dept.: MEZ1	Name / Name: kl	Zeichn.Nr. / Drawing No.: 1129.7317.00 D		



Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material	
ROHDE&SCHWARZ	Benennung / Designation: EINBAUANWEISUNG FSU-B9 Assembly Instruction		Sprache / Lang.: de en; Aei. / C.I.: 01.00; Blatt / Sh.: 1
Typ / Type: FSU-B9			Zeichn.Nr. / Drawing No.: 1142.9090.00 D
i.Z. / used in: 1142.8994.01	Datum / Date: 30.07.2002	Abteilung / Dept.: 1ESK; Name / Name: TF	

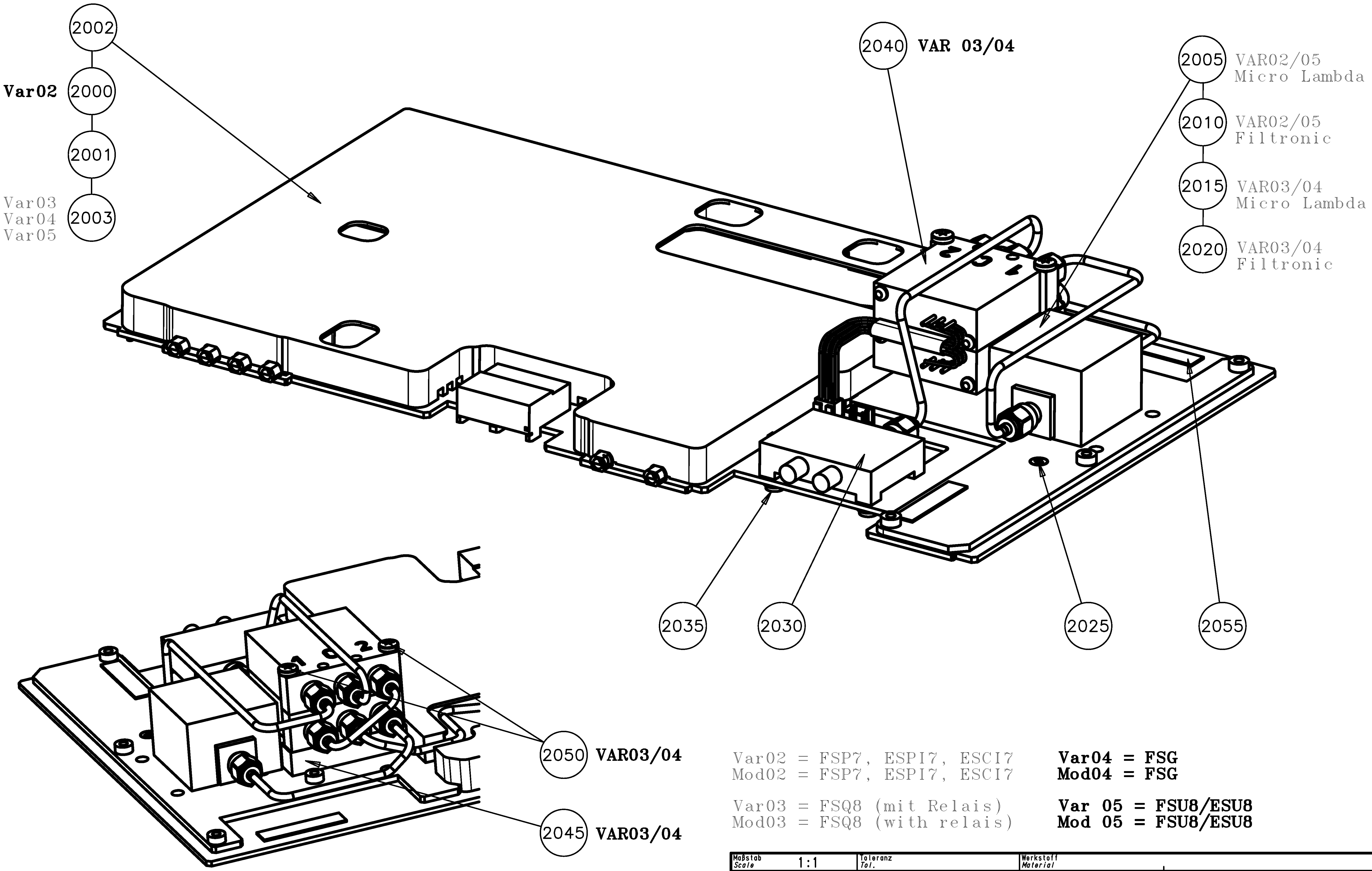
Projektions-methode / Projection Method



see connector designation of cables
and motherboard for cable mounting

Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material	
ROHDE&SCHWARZ	Benennung / Designation: EINBAUANWEISUNG FSU-B9 Assembly Instruction	Sprache / Lang.: de en	Aei. / C.I.: 02.00
Typ / Type: FSU-B9		Blatt / Sh.: 2	
I.Z. / used in: 1142.8994.01	Datum / Date: 26.05.2003	Abteilung / Dept.: 1ESK	Name: Wn
Zeichn.Nr. / Drawing No.: 1142.9090.00 D			

Projektions-methode / Projection Method



Var02 = FSP7, ESPI7, ESCI7
Mod02 = FSP7, ESPI7, ESCI7

Var03 = FSQ8 (mit Relais)
Mod03 = FSQ8 (with relais)

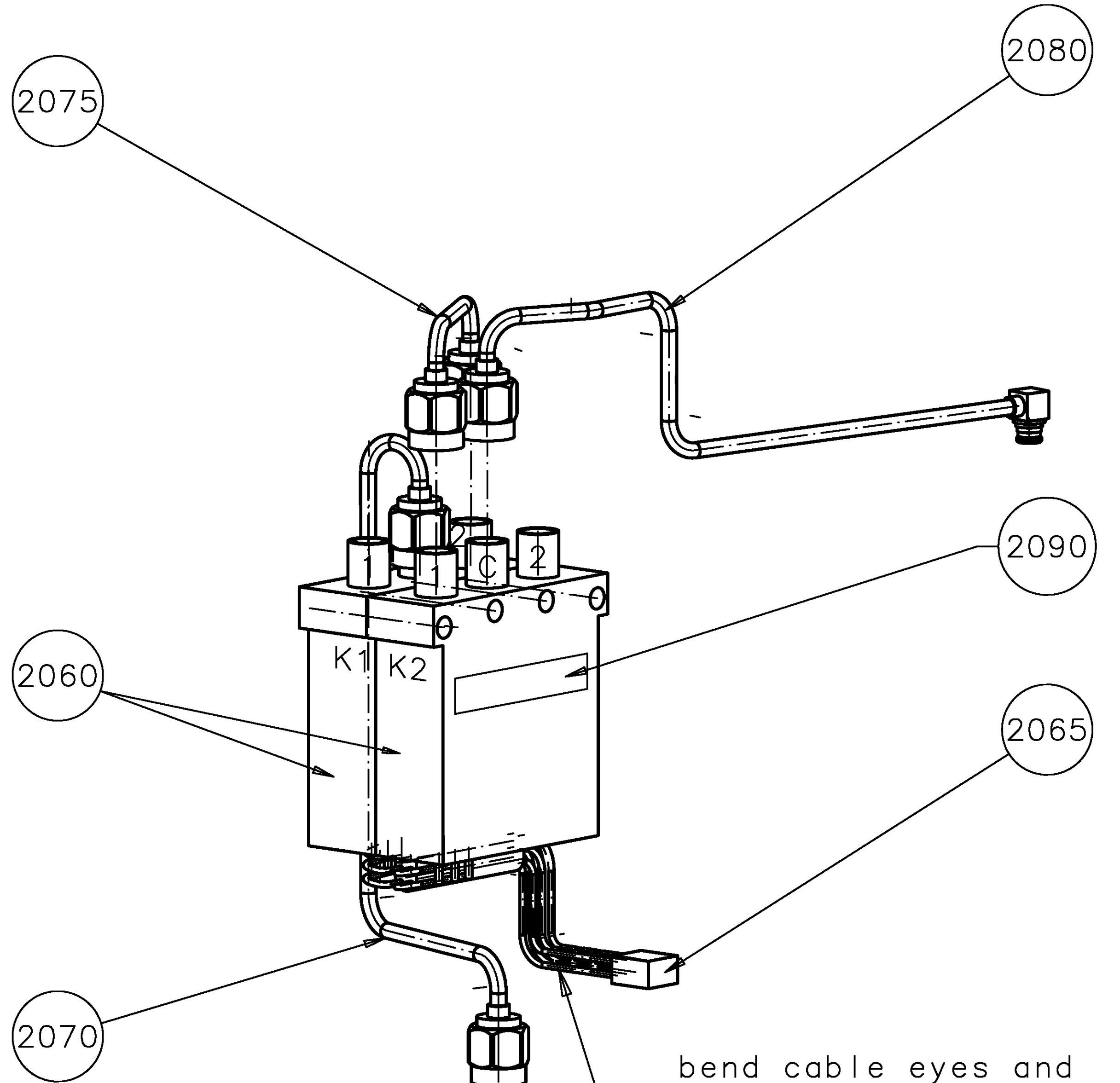
Var04 = FSG
Mod04 = FSG

Var 05 = FSU8/ESU8
Mod 05 = FSU8/ESU8

Projektions-methode / Projection Method

Maßstab / Scale 1:1	Toleranz / Tol.		Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: Converter Unit 8GHz			Sprache / Lang.: de en	Aei. / C.I.: 06.00	Blatt / Sh.: 1
Typ / Type: EMU				Zeichn.Nr. / Drawing No.: 1130.2544.01 D		
i.Z. / used in	Datum / Date: 2008-09-26	Abteilung / Dept.: 1ESK	Name / Name: Wn/VL			

Für dieses Dokument behalten wir uns alle Rechte vor



bend cable eyes and
solder it on

bei Einzeladern Oesen
biegen und anloeten

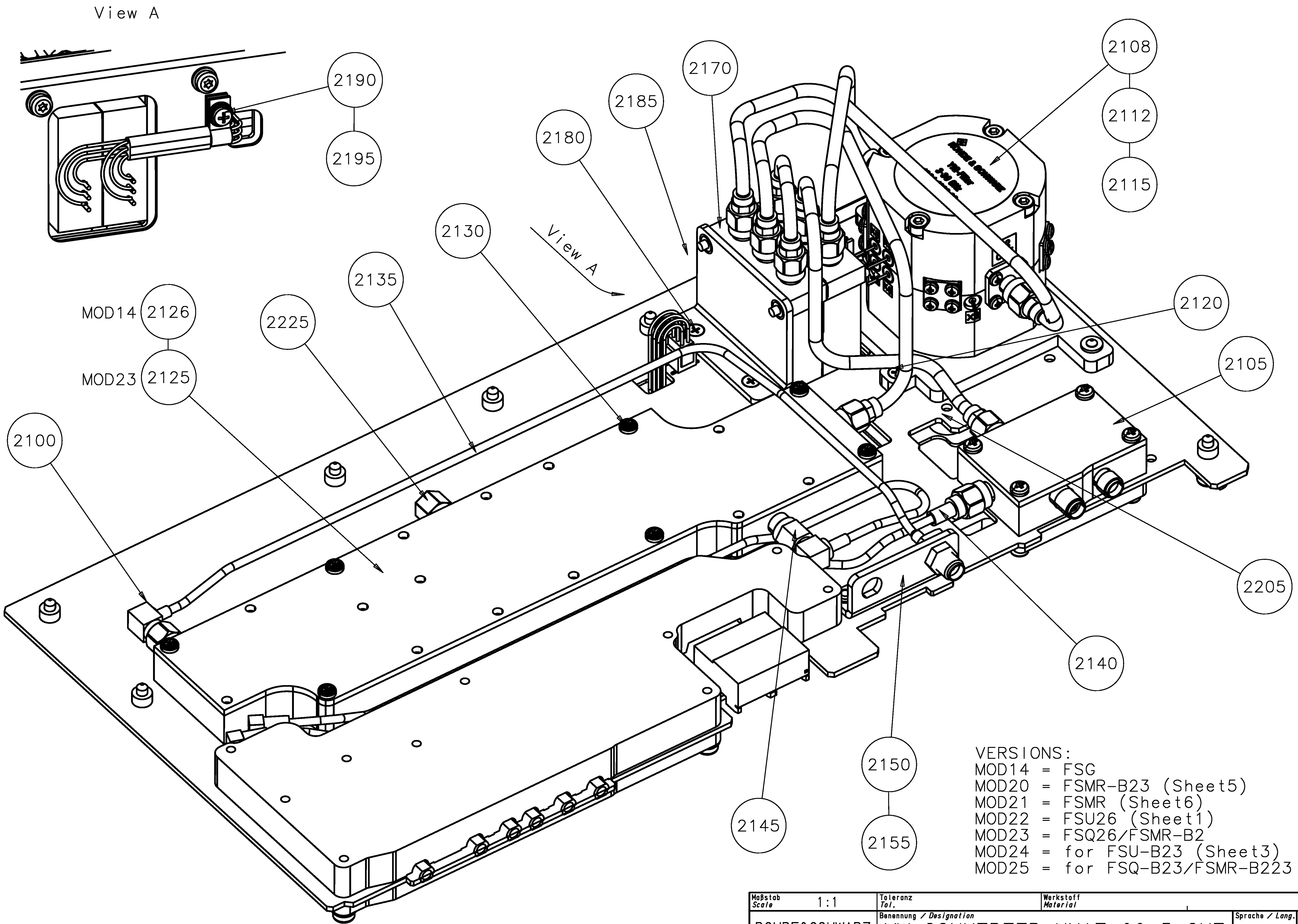
connection/Anschlussbelegung:

cable/Kabel	relay/Relais	
1 black/sw	K1 C	+12V
2 green/gn	K1 1	Yig enabled
3 blue/bl	K1 2	Yig disabled
4 red/rt	K2 C	+12V
5 yellow/ge	K2 1	Yig disabled
6 white/ws	K2 2	Yig enabled

VARIANTENERKLAERUNG/
VERSIONS:
VAR 02 = FSQ8
MOD 02 = FSQ8

Projektionsmethode
Projection Method

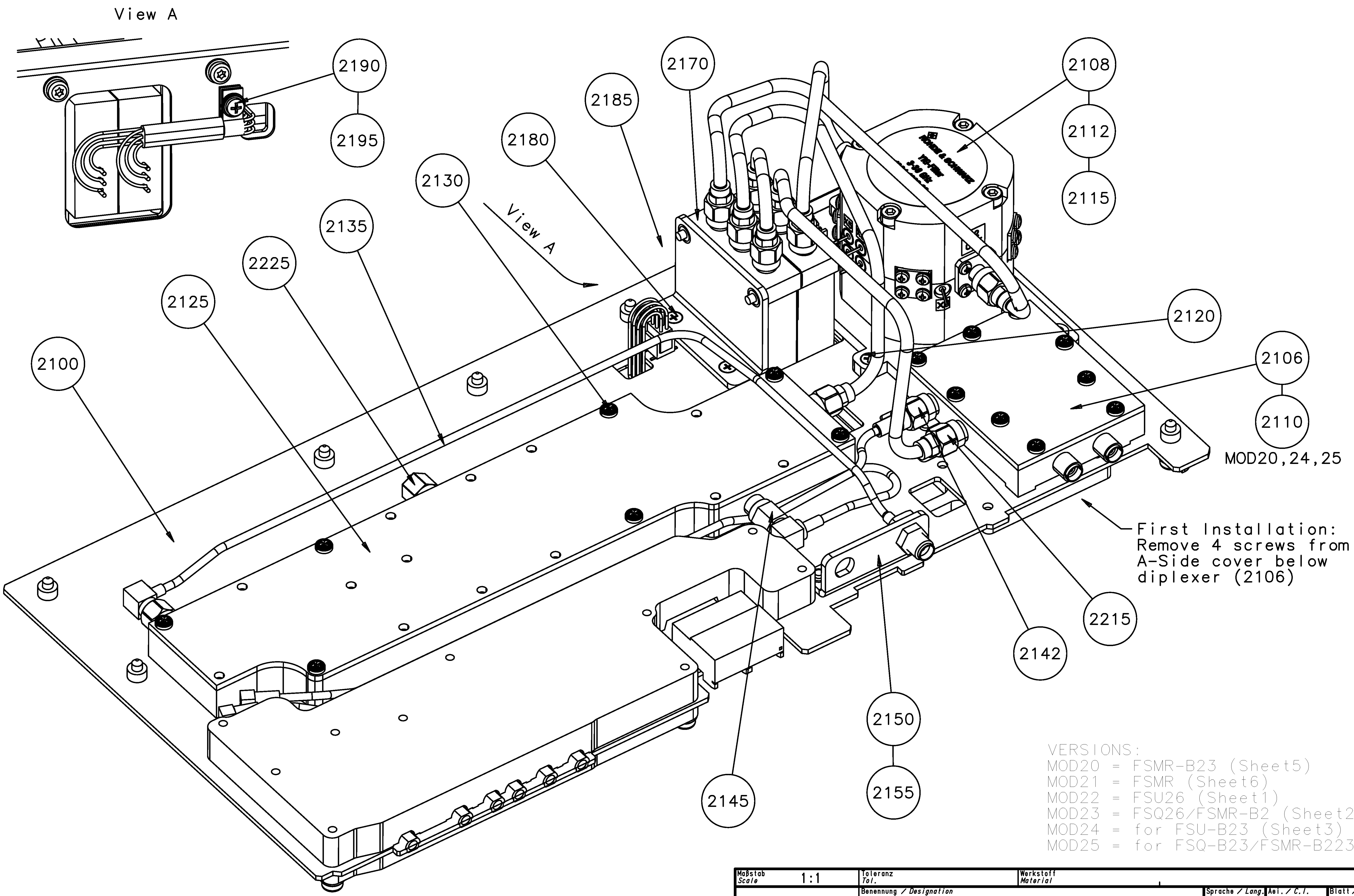
Maßstab / *Scale*: 1:1	Toleranz / *Tol.*	Werkstoff / *Material*	
ROHDE&SCHWARZ	Benennung / *Designation*: Relais Unit 8 GHz	Sprache / *Lang.*: de en	Aei. / *C.I.*: 05.00
Typ / *Type*: FSQ8		Blatt / *Sh.*: 1	Zeichn.Nr. / *Drawing No.*: 1130.2815.01 D
I.Z. / *used in*: 1130.3240.01	Datum / *Date*: 14.05.2002	Abteilung / *Dept.*: 1ESK	Name / *Name*: Wn



