



**ROHDE & SCHWARZ**

Test and Measurement  
Division

## **Service Manual Instrument**

# **SIGNAL ANALYZER**

**FSIQ3**

1119.5005.13

**FSIQ7**

1119.5005.17

**FSIQ26**

1119.6001.27

**FSIQ40**

1119.6001.40

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Republic of Germany



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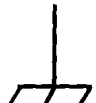






## Safety Instructions

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

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

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

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

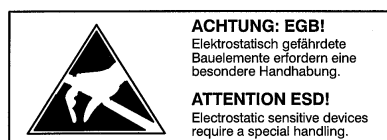
1. The unit may be used only in the operating conditions and positions specified by the manufacturer. Unless otherwise agreed, the following applies to R&S products:  
IP degree of protection 2X, Pollution severity 2, overvoltage category 2, altitude max. 2000 m.  
The unit may be operated only from supply networks fused with max. 16 A.
2. For measurements in circuits with voltages  $V_{rms} > 30 V$ , suitable measures should be taken to avoid any hazards.  
(using, for example, appropriate measuring equipment, fusing, current limiting, electrical separation, insulation).
3. If the unit is to be permanently wired, the PE terminal of the unit must first be connected to the PE conductor on site before any other connections are made. Installation and cabling of the unit to be performed only by qualified technical personnel.
4. For permanently installed units without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused such as to provide suitable protection for the users and equipment.
5. Prior to switching on the unit, it must be ensured that the nominal voltage set on the unit matches the nominal voltage of the AC supply network.  
If a different voltage is to be set, the power fuse of the unit may have to be changed accordingly.
6. Units of protection class I with disconnectible AC supply cable and appliance connector may be operated only from a power socket with earthing contact and with the PE conductor connected.
7. It is not permissible to interrupt the PE conductor intentionally, neither in the incoming cable nor on the unit itself as this may cause the unit to become electrically hazardous.  
Any extension lines or multiple socket outlets used must be checked for compliance with relevant safety standards at regular intervals.
8. If the unit has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device. In such cases it must be ensured that the power plug is easily reachable and accessible at all times (length of connecting cable approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply.  
If units without power switches are integrated in racks or systems, a disconnecting device must be provided at system level.
9. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.  
Prior to performing any work on the unit or opening the unit, the latter must be disconnected from the supply network.  
Any adjustments, replacements of parts, maintenance or repair may be carried out only by authorized R&S technical personnel.  
Only original parts may be used for replacing parts relevant to safety (eg power switches, power transformers, fuses). A safety test must be performed after each replacement of parts relevant to safety.  
(visual inspection, PE conductor test, insulation-resistance, leakage-current measurement, functional test).

continued overleaf

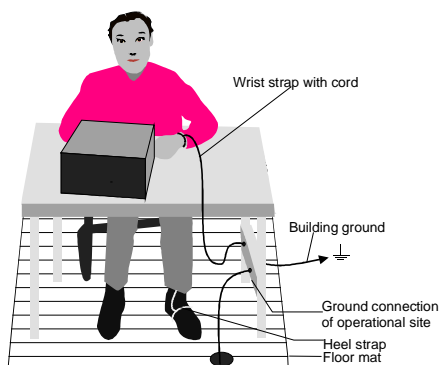
## Safety Instructions

10. Ensure that the connections with information technology equipment comply with IEC950 / EN60950.
11. Lithium batteries must not be exposed to high temperatures or fire.  
Keep batteries away from children.  
If the battery is replaced improperly, there is danger of explosion. Only replace the battery by R&S type (see spare part list).  
Lithium batteries are suitable for environmentally-friendly disposal or specialized recycling. Dispose them into appropriate containers, only.  
Do not short-circuit the battery.
12. Equipment returned or sent in for repair must be packed in the original packing or in packing with electrostatic and mechanical protection.
13. Electrostatics via the connectors may damage the equipment. For the safe handling and operation of the equipment, appropriate measures against electrostatics should be implemented.
14. Any additional safety instructions given in this manual are also to be observed.

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



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



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

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

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

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



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# Spare Parts Express Service

**Phone:** +49 89 4129 - 2465

**Fax:** +49 89 41 29 - 3306

**E-mail:** [werner.breidling@rsd.rsd.de](mailto:werner.breidling@rsd.rsd.de)

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

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



## Contents of Manuals for Signal Analyzer FSIQ

### Service Manual - Instrument

The service manual - instrument informs on how to check compliance with rated specifications (performance test), on instrument function, and on selftest of FSIQ.

The service manual comprises the following chapters:

- Chapter 1** provides all the information necessary to check FSIQ for compliance with rated specifications. The required test equipment is included, too.
- Chapter 2** describes the adjustment.
- Chapter 3** describes the function of the instruments and the selftest.
- Chapter 4** contains information on the extension and modification of FSIQ by installing instrument software and retrofitting options.
- Chapter 5** describes the shipping of the instrument and ordering of spare parts. It contains the documents for the basic instrument.

### Service Manual

The service manual modules is not delivered with the instrument but may be obtained from your R&S service department using the order number 1065.6016.24.

The service manual informs on instrument function, repair, troubleshooting and fault elimination. It contains all information required for repairing the FSIQ by the replacement of modules.

The service manual contains information about the individual modules of FSIQ. This comprises the test and adjustment of the modules, fault detection within the modules and the interface description.