VERSIONS:
MOD14 = FSG
MOD20 = FSMR-B23 (Sheet5)
MOD21 = FSMR (Sheet6)
MOD22 = FSU26 (Sheet1)
MOD23 = FSQ26/FSMR-B2
MOD24 = for FSU-B23 (Sheet3)
MOD25 = for FSQ-B23/FSMR-B223 (Sheet4)

Projektions-methode
Projection Method

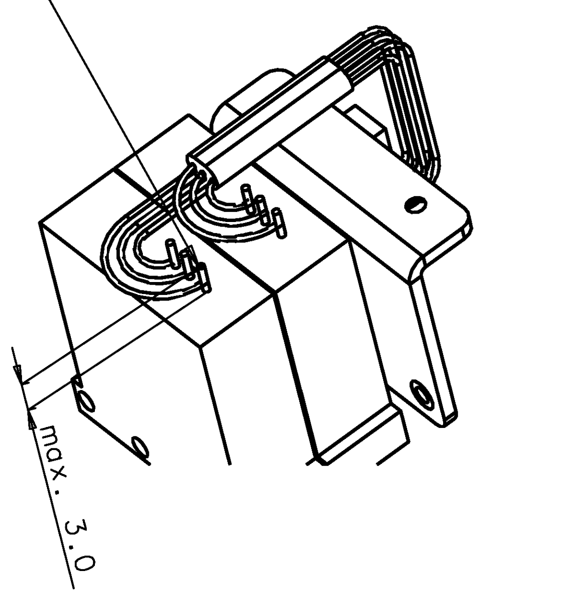
Maßstab / Scale: 1:1	Toleranz / Tol.		Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: MW CONVERTER UNIT 26.5 GHZ MW CONVERTER UNIT 26.5 GHZ			Sprache / Lang.: de en	Aei. / C.I.: 03.00	Blatt / Sh.: 2
Typ / Type: FSU				Zeichn.Nr. / Drawing No.: 1166.2338.01 D		
I.Z. / used in	Datum / Date: 2007-06-13	Abteilung / Dept.: 1ESK	Name: Wn			

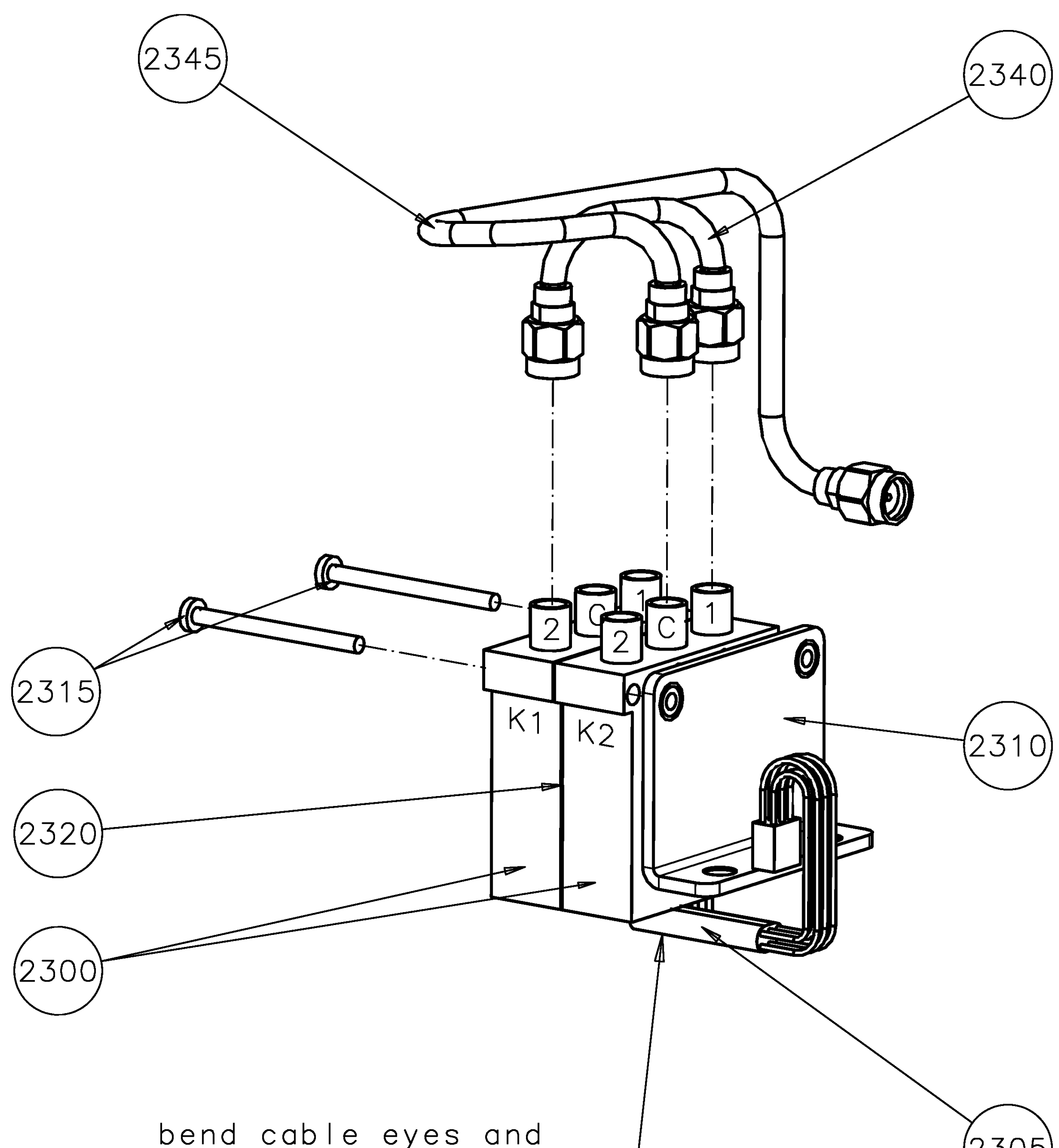


VERSIONS:
MOD20 = FSMR-B23 (Sheet5)
MOD21 = FSMR (Sheet6)
MOD22 = FSU26 (Sheet1)
MOD23 = FSQ26/FSMR-B2 (Sheet2)
MOD24 = for FSU-B23 (Sheet3)
MOD25 = for FSQ-B23/FSMR-B223

Projektionsmethode / *Projection Method*

Maßstab / *Scale*: 1:1	Toleranz / *Tol.*	Werkstoff / *Material*	
ROHDE&SCHWARZ	Benennung / *Designation*: MW CONVERTER UNIT 26.5 GHZ / MW CONVERTER UNIT 26.5 GHZ	Sprache / *Lang.*: de en	Aei. / *C.I.*: 03.00 / Blatt / *Sh.*: 4
Typ / *Type*: FSU	Datum / *Date*: 2006-12-06 / Abteilung / *Dept.*: 1ESK / Name / *Name*: Wn	Zeichn.Nr. / *Drawing No.*: 1166.2338.01 D	
I.Z. / *used in*			





Projektions-methode
Projection Method

connection / Anschlussbelegung:

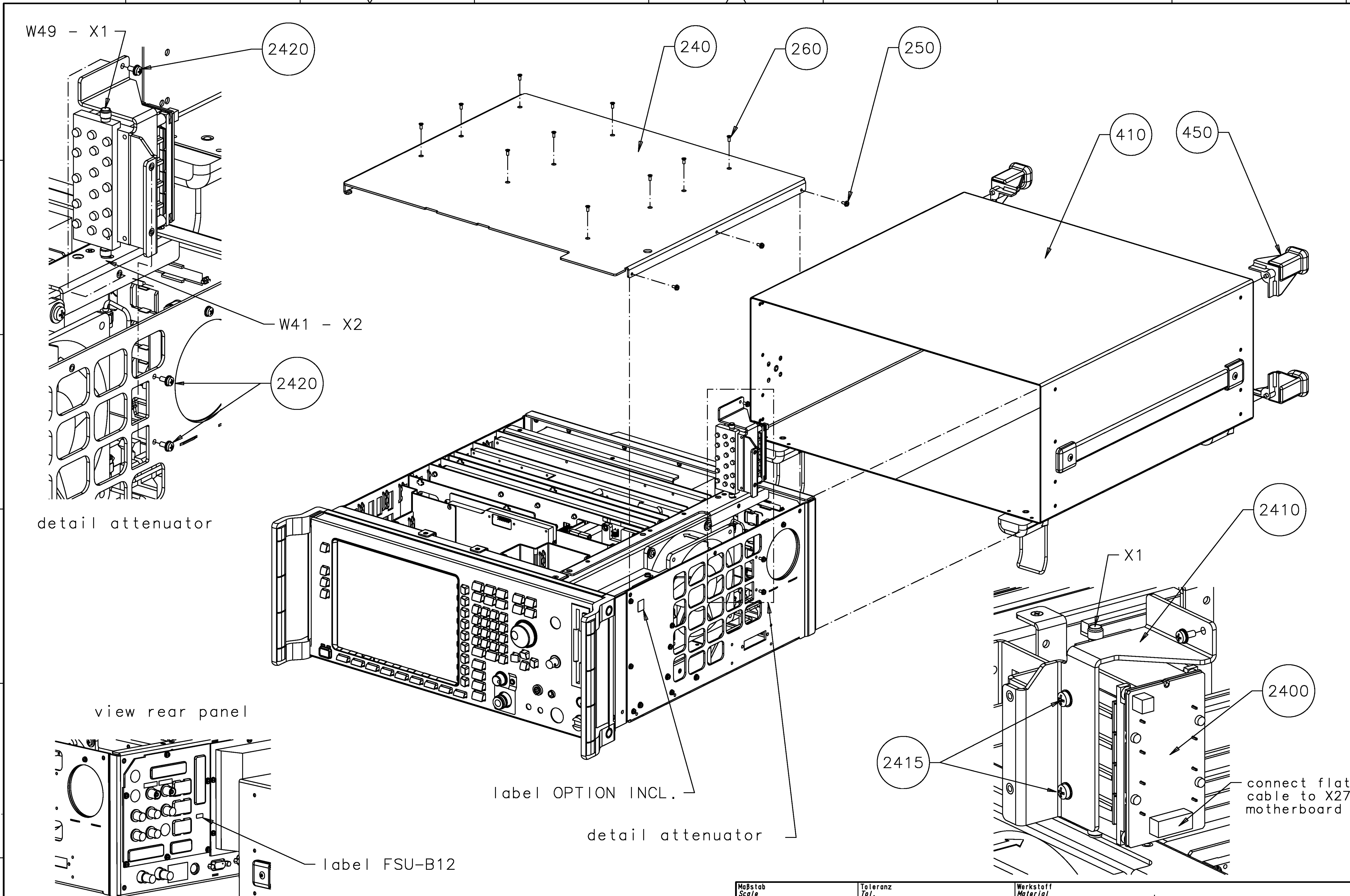
cable/Kabel	relay/Relais	
1 black/sw	K1 C	+12V
2 green/gn	K1 1	Yig enabled
3 blue/bl	K1 2	Yig disabled
4 red/rt	K2 C	+12V
5 yellow/ge	K2 1	Yig disabled
6 white/ws	K2 2	Yig enabled

bend cable eyes and
solder it on

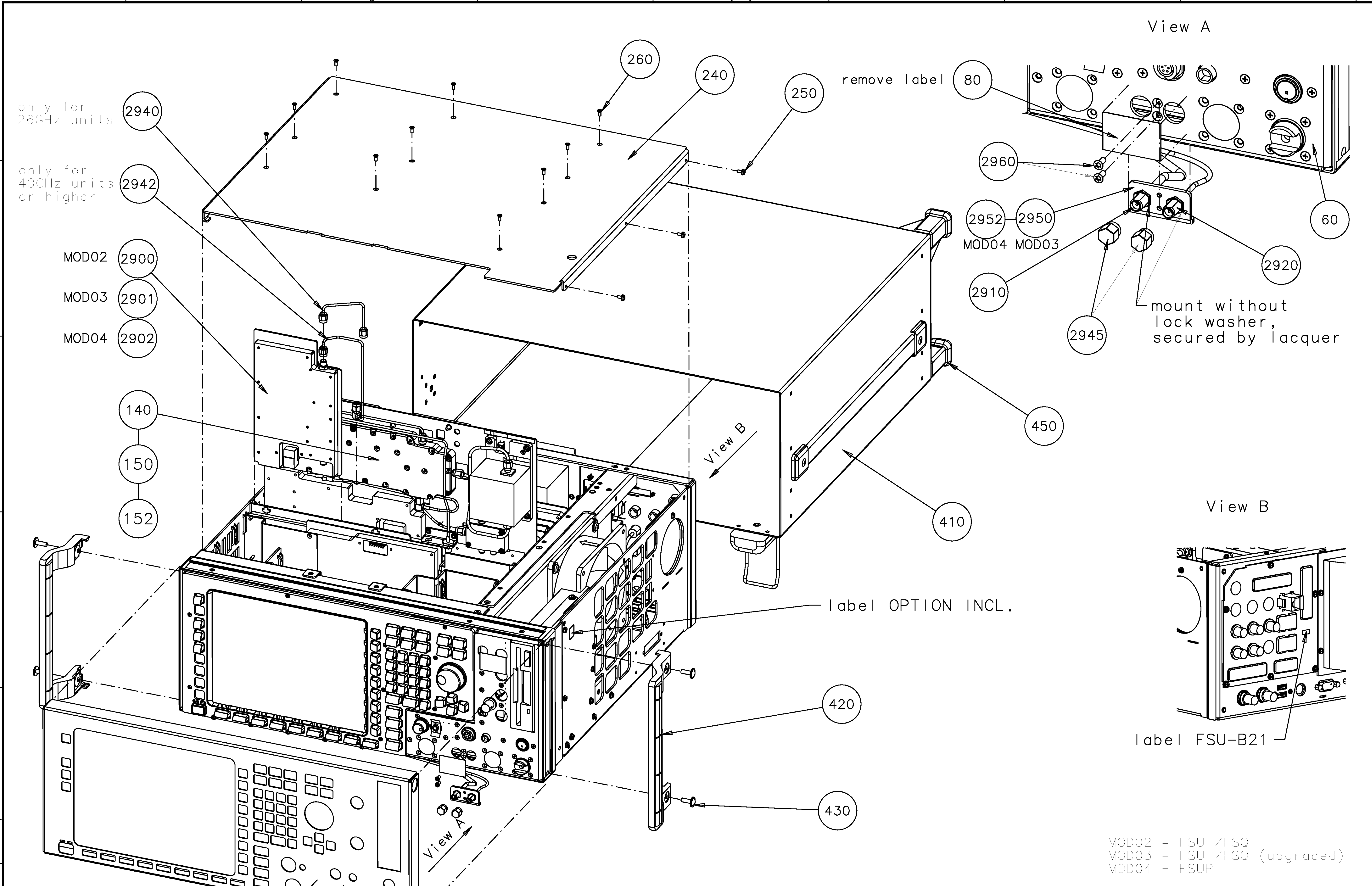
bei Einzeladern Oesen
biegen und anloeten.

VARIANTENERKLAERUNG/
VERSIONS:
VAR 02 = FSQ26 / FSQ-B23
MOD 02 = FSQ26 / FSQ-B23

Maßstab / Scale	1:1
Toleranz / Tol.	
Werkstoff / Material	
	ROHDE&SCHWARZ
Benennung / Designation	Relais Unit 26.5 GHz
Sprache / Lang.	de en
Aei. / C.I.	06.00
Blatt / Sh.	1
Typ / Type	FSQ26
i.Z. / used in	1130.3240.01
Datum / Date	18.11.2002
Abteilung / Dept.	1ESK
Name / Name	Wn
Zeichn.Nr. / Drawing No.	1130.3405.01 D

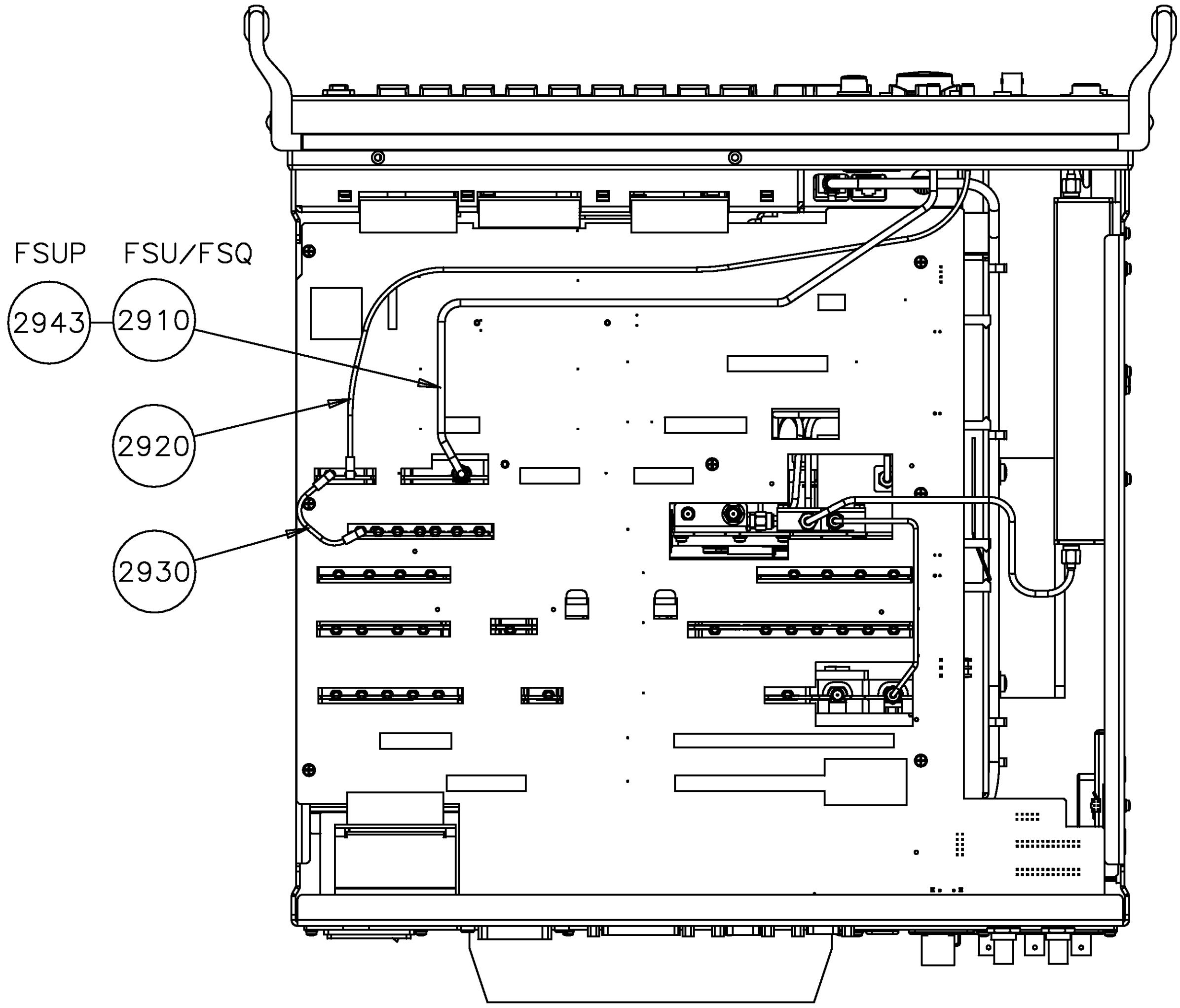


Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material		
ROHDE&SCHWARZ	Benennung / Designation: Einbauanweisung / Assembly Instruction		Sprache / Lang.: de en	Aei. / C.I.: 01.00
Typ / Type: FSU-B12				Blatt / Sh.: 1
i.Z. / used in: 1142.9349.01	Datum / Date: 19.09.2002	Abteilung / Dept.: 1ESK	Name / Name: TF	Zeichn.Nr. / Drawing No.: 1142.9361.00 D



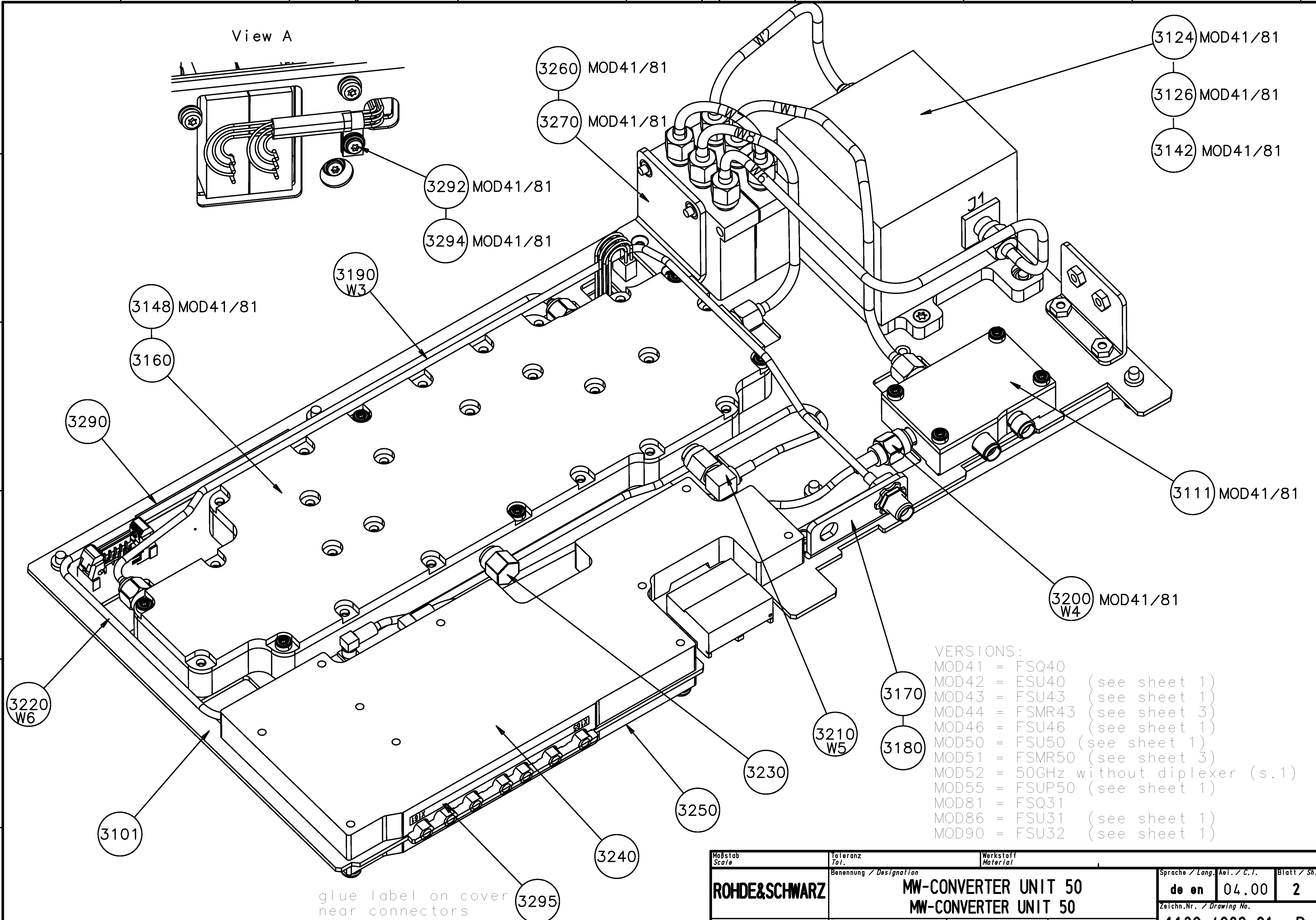
Maßstab / Scale	Toleranz / Tol.		Werkstoff / Material		
ROHDE&SCHWARZ	Benennung / Designation: EINBAUANW. FSU-B21 ASSEMBLY INSTRUCTION			Sprache / Lang.: de en	Aei. / C.I.: 03.00 — Blatt / Sh.: 1
FSU-B21	Datum / Date: 2008-03-04	Abteilung / Dept.: 1ESK	Name / Name: TF	Zeichn.Nr. / Drawing No.: 1157.1110.00 D	

I



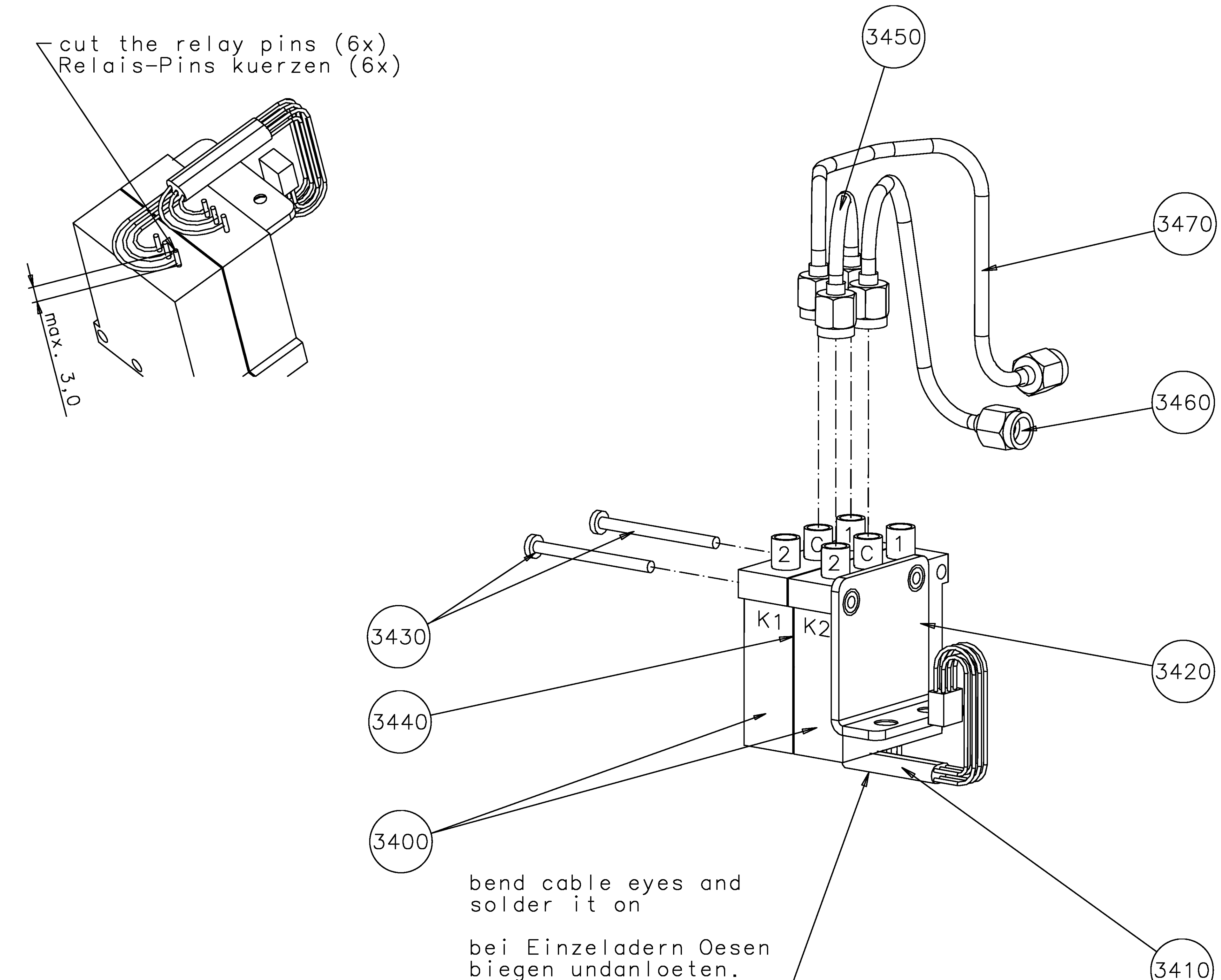
Projektions-methode
Projection Method

Maßstab / Scale	Toleranz / Tol.		Werkstoff / Material		
ROHDE&SCHWARZ	Benennung / Designation: EINBAUANW. FSU-B21 ASSEMBLY INSTRUCTION			Sprache / Lang.: de en	Aei. / C.I.: 02.00
				Blatt / Sh.: 2	
FSU-B21	Datum / Date: 2008-03-04	Abteilung / Dept.: 1ESK	Name / Name: TF	Zeichn.Nr. / Drawing No.: 1157.1110.00	D



Projektionsmethode / Projection Method

Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: MW-CONVERTER UNIT 50 / MW-CONVERTER UNIT 50		Sprache / Lang.: de en	Aei. / C.I.: 04.00	Blatt / Sh.: 2
FSU50	Datum / Date: 2010-02-02	Abteilung / Dept.: MTEK	Name: mk	Zeichn.Nr. / Drawing No.: 1130.4982.01	D



connection / Anschlussbelegung:

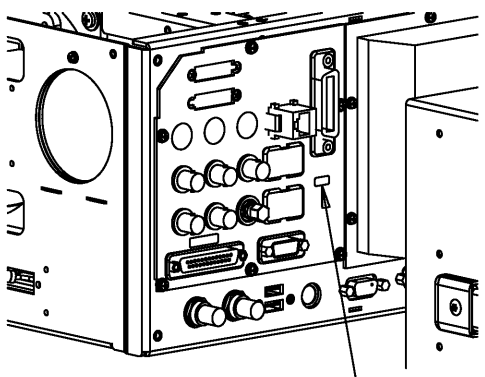
cable/Kabel	relay/Relais
1 black/sw	K1 C ⏚
2 green/gn	K1 2 Yig disabled
3 blue/bl	K1 1 Yig enabled
4 red/rt	K2 C ⏚
5 yellow/ge	K2 2 Yig enabled
6 white/ws	K2 1 Yig disabled

VARIANTENERKLAERUNG/
VERSIONS:
VAR 02 = FSQ40
MOD 02 = FSQ40

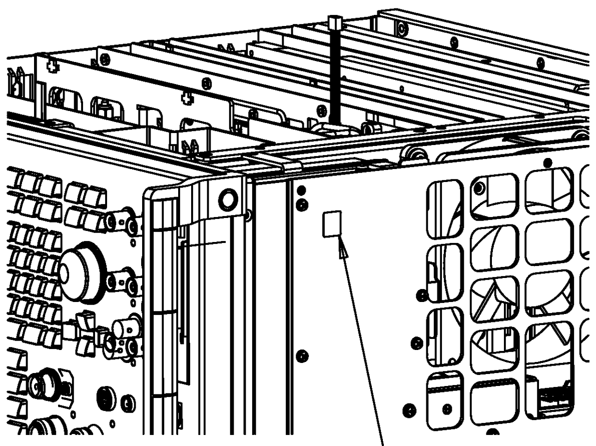
Projektionsmethode / Projection Method

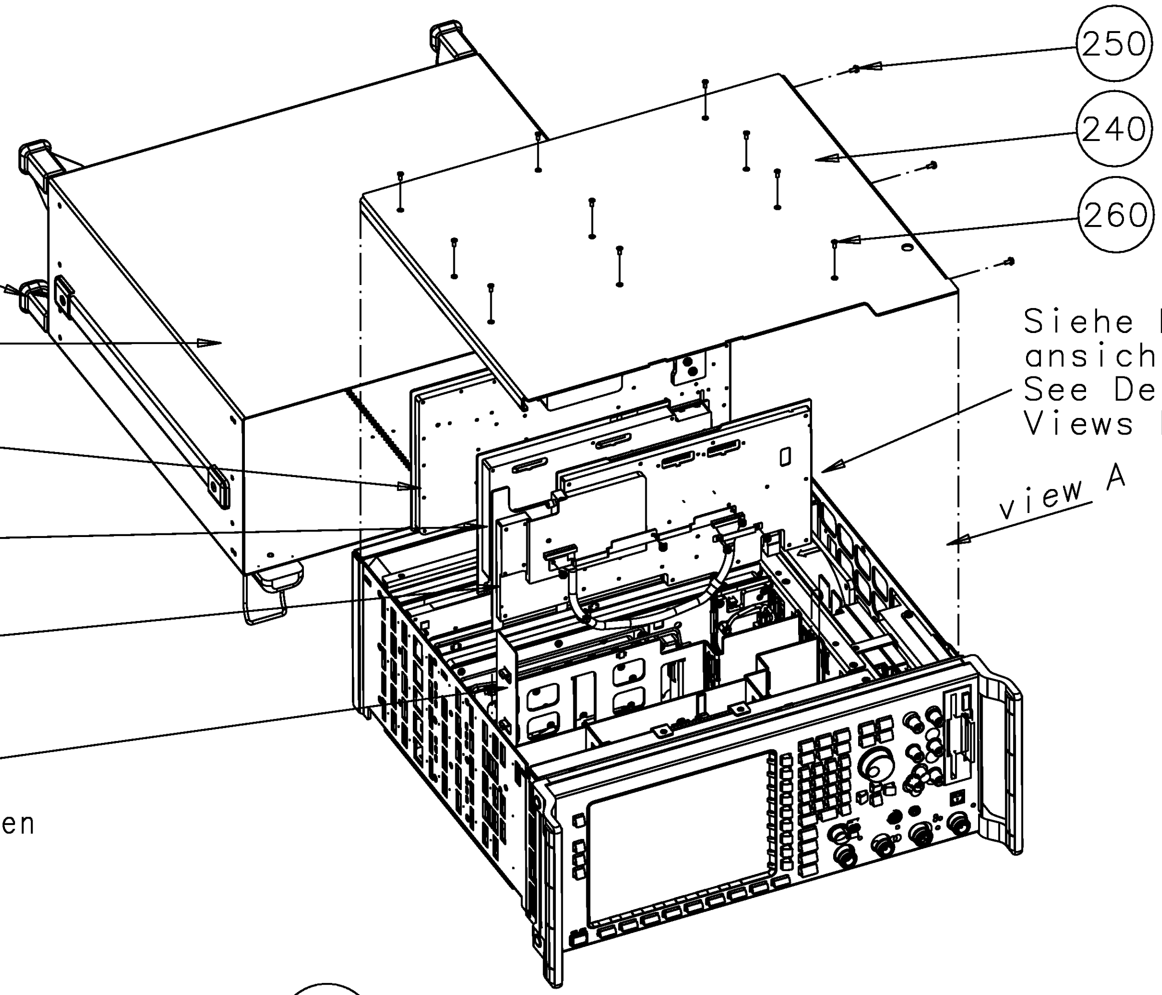
Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material	
ROHDE&SCHWARZ	Benennung / Designation: Relais Unit 40 GHz RELAIS UNIT 40 GHZ	Sprache / Lang.: de en	Aei. / C.I.: 03.00 — Blatt / Sh.: 1
	Datum / Date: 13.02.2004 — Abteilung / Dept.: 1ESK — Name / Name: TF	Zeichn.Nr. / Drawing No.: 1155.5147.01	D