### Operating Manual

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

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

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

## **Service and Repair**

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

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

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

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

Rohde & Schwarz offers the following calibrations:

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

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

# Contents - Chapter 1 "Performance Test"

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# 1 Checking the Rated Specifications

- Disconnect the instrument from the mains before opening the casing.
  - Check the AC voltage selection setting of before switching on the instrument (230 V!).
  - The rated specifications of the analyzer are tested after a warm-up time of at least 30 minutes and overall calibration. Only in this case can the compliance with the guaranteed data be ensured.
  - Values given in the following sections are not guaranteed. Only the technical specifications of the data sheet are binding.
  - Unless specified otherwise all settings are made after a PRESET.
  - Conventions for setting the FSIQ during measurements:
    - [<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 [SPAN: 15 kHz]

## Measuring Equipment and Accessories

Table 1-1 Measuring Equipment and Accessories

	Type of equipment	Specifications recommended	Equipment recommended	R&S Order No.	Use
1	Frequency counter	error < 1x10 <sup>-9</sup> , frequency range up to 10 MHz	Advantest R5361B with option 23		1.5
2	Signal generator	FSIQ3: 10 MHz to 3,5 GHz FSIQ7: 10 MHz to 7 GHz FSIQ26: 10 MHz to 26,5 GHz FSIQ40: 10 MHz to 40 GHz	SMHU SMP02 SMP03 SMP04	0835.8011.58 1035.5005.02 1035.5005.03 1035.5005.04	1.5 1.8 1.10 1.18 1.30 1.31
3	Signal generator with I/Q modulation 9 kHz to 1.9 GHz	<-100 dBc/Hz at 100 Hz <-115 dBc/Hz at 1 kHz <-127 dBc/Hz at 10 kHz <-130 dBc/Hz at 100 kHz <-142 dBc/Hz at 1 MHz  < -123 dBc/Hz at 10 kHz < -123 dBc/Hz at 100 kHz < -140 dBc/Hz at 1 MHz EVM < 0.5 % after calibration	SMHU58	0835.8011.58	1.4 1.10 1.12 1.14 1.18 1.20 1.21 1.22 1.24 1.32 1.36
4	3-dB coupler (power combiner)	decoupling > 12 dB FSIQ3: 10 MHz to 3,5 GHz FSIQ7: 10 MHz to 7 GHz FSIQ26: 10 MHz to 26,5 GHz FSIQ40: 10 MHz to 40 GHz			1.10

	Type of equipment	Specifications recommended	Equipment recommended	R&S Order No.	Use
5	6-dB divider (power splitter)	level imbalance 10 MHz to 2.2 GHz $\leq$ 0.10 dB 2.2 GHz to 7 GHz $\leq$ 0.2 dB 7 GHz to 18 GHz $\leq$ 0.3 dB 18 GHz to 26.5 GHz $\leq$ 0.4 dB 26,5 GHz to 40 GHz $\leq$ 0.4 dB  FSIQ3: 10 MHz to 3,5 GHz FSIQ7: 10 MHz to 7 GHz FSIQ26: 10 MHz to 26,5 GHz FSIQ40: 10 MHz to 40 GHz			1.18
6	50-Ω termination	Return loss > 20 dB FSIQ3: up to 3,5 GHz FSIQ7: up to 7 GHz FSIQ26: up to 26,5 GHz FSIQ40: up to 40 GHz	RNA RNA Wiltron 28S50 Wiltron 28K50	0272.4510.50 0272.4510.50	1.17
7	Power meter	100 kHz to 26.5 GHz, error < 0.1 dB	NRVD with sensors NRV-Z7 (FSIQ3/B) NRV-Z6 (FSIQ26/40)	0857.8008.02 0828.5210.22 0828.5010.02	1.4 1.5 1.18 1.28 1.30
8	Power sensor (FSIQ3 / FSIQ7 / FSIQ26 / FSIQ40 / FSE-B21)	1 MHz to 3.5 GHz RSS $\leq$ 0.8% Meter noise $\leq$ 20 pW	NRV-Z4 or NRV-Z51	0828.3618.02/ 0857.9004.02	1.4 1.5 1.18
9	Second Power sensor (FSIQ7 / FSIQ26 / FSIQ40 / FSE-B21)	RSS referred to indicated Power: 3.5 GHz to 7 GHz $\leq$ 2 % 7 GHz to 26.5 GHz $\leq$ 3.5 % 26.5 GHz to 40 GHz $\leq$ 4 %  FSIQ7: 10 MHz to 7 GHz FSIQ26: 50 MHz up to 26,5 GHz FSIQ40: 50 MHz up to 40 GHz  FSIQ-B21: 7.5 GHz to 15.2 GHz maximum power > 40 mW RSS referred to indicated power $\leq$ 2.5 %	NRV-Z2 NRV-Z6 NRV-Z55	0828.3218.02 0828.5010.02 1081.2005.02	1.5 1.18 1.37
10	Reflection coefficient VSWR bridge (FSIQ3 / FSIQ7)	directivity > 30 dB FSIQ3 / FSIQ7 10 MHz to 3.5 GHz FSIQ7: 3.5 GHz to 7 GHz	ZRC  Wiltron 87A50 (also required: adapter 34AN50, open/short 22NF50)	1039.9492.55	1.5
11	Network analyzer (FSIQ26 / FSIQ40)	FSIQ26: 10 MHz to 26,5 GHz FSIQ40: 10 MHz to 40 GHz			1.5
12	Step attenuator	variable attenuation 0 dB to 100 dB, 1-dB steps attenuation error < 0.05 dB (f = 5 MHz)	RSP	0831.3515.02	1.20 1.21 1.22



	Type of equipment	Specifications recommended	Equipment recommended	R&S Order No.	Use
13	Attenuator (2 x)	fixed attenuation 10 dB FSIQ3: 10 MHz to 3,5 GHz FSIQ7: 10 MHz up to 7 GHz FSIQ26: 10 MHz up to 26,5 GHz FSIQ40: 10 MHz to 40 GHz  FSIQ-B21: fixed attenuation 3 dB	DNF DNF Wiltron 43KB-10 Wiltron 43KC-10	0272.4210.50 0272.4210.50	1.10 1.28
14	Lowpass <sup>1)</sup>	cut-off frequency: 10 kHz, 40 kHz, 100 kHz, 20 MHz, 29 MHz, 108 MHz, 263 MHz, 454 MHz, 641 MHz, 1.1 GHz, 1.3 GHz, 1.8 GHz			1.12
15	N-connecting cables Tracking RF input	Attenuation up to 7 GHz < 0.1dB			1.26 1.26
16	2 DC sources for I and Q	can be set between $\pm 0.5V$	NGT35	0191.2019.02	1.27
17	2 DC voltmeters		URE	0350.5315.02	1.27
18	Arbitrary waveform generator	Sampling rate $\geq 40$ MHz, can be calibrated	ADS (64-k memory) + ADS-B1	1012.4002.02 1013.5748.92	1.32 1.36
19	Control software for ADS		IQSIM V4.0 or higher		1.32 1.36
20	Attenuators, 3 dB (BNC, 2 required)		--		1.32
21	Arbitrary Waveform Generator	Sampling Rate $\geq 40$ MHz, can be calibrated	AMIQ	1110.2003.02	1.32
22	Control software for AMIQ		WinIQSIM	1119.5192.00	1.32
23	Test files		FSIQ Test Data		

1) The lowpass filters improve the harmonics suppression of the test signal. If the harmonics suppression at the signal generator output is already large enough, no filters are required for the frequency ranges concerned (see section 5.2.5.2 for harmonics suppression required).

## Test Instructions

### Checking the Calibration Source at 120 MHz

- Test equipment:
- signal generator (table 1-1, item 3):
    - frequency      120 MHz
    - level           -40 dBm
  - power meter (table 1-1, item 7)
  - power sensor (table 1-1, item 8)
    - frequency      120 MHz
    - maximum power    $P_{max} \geq 1 \mu W$
    - meter noise       $\leq 20 \text{ pW}$
    - RSS  $\leq 0.8\%$  referred to indicated power
    - impedance  $Z = 50 \Omega$
- 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      120 MHz
  - level           -40 dBm  $\pm 0.1 \text{ dB}$
- Use power meter for exact level adjustment.
- Test setup:
- connect RF output of the signal generator to RF input of the FSIQ
- FSIQ settings:
- [ **SYSTEM PRESET** ]
  - [ **FREQUENCY CENTER : 120 MHz** ]
  - [ **FREQUENCY SPAN : 15 kHz** ]
  - [ **SWEEP COUPLING : RES BW MANUAL : 5 kHz** ]
  - [ **LEVEL REF : REF LEVEL : -10 dBm** ]
  - [ **INPUT : RF ATTEN MANUAL : 20 dB** ]
  - set marker to peak of signal  
[ **MARKER SEARCH : PEAK** ]
  - set reference to peak of signal  
[ **MARKER DELTA : REFERENCE FIXED** ]
  - switch internal reference generator to RF input  
[ **CONFIGURATION SETUP : SERVICE : INPUT CAL** ]
  - set marker to peak of signal  
[ **MARKER SEARCH : PEAK** ]
- Evaluation:
- The reading 'Delta 1 [T1 FXD]' displays the difference between the output level of the signal generator and the level of the calibration source.
- 'Delta 1 [T1 FXD]' .....<0,2 dB
- Note:**                                    *The level of the calibration source can be adjusted with R22 on FracSyn module.*

## Checking the Frequency Accuracy of the Reference Oscillator

- Test equipment: frequency counter (table 1-1, item 1):  
error <  $1 \times 10^{-9}$   
frequency range up to 10 MHz
- Test setup: - connect frequency counter to 10-MHz reference output of the FSIQ (rear panel)
- FSIQ settings: - [ **CONFIGURATION SETUP** : REFERENCE INT / EXT ]  
toggle to internal reference (INT)
- Measurement: ➤ measure frequency with frequency counter  
nominal frequency .....10 MHz  $\pm$  1 Hz

## Checking the Return Loss at the RF Input

- Test equipment: FSIQ3 / FSIQ7:
- signal generator (table 1-1, item 2)
 

frequency range	FSIQ3:	10 MHz to 3.5 GHz
	FSIQ7:	10 MHz to 7 GHz
  - maximum level  $\geq$  0 dBm
  - power meter (table 1-1, item 7)
  - power sensor (table 1-1; FSIQ3: item 8; FSIQ7: item 9)
 

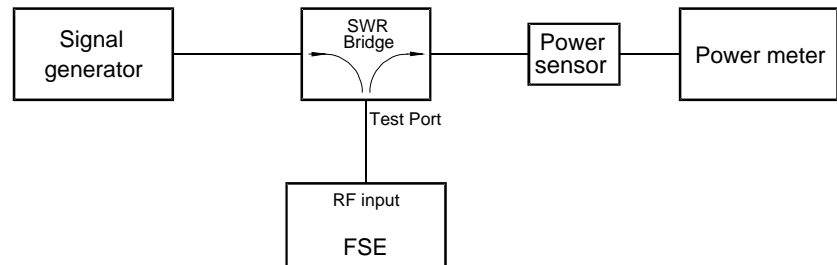
frequency range	FSIQ3:	10 MHz to 3.5 GHz
	FSIQ7:	10 MHz to 7 GHz
  - reflection coefficient bridge (table 1-1, item 10)
 

frequency range	FSIQ3:	10 MHz to 3.5 GHz
	FSIQ7:	10 MHz to 7 GHz
  - directivity  $\geq$  30 dB
- FSIQ26 / FSIQ40::
- network analyzer (table 1-1, item 11)
 

frequency range	FSIQ3:	10 MHz to 26.5 GHz
	FSIQ7:	26.5 MHz to 40 GHz

Test setup:

FSIQ3 / FSIQ7:



FSIQ26 / FSIQ40:

Connect port 1 of network analyzer to RF input of the FSIQ.

Signal generator settings:  
(FSIQ3 / FSIQ7)

- level            0 dBm
- frequency      { $f_{in}$ }

See table 1-2 (item 3) of performance test report for values of  $f_{in}$ .

FSIQ settings:

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

Calibration:

FSIQ3 / FSIQ7:

Use total reflection (OPEN or SHORT) at the test port of the SWR bridge as a reference:

Remove cable from RF input of the FSIQ 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.

FSIQ26 / FSIQ40:

See operating manual of the network analyzer for detailed information about calibration for  $S_{11}$  measurement.