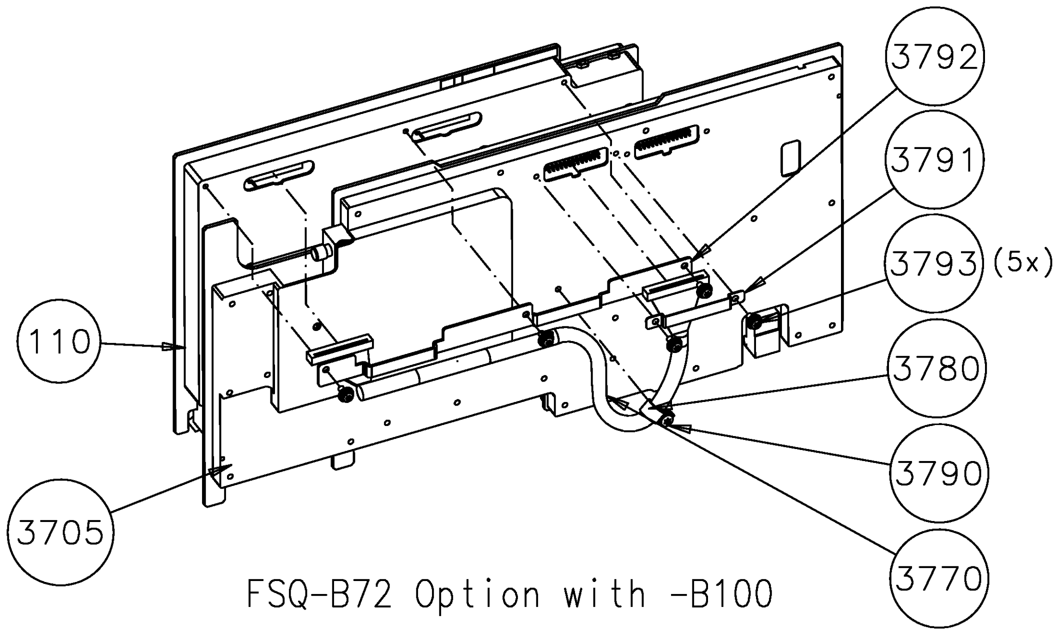
view rear panel



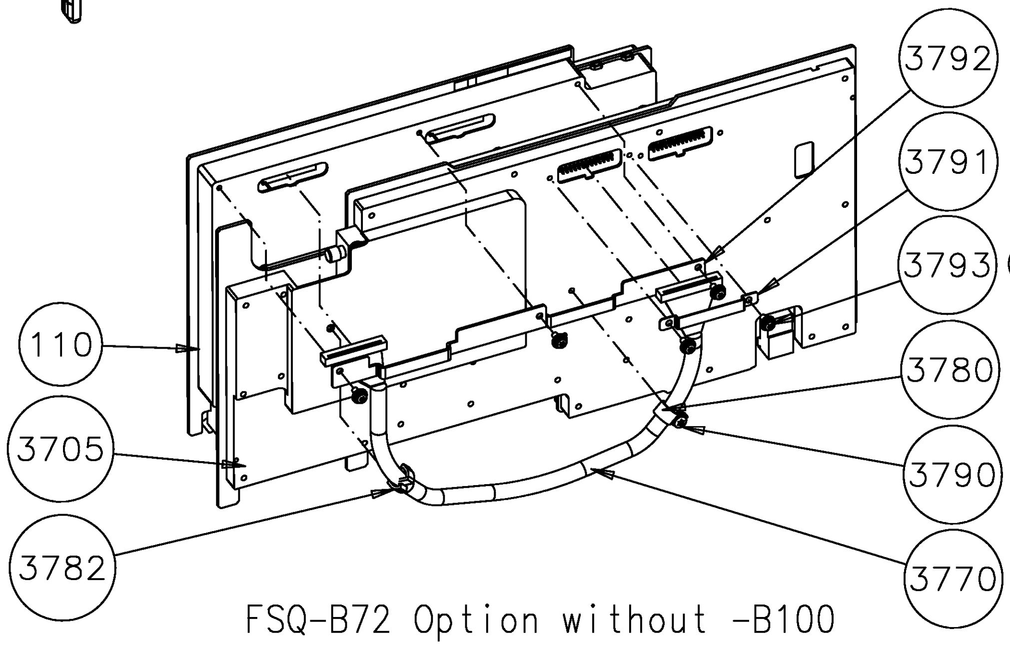
view A







FSQ-B72 Option with -B100



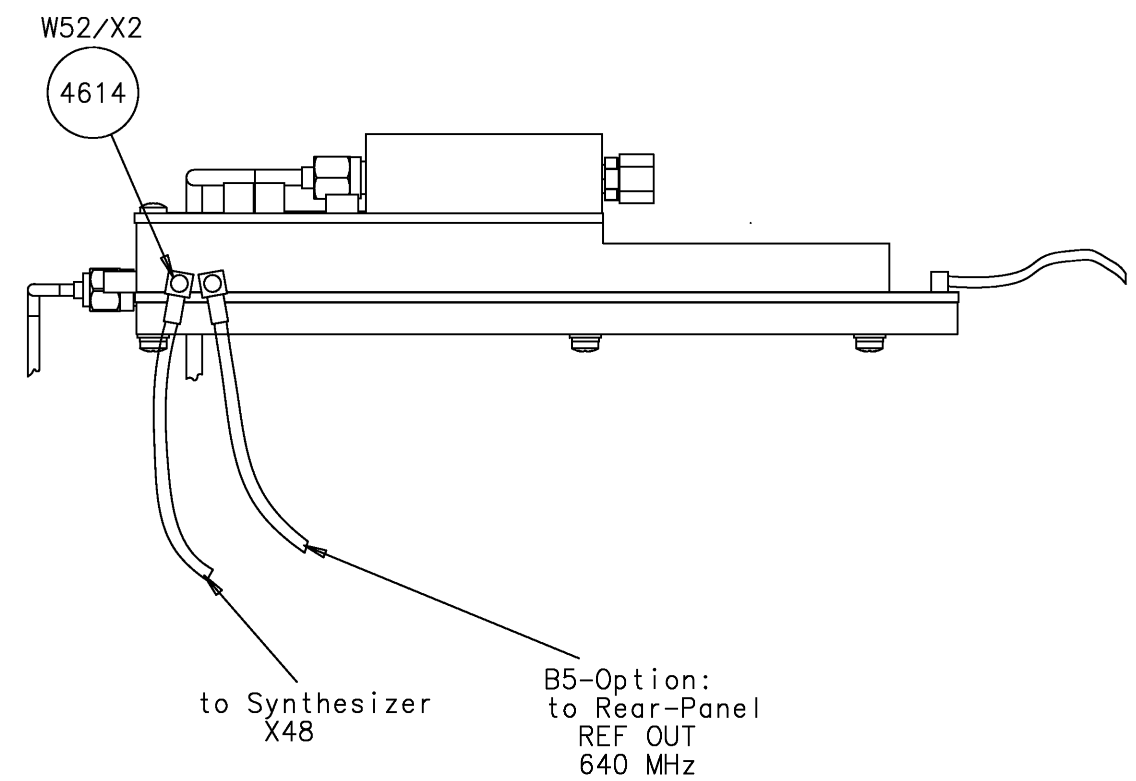
FSQ-B72 Option without -B100

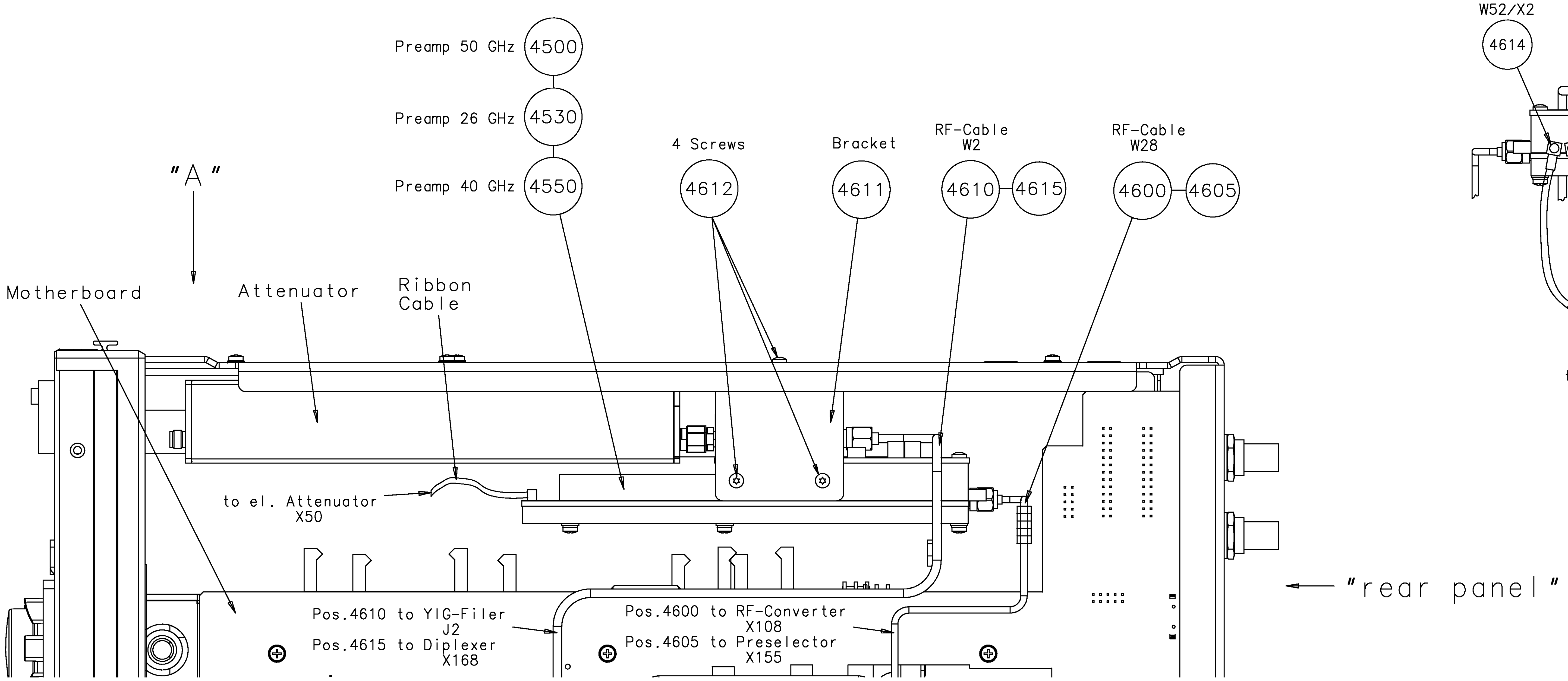
Hinweis / Note:
- Einbau nur ab Werk / Installation only ex factory
- IQ Bandwith Extension, Pos. 3705,
  kann nur ein- und ausgebaut werden mit /
  can only be installed and deassembled with
  Wide Band Detector Unit, Pos. 110.

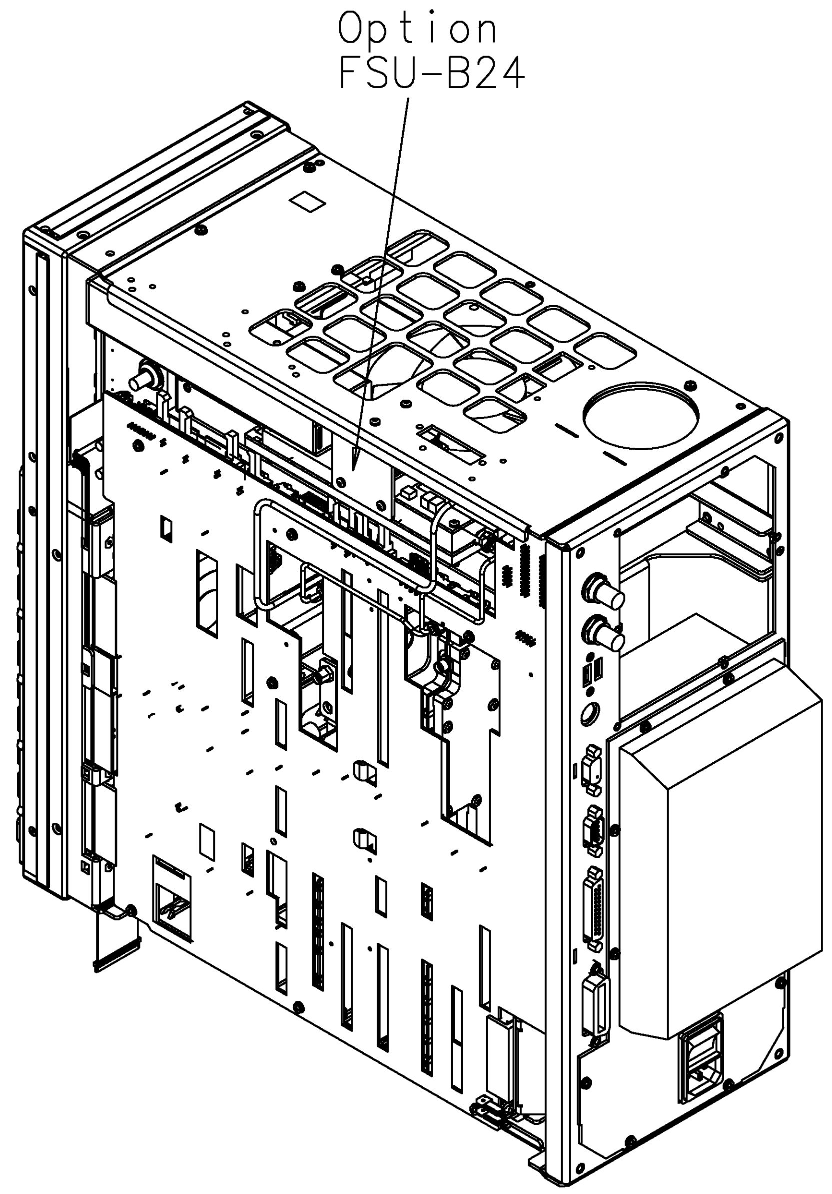
Projektions-methode / Projection Method

Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material	
ROHDE&SCHWARZ	Benennung / Designation: EINBAUANWEISUNG FSQ-B72 INSTALLATION MANUAL		Sprache / Lang.: de en; Aei. / C.I.: 01.00; Blatt / Sh.: 1
	Datum / Date: 2006-06-19	Abteilung / Dept.: 1ESK; Name / Name: Mi	Zeichn.Nr. / Drawing No.: 1157.0488.00 D

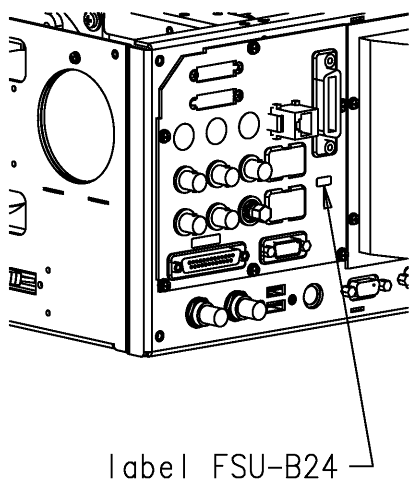
Back View - Option FSU-B24



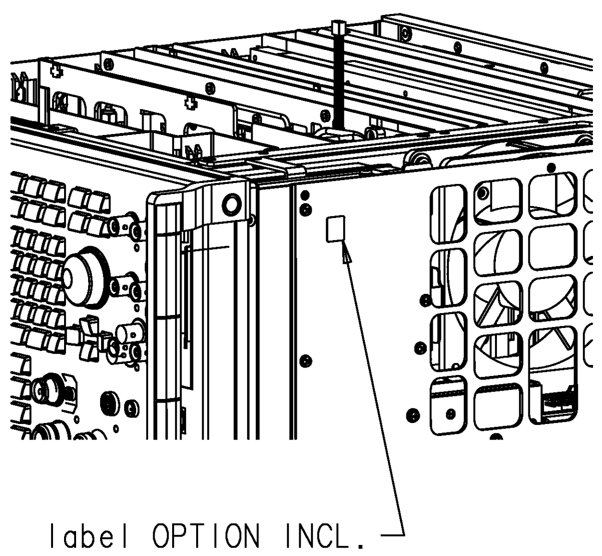




view rear panel



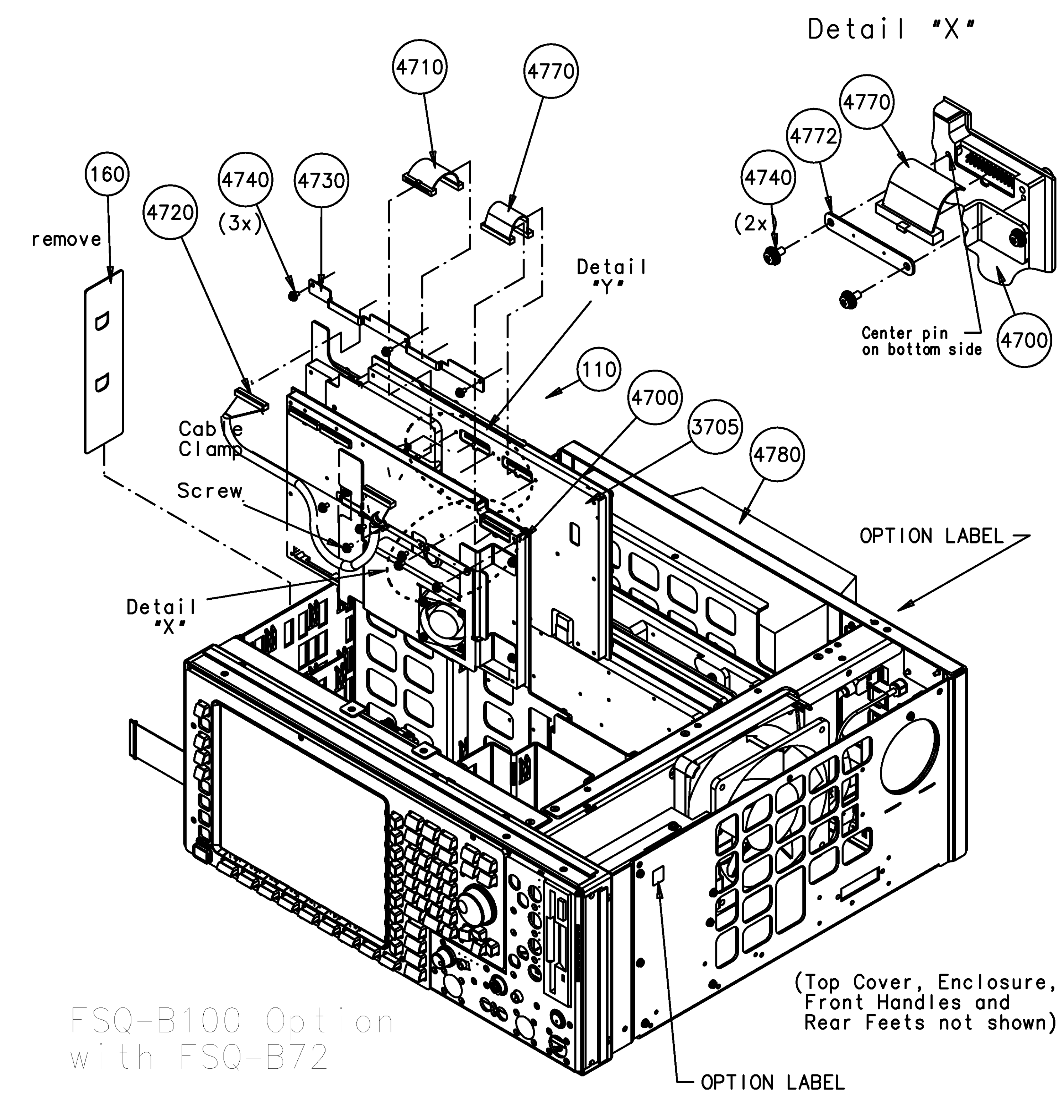
view A

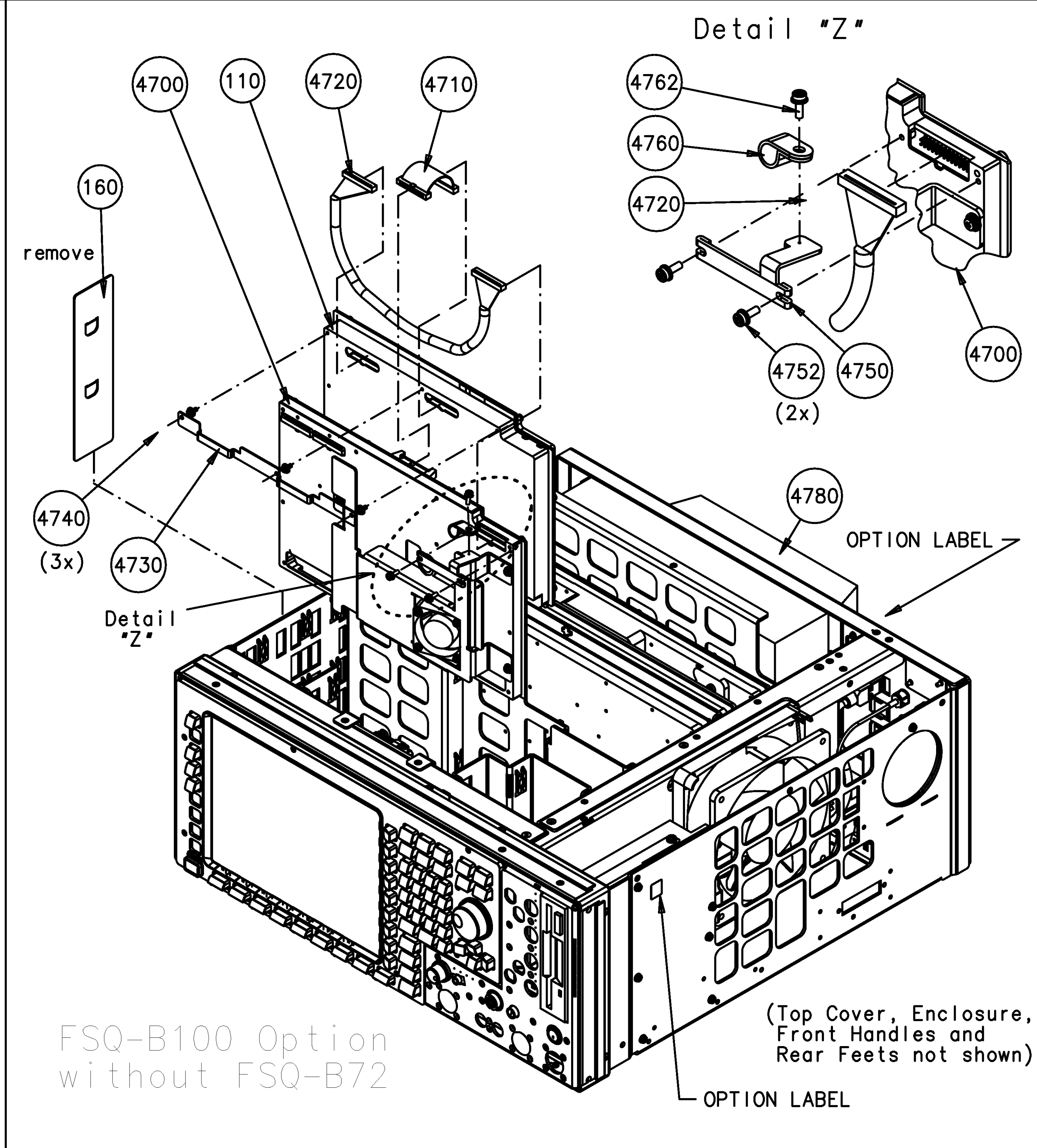


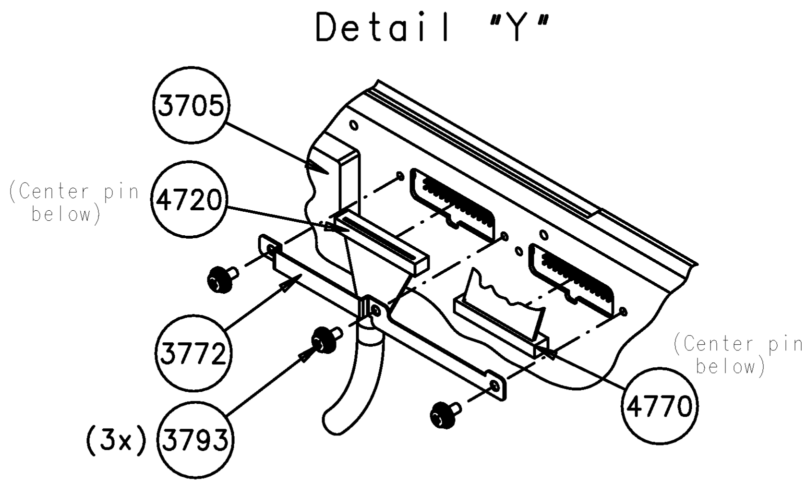
Versions:
MOD26 = Preamplifier 26 GHz
MOD40 = Preamplifier 40 GHz
MOD50 = Preamplifier 50 GHz

Projektionsmethode / Projection Method

Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material	
ROHDE&SCHWARZ	Benennung / Designation: INSTALL. INSTRUCTION / INSTALL. INSTRUCTION	Sprache / Lang.: de en	Änd. / C.I.: 05.00
		Blatt / Sh.: 1	Zeichn.Nr. / Drawing No.: 1157.2116.00 D
ESU-B24	Datum / Date: 2007-06-13	Abteilung / Dept.: 1ESK	Name: Wn







Einbau nur ab Werk; fuer Nachruesten
Option mittels FSQ-U100

Vorraussetzungen:
- FSQ mit Wideband Detector Var 05
  oder hoeher,
  Aenderungsindex 04.15 oder hoeher
- Firmware Version 4.05 oder hoeher

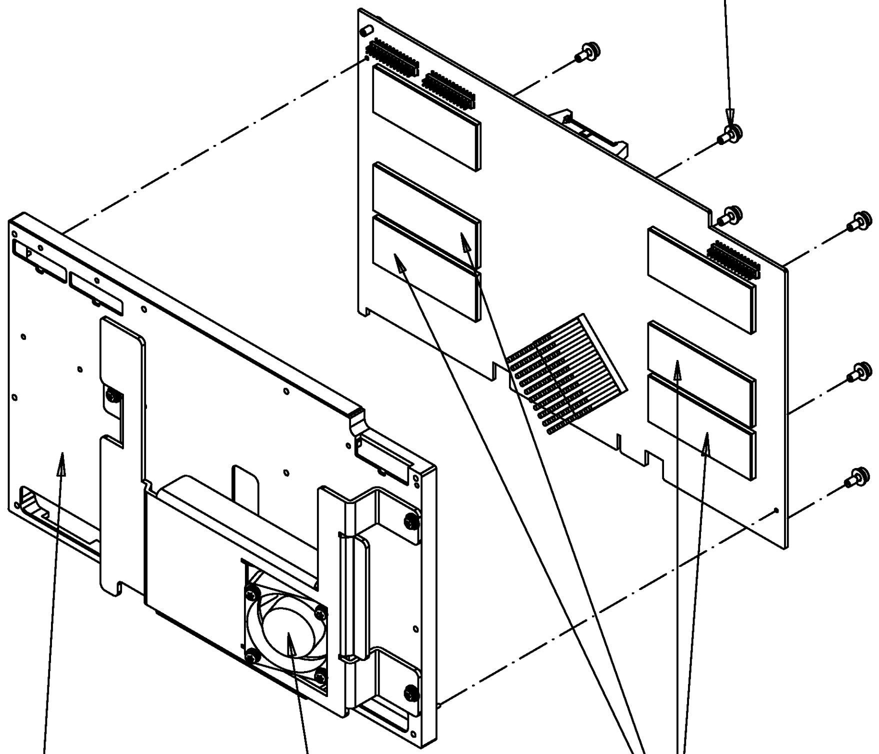
Installation only at factory; for
retrofitting option by means of FSQ-U100

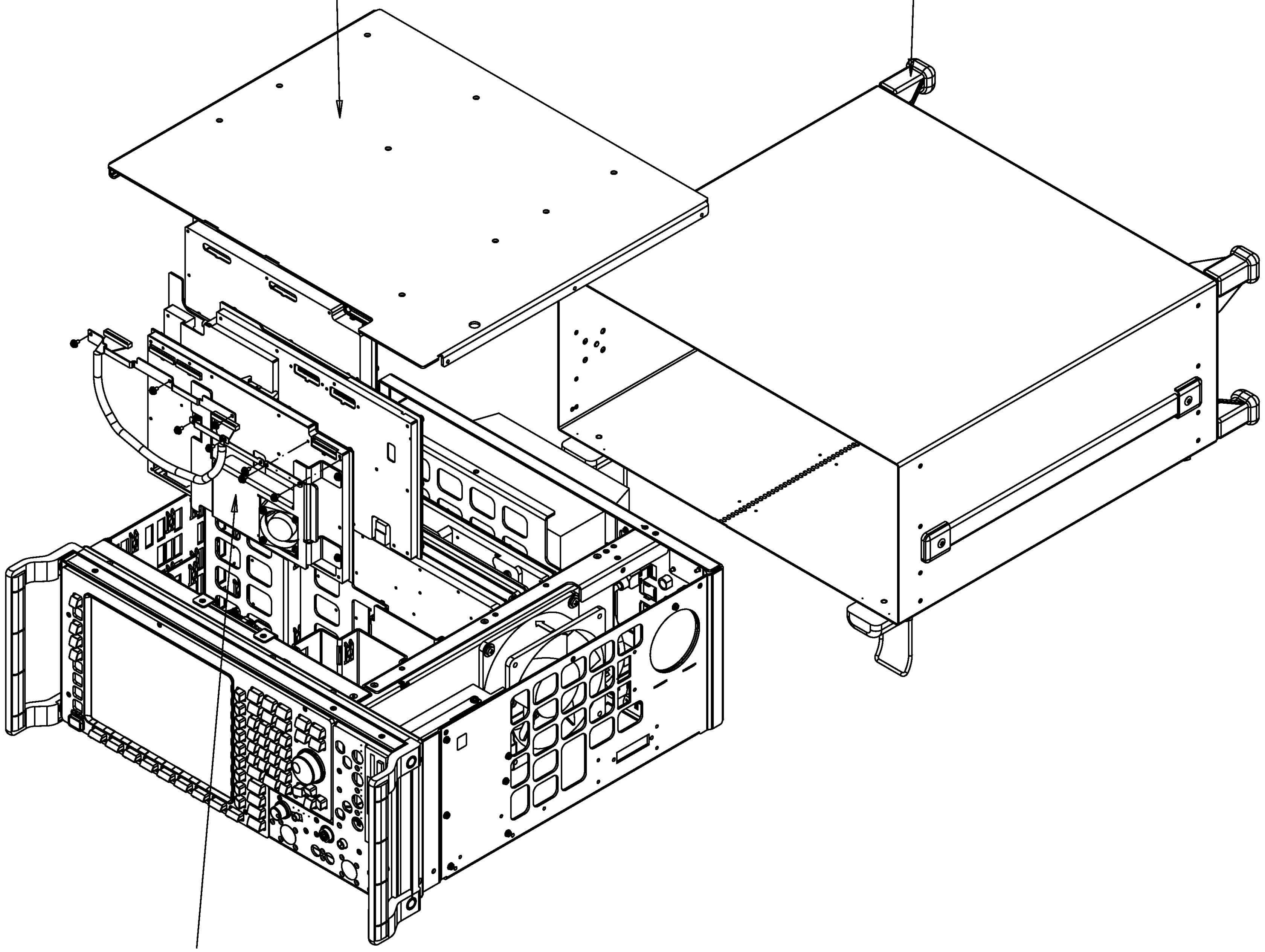
Suppositions:
- FSQ with Wideband Detector Var 05
  or higher
  Rev./Subrev. 04.15 or higher
- Firmware Version 4.05 or higher

Projektions-methode / Projection Method

Maßstab / Scale: 1:4	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: EINBAUANWEISUNG B100/U100 ASSEMBLY INSTRUCTION		Sprache / Lang.: de en	Aei. / C.I.: 04.00	Blatt / Sh.: 1
			Zeichn.Nr. / Drawing No.: 1169.5280.00 D		
FSQ-B100	Datum / Date: 2009-04-03	Abteilung / Dept.: MEEK	Name: mk		