## Measurement

## FSIQ3 / FSIQ7:

- Connect the RF input of the FSIQ 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 FSIQ can be calculated as

$$a_r = L_{\text{Ref}} - L_r .$$

The SWR can be calculated as

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

## FSIQ26 / FSIQ40:

- Determine  $S_{11}$  of the FSIQ at the frequencies shown in table 1-2 (item 3) of performance test report. See operating manual of the network analyzer for detailed information about  $S_{11}$  measurement.

$a_r$ / dB	s
6	3.0
7.4	2.5
8	2.3
9.5	2.0
10	1.9
12	1.7
14	1.5
16	1.4
18	1.3
20	1.2

## Checking Immunity to Interference

- Test equipment: signal generator (table 1-1, item 2):  
 frequency range FSIQ3: 10 MHz to 3.5 GHz  
 FSIQ7: 10 MHz to 7 GHz  
 FSIQ26/FSIQ40: 10 MHz to 8 GHz  
 maximum level  $\geq -10$  dBm
- Test setup: ➤ connect RF output of the signal generator to RF input of the FSIQ.
- Signal generator settings: level  $-10$  dBm  $\pm$  0.5 dB
- FSIQ settings:  
 - [ **SYSTEM PRESET** ]  
 - [ **INPUT** : RF ATTEN MANUAL : **0 dB** ]  
 - [ **LEVEL REF** : REF LEVEL : **-30 dBm** ]  
 - [ **FREQUENCY SPAN** : **100 kHz** ]  
 - [ **SWEEP COUPLING** : RES BW MANUAL : **2 kHz** ]

### 1<sup>st</sup> IF Image Frequency Rejection

- Additional signal generator settings:
- |                 |  |
|-----------------|--|
| - frequency     | $f_{in} + 2 \times 1st\ IF$                |
| FSIQ3           | $f_{in} + 8682.8\ MHz$                     |
| FSIQ7           | $f_{in} + 15.8828\ GHz$                    |
| FSIQ26 / FSIQ40 | $f_{in} + 15.8828\ GHz\ (f_{in} < 7\ GHz)$ |

See table 1-2 (item 4) of performance test report for values of  $f_{in}$

- Additional FSIQ settings:  
 - [ **FREQUENCY CENTER** :  $\{f_{in}\}$  ]  
 See table 1-2 (item 4) of performance test report for values of  $f_{in}$
- set marker to peak of signal  
 [ **MARKER SEARCH** : **PEAK** ]

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

$$\text{Image frequency rejection} = -10\text{dBm} - L_{dis}$$

See table 1-2 (item 4) of performance test report for limits of image frequency rejection.

## 2<sup>nd</sup> IF Image Frequency Rejection

Additional signal generator settings: - frequency  $f_{in} + 2 \times 2nd\ IF$   
 $f_{in} + 1482.8\ MHz$   
 See table 1-2 (item 5) of performance test report for values of  $f_{in}$ .

Additional FSIQ settings: - [ **FREQUENCY CENTER** : { $f_{in}$ } ]  
 See table 1-2 (item 5) of performance test report for values of  $f_{in}$ .

➤ set marker to peak of signal  
 [ **MARKER SEARCH** : PEAK ]

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

$$\text{Image frequency rejection} = -10\text{dBm} - L_{dis}$$

See table 1-2 (item 5) of performance test report for limits of image frequency rejection.

## 1<sup>st</sup> IF Rejection

Additional signal generator settings: - frequency = 1st IF  
 FSIQ3 4341.4 MHz  
 FSIQ7 7941.4 MHz  
 FSIQ26 / FSIQ40 7941.4 MHz ( $f_{in} < 7\ GHz$ )  
 741.4 MHz ( $f_{in} \geq 7\ GHz$ )

Additional FSIQ settings: - [ **FREQUENCY CENTER** : { $f_{in}$ } ]  
 See table 1-2 (item 6) of performance test report for values of  $f_{in}$ .

➤ set marker to peak of signal  
 [ **MARKER SEARCH** : PEAK ]

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

$$\text{IF rejection} = -10\text{dBm} - L_{dis}$$

See table 1-2 (item 6) of performance test report for limits of image frequency rejection.

## Checking Non-linearities

### Third-Order Intercept

- Test equipment:
- 2 signal generators FSIQ3: table 1-1, item 2 and 3;  
FSIQ7/26/40: table 1-1, 2 x item 2  
frequency range  
FSIQ3: 10 MHz to 3.5 GHz  
FSIQ7: 10 MHz to 7 GHz  
FSIQ26: 10 MHz to 26.5 GHz  
FSIQ40: 10 MHz to 40 GHz  
maximum level  $\geq 0$  dBm
  - 2 attenuators (table 1-1, item 13)  
attenuation  $a_{ATT} = 10$  dB  
frequency range  
FSIQ3: 10 MHz to 3.5 GHz  
FSIQ7: 10 MHz to 7 GHz  
FSIQ26: 10 MHz to 26.5 GHz  
FSIQ40: 10 MHz to 40 GHz
  - 3-dB coupler (table 1-1, item 4)  
frequency range  
FSIQ3: 10 MHz to 3.5 GHz  
FSIQ7: 10 MHz to 7 GHz  
FSIQ26: 10 MHz to 26.5 GHz  
FSIQ40: 10 MHz to 40 GHz  
decoupling  $> 12$  dB
- Test setup:
- connect RF outputs of the signal generators via 10-dB attenuators the inputs of the 3-dB coupler
  - connect output of the 3-dB coupler to RF input of the FSIQ.
- Signal generator settings:  
(both generators)
- frequency: generator 1  $f_{g1} = f_{in}$   
generator 2  $f_{g2} = f_{in} + 100$  kHz  
See table 1-2 (item 7) of performance test report for values of  $f_{in}$
  - level: 0 dBm
- FSIQ settings:
- [ **SYSTEM PRESET** ]
  - [ **INPUT : RF ATTEN MANUAL : 0 dB** ]
  - [ **LEVEL REF : -10 dBm** ]
  - [ **FREQUENCY SPAN : 50 kHz** ]
  - [ **SWEEP COUPLING : RES BW MANUAL : 2 kHz** ]
  - [ **FREQUENCY CENTER : { $f_{in}$ }** ]  
See table 1-2 (item 7) of performance test report for values of  $f_{in}$
  - [ **MARKER SEARCH : PEAK** ]
  - Adjust the output level of signal generator 1 until the level reading of marker 1 is  $-10$  dBm  $\pm 0.1$  dB.