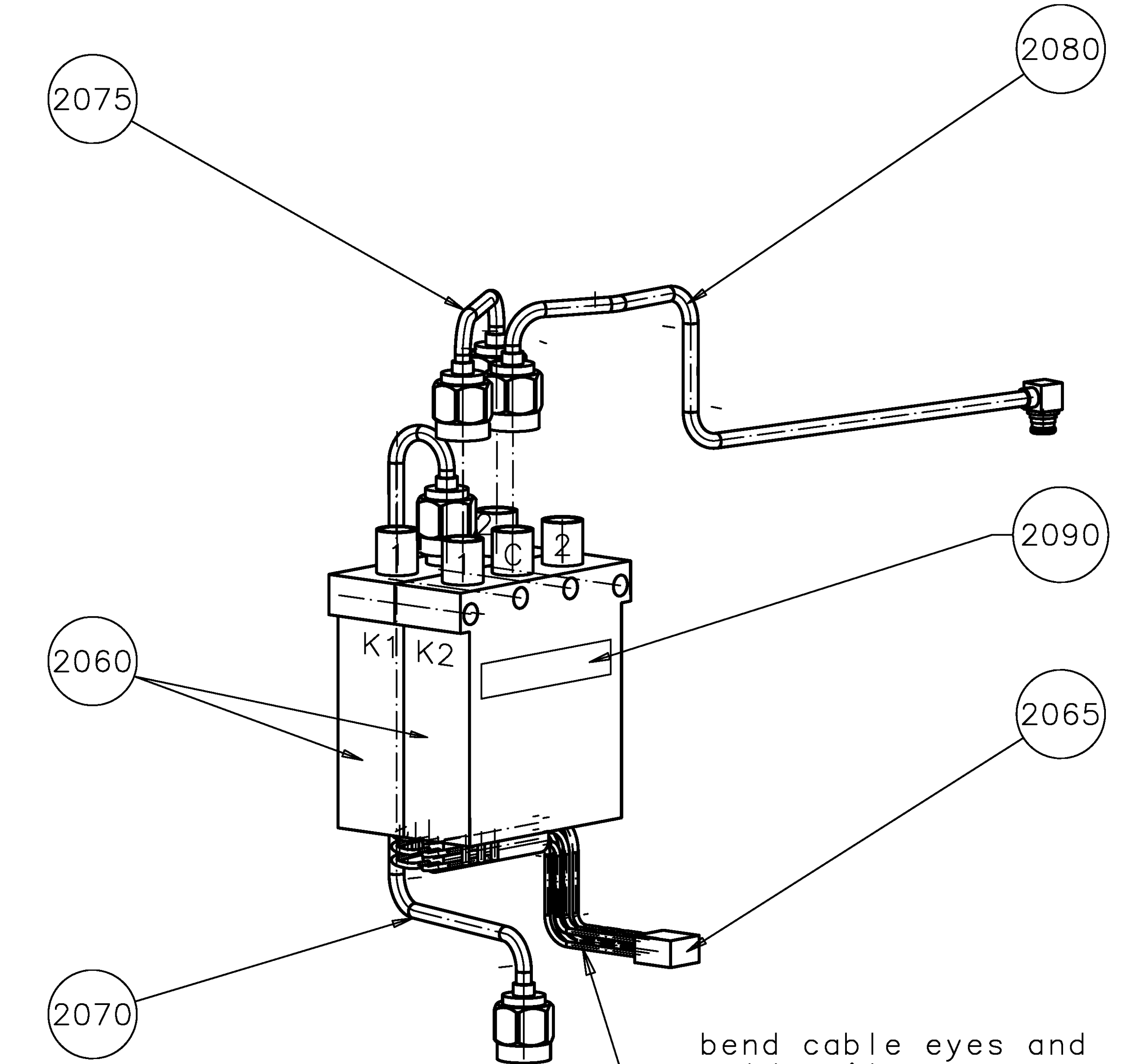
Disassembling of FSQ-B100





Projektions-methode
Projection Method

Maßstab / Scale	Toleranz / Tol.		Werkstoff / Material		Sprache / Lang.	Aei. / C.I.	Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation: EINBAUANWEISUNG B102 ASSEMBLY INSTRUCTION				de en	01.00	1
	Datum / Date: 2006-04-28	Abteilung / Dept.: 1ESK	Name / Name: Mi		Zeichn.Nr. / Drawing No.: 1169.5450.00		D



bend cable eyes and
solder it on

bei Einzeladern Oesen
biegen und anloeten

connection/Anschlussbelegung:

cable/Kabel	relay/Relais	
1 black/sw	K1 C	+12V
2 green/gn	K1 1	Yig enabled
3 blue/bl	K1 2	Yig disabled
4 red/rt	K2 C	+12V
5 yellow/ge	K2 1	Yig disabled
6 white/ws	K2 2	Yig enabled

VARIANTENERKLAERUNG/
VERSIONS:
VAR 02 = FSQ8
MOD 02 = FSQ8

Projektions-methode / *Projection Method*

Maßstab / *Scale*	Toleranz / *Tol.*	Werkstoff / *Material*
1:1		

ROHDE&SCHWARZ

Benennung / *Designation*: Relais Unit 8 GHz

Sprache / *Lang.*: de en — Aei. / *C.I.*: 05.00 — Blatt / *Sh.*: 1

Typ / *Type*: FSQ8

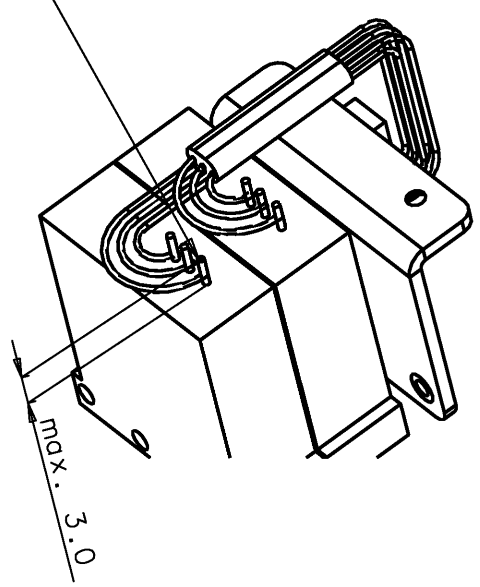
I.Z. / *used in*: 1130.3240.01

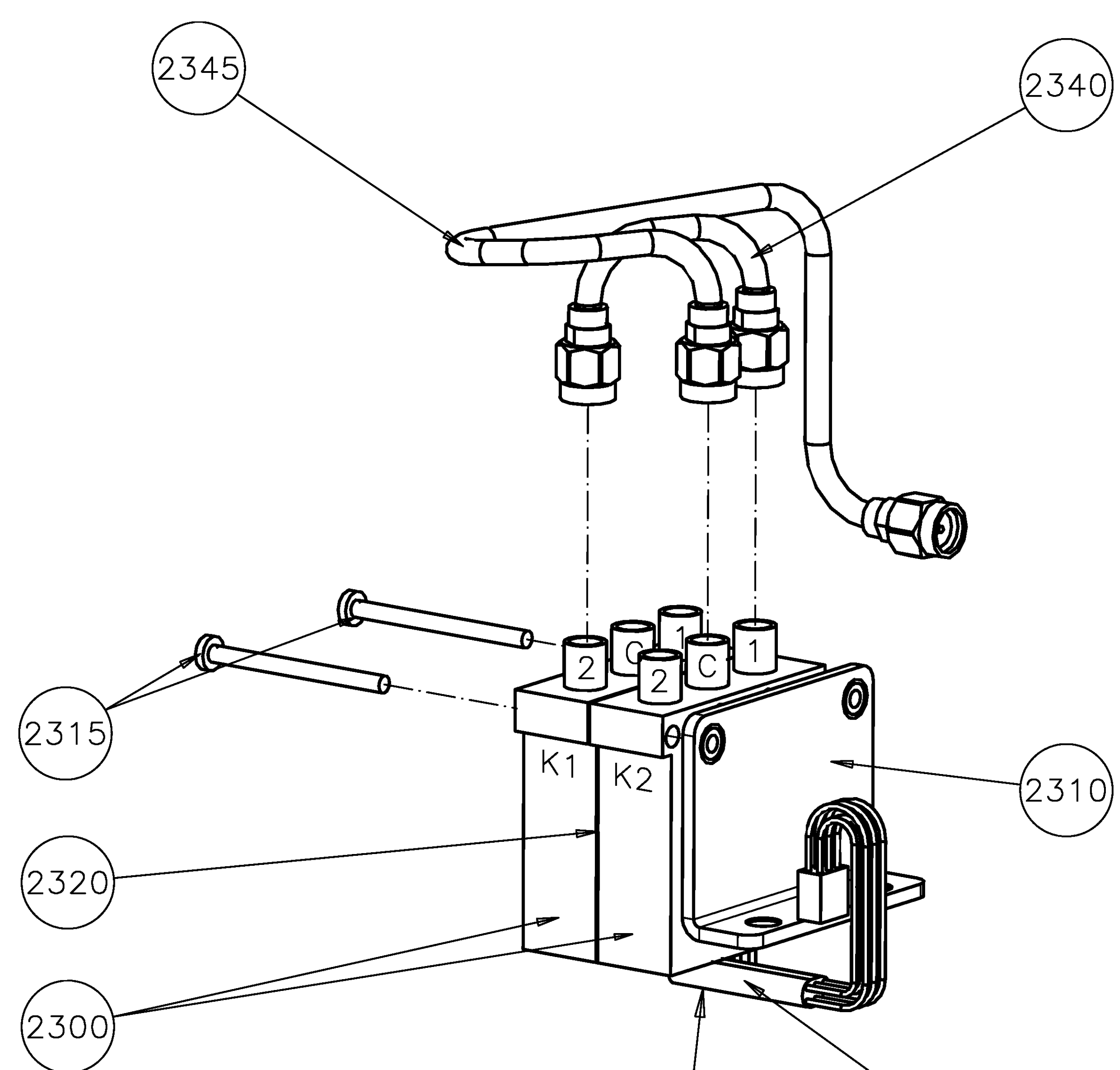
Datum / *Date*: 14.05.2002 — Abteilung / *Dept.*: 1ESK — Name / *Name*: Wn

Zeichn.Nr. / *Drawing No.*: 1130.2815.01 D

I

cut the relay pins (6x)
Relais-Pins kürzen (6x)





connection / Anschlussbelegung:

cable/Kabel	relay/Relais	
1 black/sw	K1 C	+12V
2 green/gn	K1 1	Yig enabled
3 blue/bl	K1 2	Yig disabled
4 red/rt	K2 C	+12V
5 yellow/ge	K2 1	Yig disabled
6 white/ws	K2 2	Yig enabled

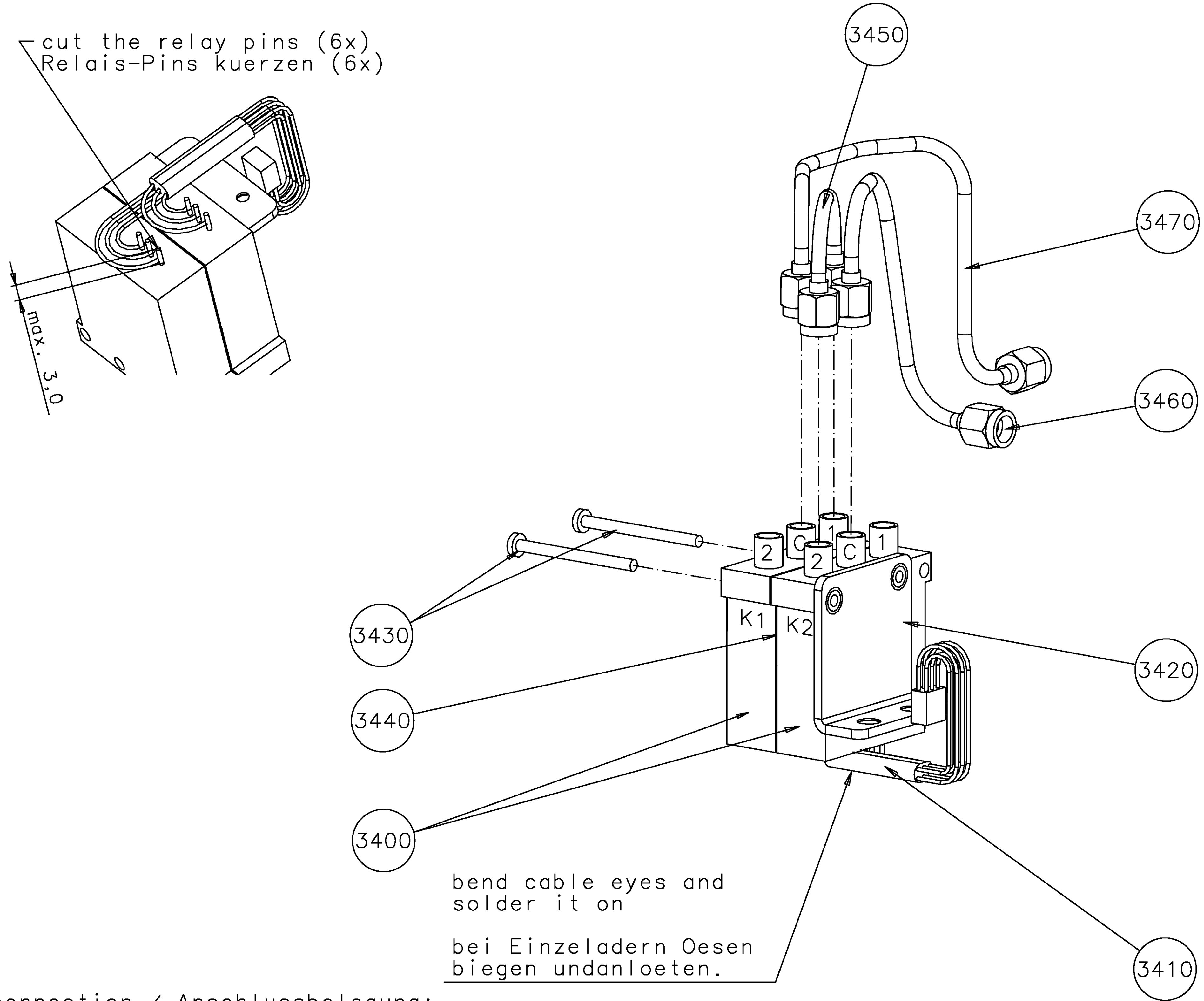
bend cable eyes and
solder it on

bei Einzeladern Oesen
biegen und anloeten.

VARIANTENERKLAERUNG/
VERSIONS:
VAR 02 = FSQ26 / FSQ-B23
MOD 02 = FSQ26 / FSQ-B23

Projektions-methode
Projection Method

Maßstab / Scale: 1:1	Toleranz / Tol.	Werkstoff / Material	
ROHDE&SCHWARZ	Benennung / Designation: Relais Unit 26.5 GHz	Sprache / Lang.: de en	Aei. / C.I.: 06.00 · Blatt / Sh.: 1
Typ / Type: FSQ26		Zeichn.Nr. / Drawing No.: 1130.3405.01 D	
I.Z. / used in: 1130.3240.01	Datum / Date: 18.11.2002 · Abteilung / Dept.: 1ESK · Name / Name: Wn		



connection / Anschlussbelegung:

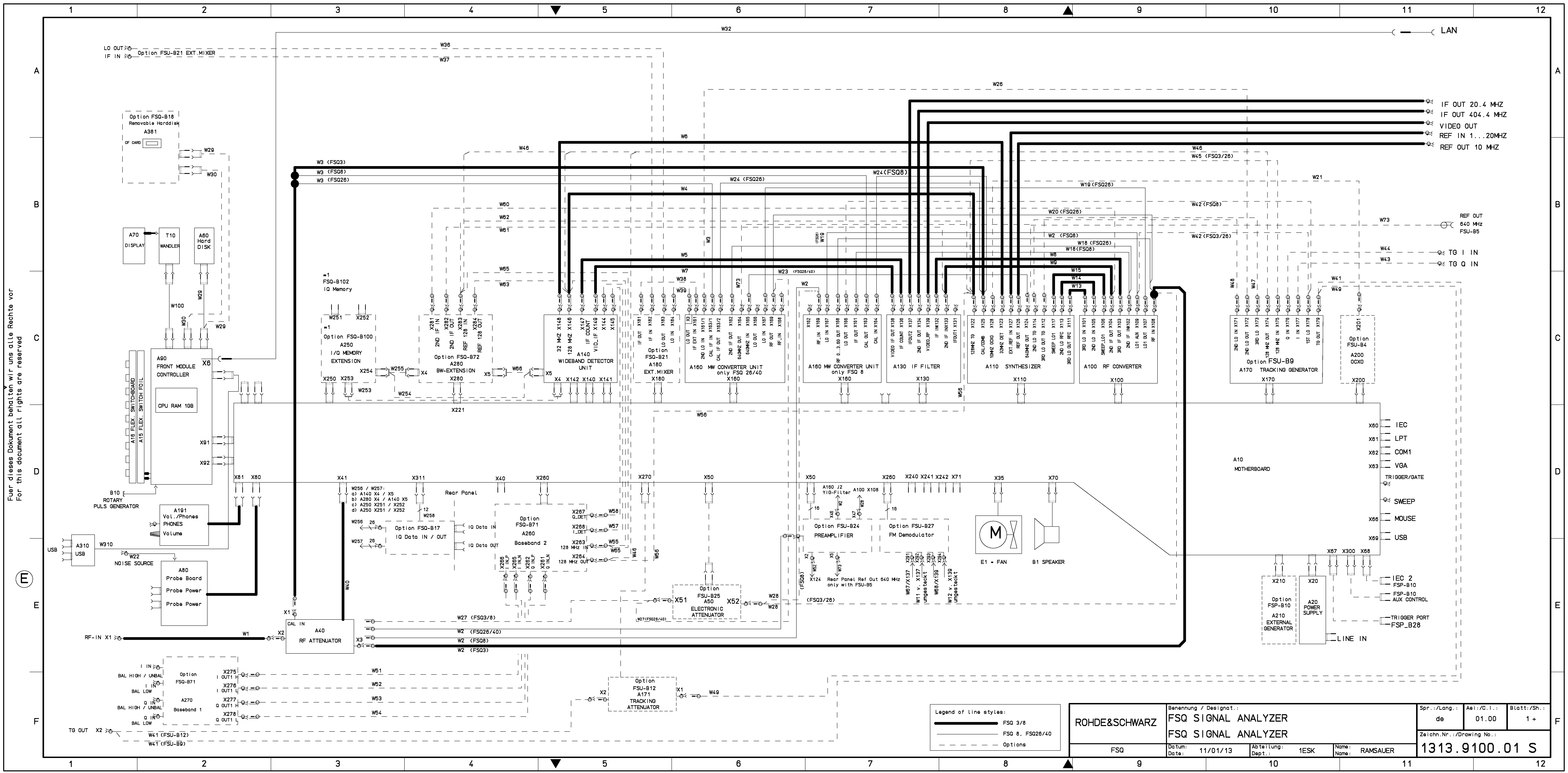
cable/Kabel	relay/Relais
1 black/sw	K1 C ⏚
2 green/gn	K1 2 Yig disabled
3 blue/bl	K1 1 Yig enabled
4 red/rt	K2 C ⏚
5 yellow/ge	K2 2 Yig enabled
6 white/ws	K2 1 Yig disabled