- [ **FREQUENCY CENTER** : { $f_{in} + 100$  kHz} ]

See table 1-2 (item 7) of performance test report for values of  $f_{in}$

- [ **MARKER SEARCH** : PEAK ]

➤ Adjust the output level of signal generator 2 until the level reading of marker 1 is  $-10$  dBm  $\pm$  0.1 dB.

➤ set reference to peak of signal  
[ **MARKER DELTA** : REFERENCE FIXED ]

➤ set center frequency to intermodulation product ( $2 \times f_{g1} - f_{g2}$ )  
[ **FREQUENCY CENTER** : { $f_{in} - 100$  kHz} ]

- [ **MARKER SEARCH** : PEAK ]

The level difference  $\Delta$  between generator signal and third order intermodulation product is displayed by the reading 'Delta 1 [T1 FXD]'.

The intermodulation ratio  $a_{IM3,1}$  can be calculated as follows:  
IMR1 = - 'Delta 1 [T1 FXD]'

➤ set center frequency to intermodulation product ( $2 \times f_{g2} - f_{g1}$ )  
[ **FREQUENCY CENTER** : { $f_{in} + 200$  kHz} ]

- [ **MARKER SEARCH** : PEAK ]

The level difference  $\Delta$  between generator signal and third order intermodulation product is displayed by the reading 'Delta 1 [T1 FXD]'.

The intermodulation ratio IMR2 can be calculated as follows:  
IMR2 = - 'Delta 1 [T1 FXD]'

Evaluation:

The third order intercept point (T.O.I) referred to the input signal can be calculated as

$$T.O.I. = \frac{IMR}{2} - 10dBm ,$$

where IMR is the lower of IMR<sub>1</sub> and IMR<sub>2</sub>

See table 1-2 (item 7) of performance test report for limits of T.O.I.

## Second-Order Harmonic Distortion

### Test equipment:

- signal generator (table 1-1, item 3)  
frequency range
  - FSIQ3: 9 kHz to 1.7 GHz
  - FSIQ7 / FSIQ26 / FSIQ40: 9kHz to 3.4 GHz

To improve the harmonic suppression of the generator it is recommended to insert a lowpass filter with a suitable cut-off frequency (table 1-1, item 14) after the generator.

The required suppression of the second harmonics is listed in the table at the end of this section. As a result, the error for the entire frequency range is < 1dB.

### Test setup:

- connect RF output of the signal generator to the input of the lowpass
- connect the output of the lowpass to the RF input of the FSIQ

**Note:** *If the harmonic suppression of the signal generator is sufficient, the lowpass can be left out.  
The RF output of the generator can be connected directly to the RF input of the FSIQ in this case.*

### Signal generator settings:

- frequency:  $f_{in}$   
see table 1-2 (item 8) of performance test report for values of  $f_{in}$
- level: -10 dBm

### FSIQ settings:

- [ **SYSTEM PRESET** ]
- [ **INPUT : RF ATTEN MANUAL : 0 dB** ]
- [ **LEVEL REF : -10 dBm** ]
- [ **FREQUENCY SPAN : 3 kHz** ]
- [ **SWEEP COUPLING : RES BW MANUAL : 1 kHz** ]
- [ **FREQUENCY CENTER : { $f_{in}$ }** ]

See table 1-2 (item 8) of performance test report for values of  $f_{in}$

- set marker to peak of signal  
[ **MARKER SEARCH : PEAK** ]
- set reference to peak of signal  
[ **MARKER DELTA : REFERENCE FIXED** ]
- set center frequency of the FSIQ to the frequency of the 2nd harmonic  
[ **FREQUENCY CENTER : { $2 \times f_{in}$ }** ]

See table 1-2 (item 8) of performance test report for values of  $f_{in}$

- set marker to peak of the 2nd harmonic  
[ **MARKER SEARCH : PEAK** ]

Evaluation:

The reading 'Delta 1 [T1 FXD]' displays the level difference  $\Delta$  between the generator signal and the second harmonic. The second harmonic suppression ( $a_{k2}$ ) can be calculated as follows:  $a_{k2} = -\Delta$

The exact input level  $L_{in}$  is displayed by the reading 'FXD {level} dBm'.

The second-order distortion factor can be calculated as follows:

$$IP_{k2} / \text{dBm} = a_{k2} + L_{in}$$

See table 1-2 (item 8) of performance test report for nominal values.

Frequency range	$IP_{k2}$	Required suppression of the second harmonics
$f \leq 150 \text{ MHz}$	> 25 dBm	45 dBc
$f > 150 \text{ MHz}$	> 40 dBm	60 dBc

## Checking IF Filters

Test equipment: signal generator (table 1-1, item 3):  
 frequency 120 MHz  
 level  $\geq -10$  dBm

Test setup: ➤ connect RF output of the signal generator to the RF input of the FSIQ.

## Checking the Level Error

### Reference Measurement (RBW 5 kHz)

Signal generator settings: - frequency: 120 MHz  
 - level: -20 dBm

FSIQ settings: - [ **SYSTEM PRESET** ]  
 - [ **INPUT : RF ATTEN MANUAL : 10 dB** ]  
 - [ **LEVEL REF : 0 dBm** ]  
 - [ **FREQUENCY CENTER : 120 MHz** ]  
 - [ **SWEEP COUPLING : COUPLING RATIO : RBW/VBW SINE [1]** ]  
 - [ **SWEEP COUPLING : COUPLING RATIO : SPAN/RBW MANUAL : 5 : ENTER** ]  
 - resolution bandwidth 5 kHz  
 [ **FREQUENCY SPAN : 25 kHz** ]  
 ➤ set marker to peak of signal  
 [ **MARKER SEARCH : PEAK** ]  
 ➤ set reference to peak of signal  
 [ **MARKER DELTA : REFERENCE FIXED** ]

### Checking the Level Error

FSIQ settings: - [ **FREQUENCY SPAN : {5 x RBW}** ]  
 See table 1-2 (item 9) of performance test report for values of RBW.  
 - [ **SWEEP COUPLING : RES BW MANUAL : {RBW}** ]<sup>1</sup>

<sup>1</sup> **Note:** To check the level error of the 5-MHz and the 10-MHz filter, the resolution bandwidth has to be set manually to 5 MHz or 10 MHz. All other bandwidths will be set automatically by changing the frequency span.