VARIANTENERKLAERUNG/
VERSIONS:
VAR 02 = FSQ40
MOD 02 = FSQ40

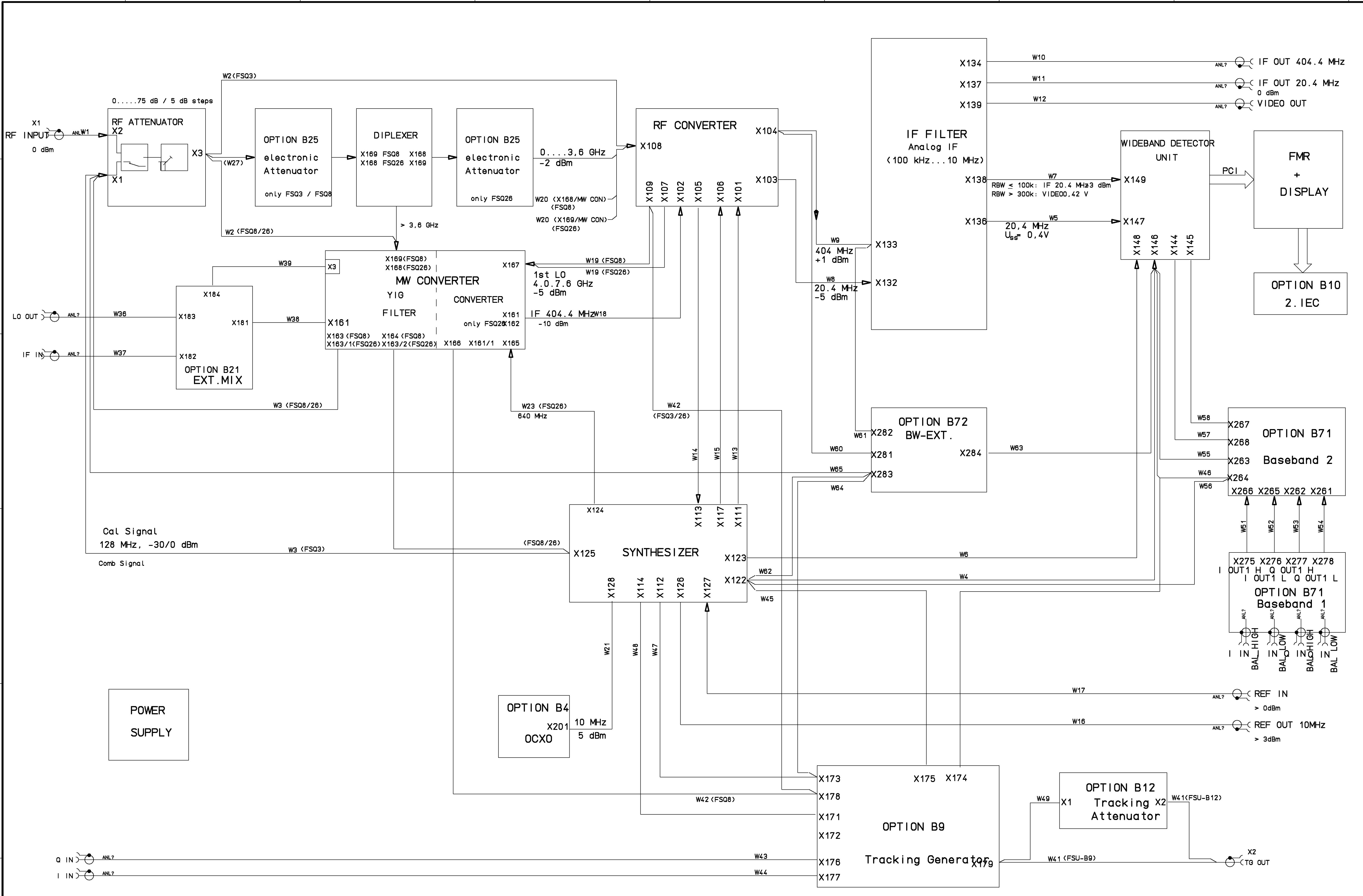
Projektions-methode / Projection Method

Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material	
ROHDE&SCHWARZ	Benennung / Designation: Relais Unit 40 GHz RELAIS UNIT 40 GHZ	Sprache / Lang.: de en	Aei. / C.I.: 03.00 — Blatt / Sh.: 1
	Datum / Date: 13.02.2004 — Abteilung / Dept.: 1ESK	Name / Name: TF	Zeichn.Nr. / Drawing No.: 1155.5147.01 D

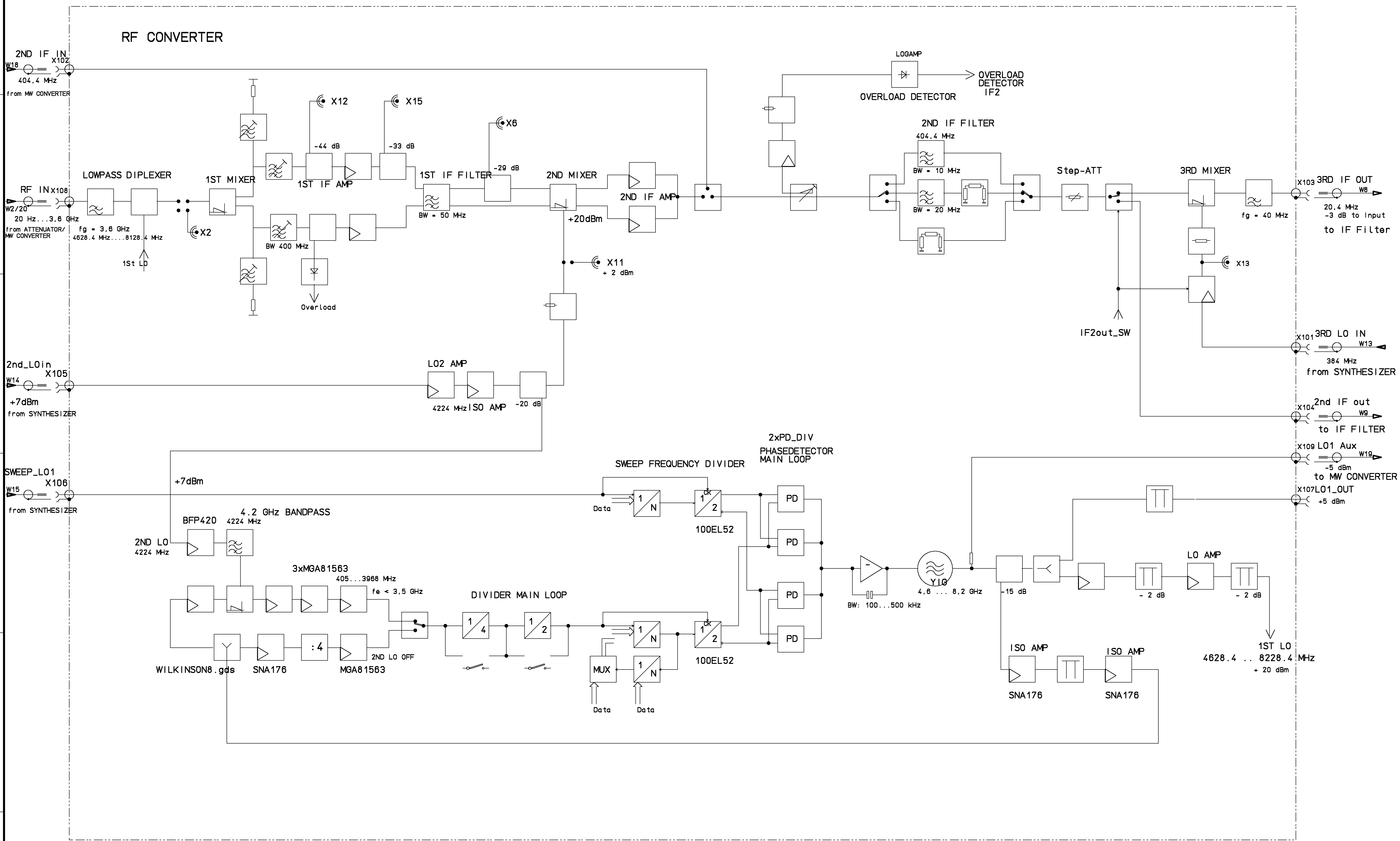
Block Circuit Diagram



LO OUT
IF IN
Option FSU-B21 EXT.MIXER
W32
LAN
W36
W37
W26
IF OUT 20.4 MHZ
IF OUT 404.4 MHZ
VIDEO OUT
REF IN 1...20MHZ
REF OUT 10 MHZ
Option FSQ-B18
Removable Harddisk
A381
CF CARD
W29
W30
W6
W46
W45 (FSQ3/26)
W3 (FSQ3)
W3 (FSQ8)
W3 (FSQ26)
W24(FSQ8)
W24 (FSQ26)
W4
W21
W19 (FSQ26)
W60
W62
W61
W20 (FSQ26)
W42 (FSQ8)
REF OUT
640 MHz
FSU-B5
W73
A70
DISPLAY
T10
WANDLER
A60
Hard
DISK
W2 (FSQ8)
W18 (FSQ26)
W18 (FSQ8)
W42 (FSQ3/26)
W44
TG I IN
W43
TG Q IN
W5
W8
W9
W15
W14
W13
W65
W63
W7
W38
W39
W23 (FSQ26/40)
W2
W41
W49
W48
W47
W100
*1
FSQ-B102
IQ Memory
W251
W252
Option FSQ-B100
A250
I/Q MEMORY
EXTENSION
X254
W255
X4
X250
X253
W253
W254
Option FSQ-B72
A280
BW-EXTENSION
X280
X281 2ND IF IN
X282 2ND IF OUT
X283 REF 128 IN
X284 REF 128 OUT
X5
W66
A140
WIDEBAND DETECTOR
UNIT
X148 32 MHZ
X146 128 MHZ
X147 IF COUNT
X149 VID_IF
X144
X145
X4
X142
X140
X141
Option
FSU-B21
A180
EXT.MIXER
X180
A160 MW CONVERTER UNIT
only FSQ 26/40
X160
A160 MW CONVERTER UNIT
only FSQ 8
X160
A130 IF FILTER
X130
A110 SYNTHESIZER
X110
A100 RF CONVERTER
X100
Option FSU-B9
A170 TRACKING GENERATOR
X170
Option
FSU-B4
A200
OCXO
X201
X200
A90
FRONT MODULE
CONTROLLER
X6
CPU RAM 1GB
X91
X92
A16 FLEX. SWITCHBOARD
A15 FLEX. SWITCH FOIL
X221
W56
W55
A10
MOTHERBOARD
X60 IEC
X61 LPT
X62 COM1
X63 VGA
TRIGGER/GATE
SWEEP
X66 MOUSE
X69 USB
B10
ROTARY
PULS GENERATOR
X81
X80
A191
Vol./Phones
PHONES
Volume
A310
USB
USB
W310
W22
NOISE SOURCE
A80
Probe Board
Probe Power
Probe Power
X41
W256 / W257:
a) A140 X4 / X5
b) A280 X4 / A140 X5
c) A250 X251 / X252
d) A250 X251 / X252
X311
Rear Panel
X40
X260
X270
X50
X50
A160 J2
YIG-Filter
A100 X108
X260
X240
X241
X242
X71
X35
X70
Option FSQ-B17
IQ Data IN / OUT
W258
IQ Data IN
IQ Data OUT
Option
FSQ-B71
A260
Baseband 2
X267 Q_DET
X268 I_DET
X263 128 MHz IN
X264 128 MHz OUT
W58
W57
W55
W65
W46
W56
X266 I IN_P
X265 I IN_N
X262 Q IN_P
X261 Q IN_N
Option FSU-B24
PREAMPLIFIER
Option FSU-B27
FM Demodulator
E1 = FAN
B1 SPEAKER
X124
Rear Panel Ref Out 640 MHz
only with FSU-B5
W67/X137
W11 v. X137 ungesteckt
W68/X139
W12 v. X139 ungesteckt
X67
X300
X68
X210
Option
FSP-B10
A210
EXTERNAL
GENERATOR
X20
A20
POWER
SUPPLY
IEC 2
FSP-B10
FSP-B10
AUX CONTROL
TRIGGER PORT
FSP_B28
LINE IN
W40
X1
CAL IN
A40
RF ATTENUATOR
RF-IN X1
W1
X2
X3
W27 (FSQ3/8)
W2 (FSQ26/40)
W2 (FSQ8)
W2 (FSQ3)
Option
FSU-B25
A50
ELECTRONIC
ATTENUATOR
X51
X52
W28
W27(FSQ26/40)
(FSQ3/26)
(FSQ8)
I IN
BAL HIGH / UNBAL
I IN
BAL LOW
Q IN
BAL HIGH / UNBAL
Q IN
BAL LOW
Option
FSU-B71
A270
Baseband 1
X275 OUT1 H
X276 OUT1 L
X277 Q OUT1 H
X278 Q OUT1 L
W51
W52
W53
W54
Option
FSU-B12
A171
TRACKING
ATTENUATOR
X2
X1
W49
TG OUT X2
W41 (FSU-B12)
W41 (FSU-B9)
Legend of line styles:
FSQ 3/8
FSQ 8, FSQ26/40
Options
ROHDE&SCHWARZ
Benennung / Designat.:
FSQ SIGNAL ANALYZER
FSQ SIGNAL ANALYZER
Spr.:/Lang.: de
Aei:/C.I.: 01.00
Blatt:/Sh.: 1 +
Zeichn.Nr.:/Drawing No.:
1313.9100.01 S
FSQ
Datum: / Date: 11/01/13
Abteilung: / Dept.: 1ESK
Name: / Name: RAMSAUER

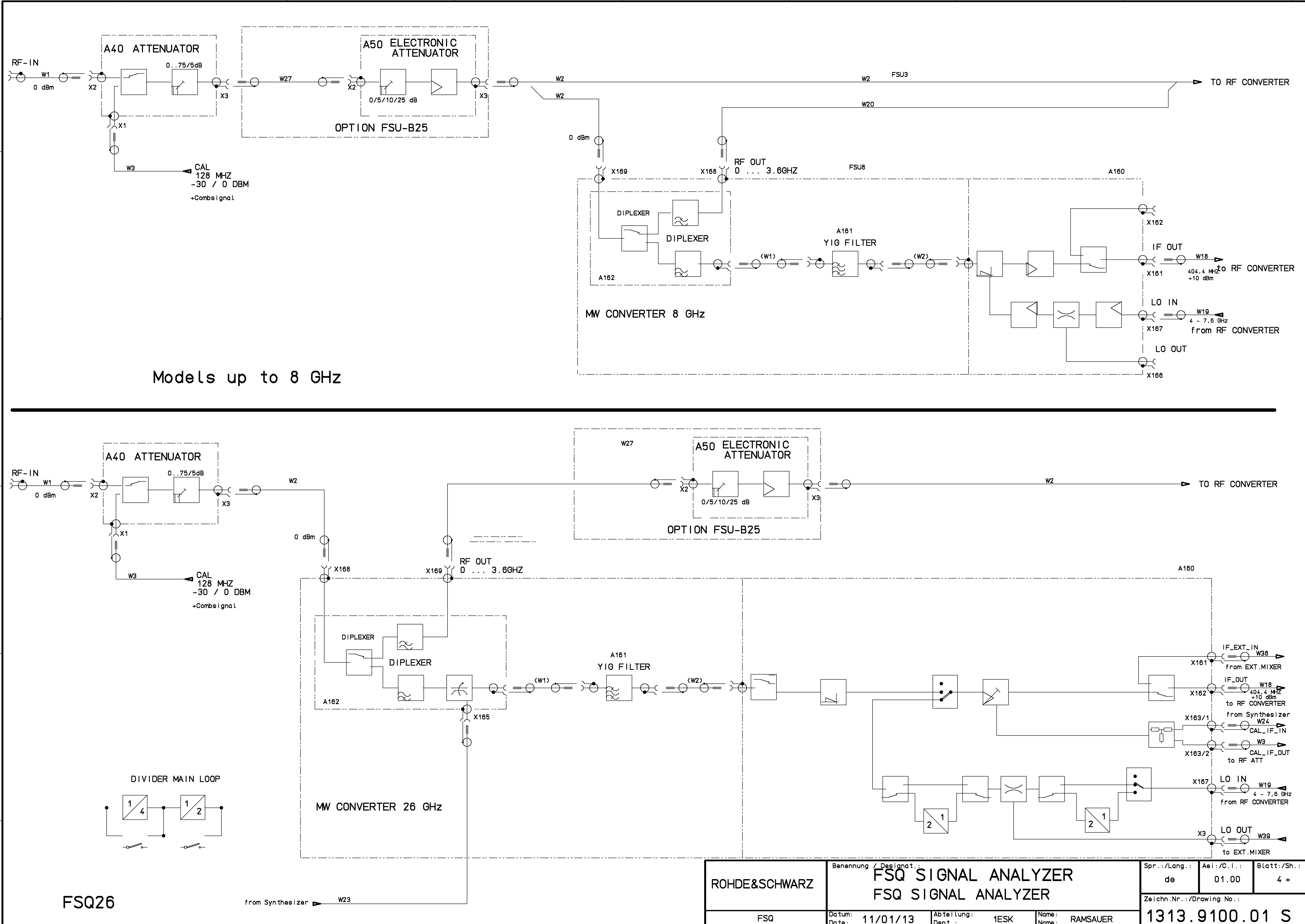


ROHDE&SCHWARZ	Benennung / Designat.: FSQ SIGNAL ANALYZER FSQ SIGNAL ANALYZER			Spr.:/Lang.: de	Aei:/C.I.: 01.00	Blatt:/Sh.: 2 +
FSQ	Datum: / Date: 11/01/13	Abteilung: / Dept.: 1ESK	Name: / Name: RAMSAUER	Zeichn.Nr.:/Drawing No.: 1313.9100.01 S		