- set marker to peak of signal  
 [ **MARKER SEARCH : PEAK** ]

The level error is displayed by the reading  
 'Delta 1 [T1 FXD] {level error} dB'.

Evaluation: See table 1-2 (item 9) of performance test report for upper and lower limits of level error.

## Checking 3-dB Bandwidths

Signal generator settings:

- frequency: 120 MHz
- level: -20 dBm

FSIQ settings:

- [ **SYSTEM PRESET** ]
- [ **INPUT : RF ATTEN MANUAL : 10 dB** ]
- [ **LEVEL REF : 0 dBm** ]
- [ **FREQUENCY CENTER : 120 MHz** ]
- [ **SWEEP COUPLING : COUPLING RATIO : RBW/VBW SINE [1]** ]
- [ **SWEEP COUPLING : COUPLING RATIO : SPAN/RBW MANUAL : 5 : ENTER** ]

➤ determine 3-dB bandwidth

- [ **MARKER SEARCH : MENU ⇒ : N DB DOWN : 3 dB** ]
- [ **FREQUENCY SPAN : {5 x RBW}** ]  
See table 1-2 (item 10) of performance test report for values of RBW.
- [ **SWEEP COUPLING : RES BW MANUAL : {RBW}** ]<sup>1</sup>

<sup>1</sup> **Note:** *To check the bandwidth of the 5-MHz and the 10-MHz filter, the resolution bandwidth has to be set manually to 5 MHz or 10 MHz. All other bandwidths will be set automatically by changing the frequency span.*

- [ **MARKER SEARCH : PEAK** ]

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

Evaluation: See table 1-2 (item 10) of performance test report for upper and lower limits of 3dB-bandwidths.

## Checking the Shape Factor

Signal generator settings:

- frequency: 120 MHz
- level: -10 dBm

FSIQ settings:

- [ **SYSTEM PRESET** ]
- [ **INPUT : RF ATTEN MANUAL : 10 dB** ]
- [ **LEVEL REF : 0 dBm** ]
- [ **FREQUENCY CENTER : 120 MHz** ]
- [ **SWEEP COUPLING : VIDEO BW MANUAL : 100 Hz** ]
- [ **SWEEP COUPLING : COUPLING RATIO : SPAN/RBW MANUAL : 30 : ENTER** ]

➤ determine shape factor

[ **MARKER SEARCH : MENU** ⇒ : SHAPE FACT 60/3 DB ]

- [ **FREQUENCY SPAN : {30 x RBW}** ]

See table 1-2 (item 11) of performance test report for values of RBW.

- [ **SWEEP COUPLING : RES BW MANUAL : {RBW}** ]<sup>1</sup>

<sup>1</sup> **Note:** To check the shape factor of the 5-MHz and the 10-MHz filter the resolution bandwidth has to be set manually to 5 MHz or 10 MHz. All other bandwidths will be set automatically by changing the frequency span.

- [ **MARKER SEARCH : PEAK** ]

The shape factor is displayed by the reading 'SH3 {shape factor}'.

Evaluation: See table 1-2 (item 11) of performance test report for upper and lower limits of shape factor.

## Checking LO Feedthrough, Noise Display

Test equipment: 50-Ω termination (table 1-1, item 6)  
 frequency range FSIQ3 up to 3.5 GHz  
 FSIQ7 up to 7 GHz  
 FSIQ26 up to 26.5 GHz  
 FSIQ40 up to 40 GHz  
 return loss > 20 dB

Test setup: ➤ terminate the RF input of the FSIQ with 50 Ω

FSIQ settings: - [ **SYSTEM PRESET** ]  
 - [ **INPUT : RF ATTEN MANUAL : 0 dB** ]  
 - [ **FREQUENCY SPAN : 0 Hz** ]

### LO Feedthrough

Additional FSIQ settings: - [ **LEVEL REF : -10 dBm** ]  
 - [ **FREQUENCY CENTER : 0 Hz** ]  
 ➤ start calibration of LO compensation  
 [ **SYSTEM CAL : CAL LO SUP** ]  
 ➤ set marker to peak  
 [ **MARKER SEARCH : PEAK** ]

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

### Noise Display

Additional FSIQ settings: - [ **SWEEP COUPLING : RES BW MANUAL : 10 Hz** ]  
 - [ **SWEEP COUPLING : VIDEO BW MANUAL : 1 Hz** ]  
 - [ **SWEEP COUPLING : SWEEP TIME MANUAL : 0.1 s** ]  
 - [ **TRACE 1 : AVERAGE** ]  
 - [ **TRACE 1 : SWEEP COUNT : 30 ENTER** ]  
 - [ **LEVEL REF : {L<sub>ref</sub>}** ]  
 - [ **FREQUENCY CENTER : {f<sub>n</sub>}** ]

Values of L<sub>ref</sub>:

20 Hz:-30 dBm; 1 kHz:-30 dBm; 9.9 kHz:-60 dBm; ≥95 kHz:-60 dBm  
 See table 1-2 (item 13) of performance test report for values of f<sub>n</sub>.

➤ set marker to peak  
 [ **MARKER SEARCH : PEAK** ]

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

## Checking the Frequency Response

- Test equipment:
- signal generator
    - FSIQ3: table 1-1, item 2;
    - FSIQ7/26/40: table 1-1, item 2 and item 3
  - frequency range
    - FSIQ3: 1 MHz to 3.5 GHz
    - FSIQ7: 1 MHz to 7 GHz
    - FSIQ26: 1 MHz to 26.5 GHz
    - FSIQ40: 1 MHz to 40 GHz
  - maximum level  $\geq -10$  dBm
  - power meter (table 1-1, item 7)
  - power sensor
    - FSIQ3: table 1-1, item 8;
    - FSIQ7/26/40: table 1-1, item 8 and 9.
  - frequency range
    - FSIQ3: 1 MHz to 3.5 GHz
    - FSIQ7: 1 MHz to 7 GHz
    - FSIQ26: 1 MHz to 26.5 GHz
    - FSIQ40: 1 MHz to 40 GHz
  - maximum power  $P_{\max} \geq 100$   $\mu$ W
  - RSS referred to indicated power
    - 1 MHz to 1 GHz .....  $\leq 1.5$  %
    - 1 GHz to 7 GHz.....  $\leq 2$  %
    - 7 GHz to 26.5 GHz.....  $\leq 3.5$  %
    - 26.5 GHz to 40 GHz.....  $\leq 4$  %
  - impedance  $Z = 50$   $\Omega$
  - 6-dB divider (table 1-1, item 5)
  - frequency range
    - FSIQ3: 1 MHz to 3.5 GHz
    - FSIQ7: 1 MHz to 7 GHz
    - FSIQ26: 1 MHz to 26.5 GHz
    - FSIQ40: 1 MHz to 40 GHz
  - level imbalance<sup>1</sup>
    - 1 MHz to 1 GHz  $\leq 0.15$  dB
    - 1 GHz to 7 GHz  $\leq 0.2$  dB
    - 7 GHz to 18 GHz  $\leq 0.3$  dB
    - 18 GHz to 26.5 GHz  $\leq 0.4$  dB
    - 26.4 GHz to 40 GHz  $\leq 0.4$  dB
- <sup>1</sup>If a power splitter with higher level imbalance is used correction of the measured frequency response is recommended.

### Determining the absolute error at 120 MHz

- Test setup:
- connect power sensor to the power meter and execute function 'ZERO' when there is no signal applied to the power sensor
  - connect power sensor to RF output of signal generator
- Signal generator settings:
- frequency 120 MHz
  - level -10 dBm
- Measurement:
- determine output power of the signal generator with the power meter
  - connect RF output of the signal generator to RF input of the FSIQ



- FSIQ settings:
- [ **SYSTEM PRESET** ]
  - [ **INPUT** : RF ATTEN MANUAL : **10 dB** ]
  - [ **LEVEL REF** : **-7 dBm** ]
  - [ **FREQUENCY SPAN** : **15 kHz** ]
  - [ **SWEEP COUPLING** : RES BW MANUAL : **5 kHz** ]
  - [ **FREQUENCY CENTER** : **120 MHz** ]
- set marker to peak of signal  
[ **MARKER SEARCH** : PEAK ]

Evaluation: The deviation between the signal levels measured with the power meter and the FSIQ (level reading of marker 1) reflects the absolute level error of the FSIQ. It can be calculated as

$$\text{absolute error}_{120\text{MHz}} = L_{\text{FSIQ}} - L_{\text{powermeter}}$$

### Checking the frequency response

- Test setup:
- connect RF output of the signal generator to input of the divider
  - connect output 1 of the divider to the power sensor of the power meter
  - connect output 2 of the divider to RF input of the FSIQ

- Signal generator settings:
- level                    -10 dBm
  - frequency               $f_{\text{fresp}}$
- see table 1-2 (item 14) of performance test report for values of  $f_{\text{fresp}}$

- FSIQ settings:
- [ **SYSTEM PRESET** ]
  - [ **INPUT** : RF ATTEN MANUAL : { $a_{\text{ATT}}$ } ]
  - [ **LEVEL REF** : **-7 dBm** ]
  - [ **FREQUENCY SPAN** : **30 kHz** ]
  - [ **SWEEP COUPLING** : RES BW MANUAL : **5 kHz** ]
  - [ **FREQUENCY CENTER** : { $f_{\text{fresp}}$ } ]
- see table 1-2 (item 14) of performance test report for values of  $f_{\text{fresp}}$  and  $a_{\text{ATT}}$ .
- activate 'preselector peak' if center frequency is higher than 7 GHz (only available for FSIQ26)  
[ **SYSTEM CAL** : PRESEL PEAK ]
- set marker to peak of signal  
[ **MARKER SEARCH** : PEAK ]

The signal level  $L_{\text{FSIQ}}$  is displayed by the level reading of marker 1.

Power meter settings: Determine signal level  $L_{\text{powermeter}}$ . To achieve higher accuracy it is recommended to compensate the frequency response of the power sensor.

Evaluation: The frequency response can be calculated as

$$\text{Frequency response} = L_{\text{FSIQ}} - L_{\text{powermeter}} - \text{absolute error}_{120\text{ MHz}}$$

## Checking the Display Linearity

- Test equipment:
- signal generator (table 1-1, item 3)
    - frequency           5 MHz
    - maximum level    ≥ 6 dBm
  - step attenuator (table 1-1, item 12)
    - frequency           5 MHz
    - attenuation        0 to 95 dB
    - steps               1 dB
    - maximum attenuation error < 0.01 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 FSIQ
- Signal generator settings:
- frequency        5 MHz
  - level             +6 dBm
- Step attenuator settings:
- attenuation       16 dB
- FSIQ settings:
- [ **SYSTEM PRESET** ]
  - [ **INPUT : RF ATTEN MANUAL : 10 dB** ]
  - [ **LEVEL REF : 0 dBm** ]
  - [ **FREQUENCY CENTER : 5 MHz** ]
  - [ **FREQUENCY SPAN : 500 Hz** ]
  - [ **SWEEP COUPLING : RES BW MANUAL : 3 kHz** ]
  - [ **SWEEP COUPLING : VIDEO BW MANUAL : 100 Hz** ]
  - [ **LEVEL RANGE : LOG 100 dB** ]
  - set marker to peak of signal  
[ **MARKER SEARCH : PEAK** ]
  - set reference to peak of signal  
[ **MARKER DELTA : REFERENCE FIXED** ]

### Measurement

- Step attenuator settings:
- attenuation        {*a<sub>ATT</sub>*}
- see table 1-2 (item 15) of performance test report for values of *a<sub>ATT</sub>*.