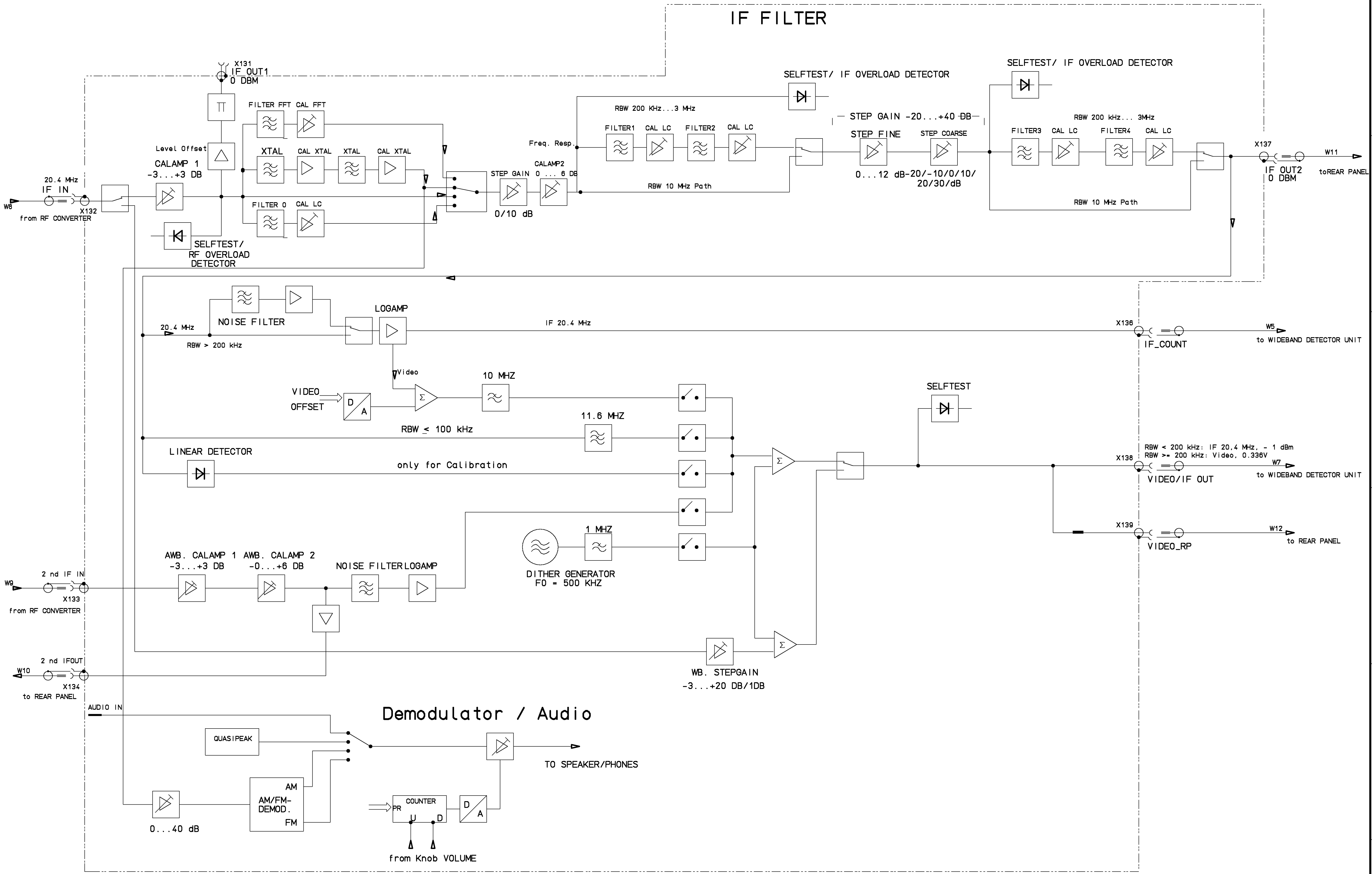


ROHDE&SCHWARZ	Benennung / Designat.: FSQ SIGNAL ANALYZER FSQ SIGNAL ANALYZER			Spr.:/Lang.: de	Aei:/C.I.: 01.00	Blatt:/Sh.: 3 +
FSQ	Datum: Date: 11/01/13	Abteilung: Dept.: 1ESK	Name: Name: RAMSAUER	Zeichn.Nr.:/Drawing No.: 1313.9100.01 S		

E

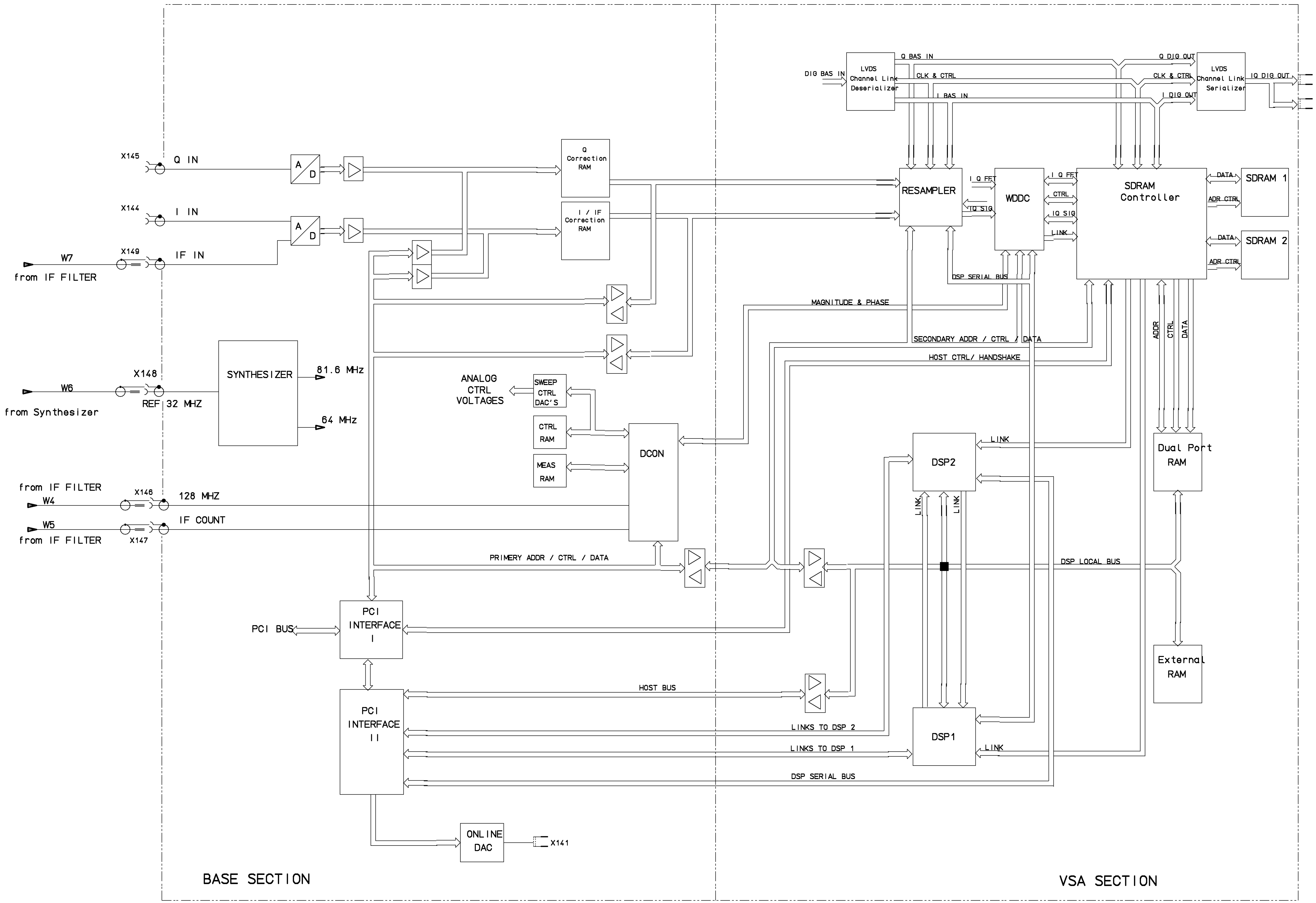


ROHDE&SCHWARZ	Benennung / Designat.: FSQ SIGNAL ANALYZER FSQ SIGNAL ANALYZER			Spr.:/Lang.: de	Aei:/C.I.: 01.00	Blatt:/Sh.: 4 +
				Zeichn.Nr.:/Drawing No.: 1313.9100.01 S		
FSQ	Datum:/Date: 11/01/13	Abteilung:/Dept.: 1ESK	Name:/Name: RAMSAUER			



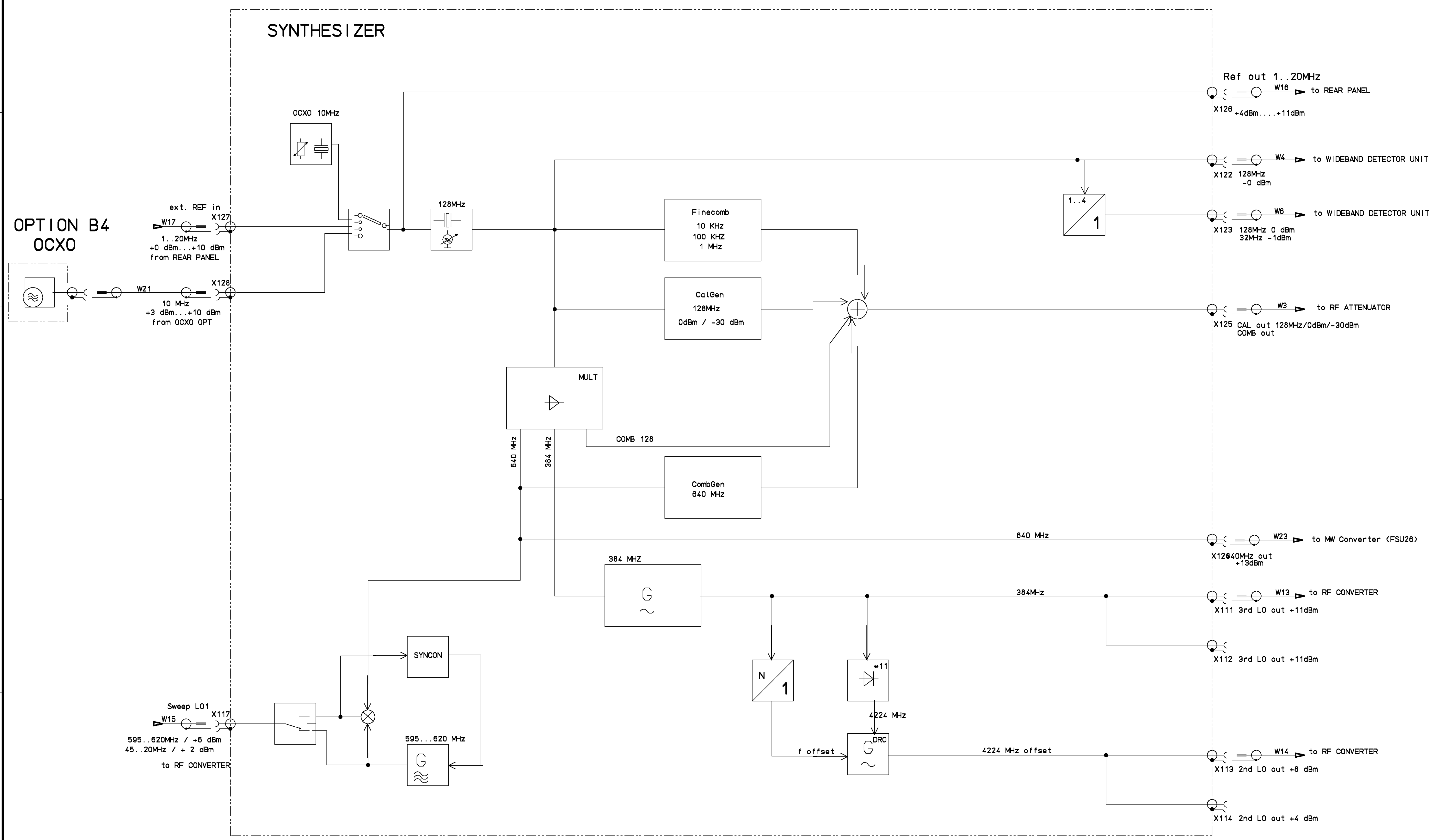
ROHDE&SCHWARZ	Benennung / Designat.: FSQ SIGNAL ANALYZER FSQ SIGNAL ANALYZER			Spr.:/Lang.: de	Aei:/C.I.: 01.00	Blatt:/Sh.: 5 +
FSQ	Datum: Date: 11/01/13	Abteilung: Dept.: 1ESK	Name: Name: RAMSAUER	Zeichn.Nr.:/Drawing No.: 1313.9100.01 S		

DETECTOR

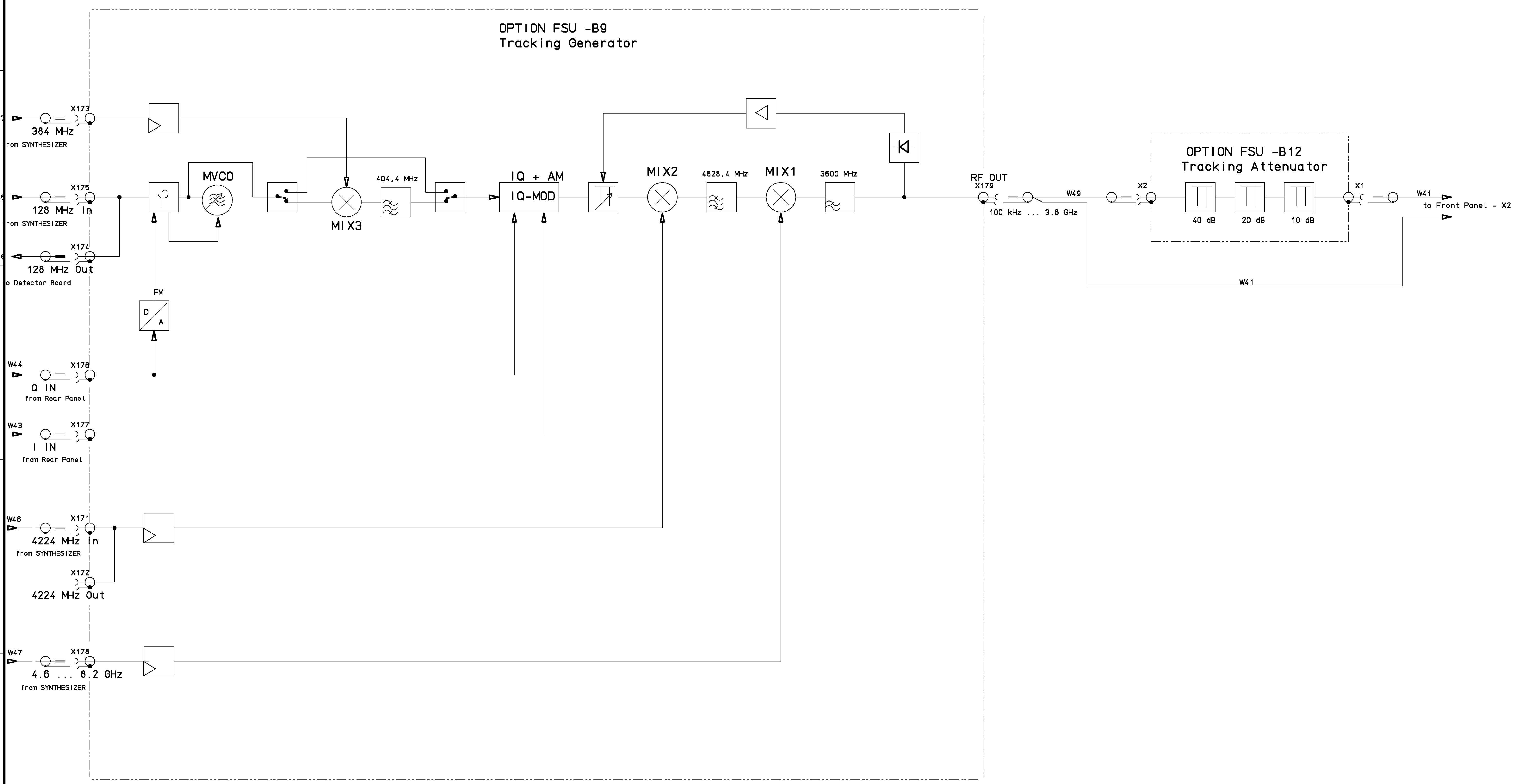


ROHDE&SCHWARZ	Benennung / Designat.: FSQ SIGNAL ANALYZER FSQ SIGNAL ANALYZER			Spr.:/Lang.: de	Aei:/C.I.: 01.00	Blatt:/Sh.: 6 +
FSQ	Datum: Date: 11/01/13	Abteilung: Dept.: 1ESK	Name: Name: RAMSAUER	Zeichn.Nr.:/Drawing No.: 1313.9100.01 S		

E



ROHDE&SCHWARZ	Benennung / Designat.: FSQ SIGNAL ANALYZER FSQ SIGNAL ANALYZER	Spr.:/Lang.: de	Aei:/C.I.: 01.00	Blatt:/Sh.: 7 +
FSQ	Datum:/Date: 11/01/13 · Abteilung:/Dept.: 1ESK · Name:/Name: RAMSAUER	Zeichn.Nr.:/Drawing No.: 1313.9100.01 S		



ROHDE&SCHWARZ	Benennung / Designat.: FSQ SIGNAL ANALYZER FSQ SIGNAL ANALYZER			Spr.:/Lang.: de	Aei:/C.I.: 01.00	Blatt:/Sh.: 8 -
FSQ	Datum: / Date: 11/01/13	Abteilung: / Dept.: 1ESK	Name: / Name: RAMSAUER	Zeichn.Nr.:/Drawing No.: 1313.9100.01 S		