Evaluation:

The difference between the level of the input signal of the FSIQ and the reference (about 10 dB below the reference level) is displayed by the reading 'Delta 1 [T1 FXD]'. Compare the measured values with the limits given in table 1-2 (item 15) of performance test report.

## Checking the Attenuator

- Test equipment:
- signal generator (table 1-1, item 3)
    - frequency        5 MHz
    - maximum level     $\geq 6$  dBm
  - step attenuator (table 1-1, item 12)
    - frequency        5 MHz
    - attenuation       0 to 70 dB
    - steps             10 dB
    - maximum attenuation error < 0.05 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 FSIQ
- Signal generator settings:
- frequency        5 MHz
  - level             0 dBm
- Step attenuator settings:
- attenuation        60 dB
- FSIQ settings:
- [ **SYSTEM PRESET** ]
  - [ **FREQUENCY CENTER : 5 MHz** ]
  - [ **FREQUENCY SPAN : 500 Hz** ]
  - [ **SWEEP COUPLING : RES BW MANUAL : 3 kHz** ]
  - [ **SWEEP COUPLING : VIDEO BW MANUAL : 100 Hz** ]
  - [ **INPUT : RF ATTEN MANUAL : 10 dB** ]
  - [ **LEVEL REF : -30 dBm** ]
  - [ **MARKER SEARCH : PEAK** ]
- adjust output level of the signal generator until the level reading of marker 1 is exactly -60.0 dBm.

### Measurement

- Step attenuator settings:
- attenuation         $\{a_{ATT}\}$
- see table below for values of  $a_{ATT}$ .
- FSIQ settings:
- [ **INPUT : RF ATTEN MANUAL :  $\{a_{FSIQ}\}$**  ]
  - [ **LEVEL REF : {reference level} dBm** ]
  - [ **MARKER SEARCH : PEAK** ]
- see table below for values of  $a_{FSIQ}$  and reference level.
- Evaluation:
- Compare level reading of marker 1 with the limits given in table 1-2 (item 16) of performance test report.

<b><math>a_{ATT}</math></b>	70 dB	60 dB	50 dB	40 dB	30 dB	20 dB	10 dB	0 dB
<b><math>a_{FSIQ}</math></b>	0 dB	10 dB	20 dB	30 dB	40 dB	50 dB	60 dB	70 dB
<b>reference level</b>	-40 dBm	-30 dBm	-20 dBm	-10 dBm	0 dBm	+10 dBm	+20 dBm	+30 dBm

## Checking the IF Gain Switching

- Test principle: The IF gain of the FSIQ can be switched from 0 to 50 dB by changing the reference level at fixed RF attenuation. To prevent the IF gain errors to be mixed up with the log amplifier error it is determined by comparison using an external precision attenuator.
- Test equipment:
- signal generator (table 1-1, item 3)
    - frequency 5 MHz
    - maximum level  $\geq -10$  dBm
  - step attenuator (table 1-1, item 10)
    - frequency 5 MHz
    - attenuation 0 to 50 dB
    - steps 1 dB
    - maximum attenuation error  $< 0.05$  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 FSIQ
- Signal generator settings:
- frequency 5 MHz
  - level -10 dBm
- Step attenuator settings:
- attenuation 30 dB
- FSIQ settings:
- [ **SYSTEM PRESET** ]
  - [ **FREQUENCY CENTER : 5 MHz** ]
  - [ **FREQUENCY SPAN : 2 kHz** ]
  - [ **SWEEP COUPLING : RES BW MANUAL : 1 kHz** ]
  - [ **SWEEP COUPLING : VIDEO BW MANUAL : 100 Hz** ]
  - [ **INPUT : RF ATTEN MANUAL : 10 dB** ]
  - [ **LEVEL REF : -30 dBm** ]
  - [ **MARKER SEARCH : PEAK** ]
- adjust output level of the signal generator until the level reading of marker 1 is exactly -40.0 dBm.

### Measurement

- Step attenuator settings:
- attenuation  $\{a_{ATT}\}$
  - see table below for values of  $a_{ATT}$ .
- FSIQ settings:
- [ **LEVEL REF : {reference level} dBm** ]
  - see table below for values of reference level.
  - [ **MARKER SEARCH : PEAK** ]
- Evaluation:
- Compare level reading of marker 1 with the limits given in table 1-2 (item 17) of performance test report.

**10-dB gain steps:**

<b>a<sub>ATT</sub></b>	<b>reference level</b>	<b>Marker level</b>
0 dB	0 dBm	-10 ±0.2 dBm
10 dB	-10 dBm	-20 ±0.1 dBm
20 dB	-20 dBm	-30 ±0.1 dBm
30 dB	-30 dBm	-40 ±0.1 dBm
40 dB	-40 dBm	-50 ±0. dBm
50 dB	-50 dBm	-60 ±0.2 dBm

**1-dB gain steps:**

<b>a<sub>ATT</sub></b>	<b>reference level</b>	<b>Marker level</b>
30 dB	-30 dBm	-40,0 ±0.2 dBm
31 dB	-31 dBm	-41 ±0.2 dBm
32 dB	-32 dBm	-42 ±0.2 dBm
33 dB	-33 dBm	-43 ±0.2 dBm
34 dB	-34 dBm	-44 ±0.2 dBm
35 dB	-35 dBm	-45 ±0.2 dBm
36 dB	-36 dBm	-46 ±0.2 dBm
37 dB	-37 dBm	-47 ±0.2 dBm
38 dB	-38 dBm	-48 ±0.2 dBm
39 dB	-39 dBm	-49 ±0.2 dBm

## Checking the Phase Noise

Test equipment:

signal generator (table 1-1, item 3)  
 frequency 498 MHz  
 level  $\geq 0$  dBm  
 phase noise at 498 MHz: < -100 dBc/Hz @ 100 Hz  
 < -115 dBc/Hz @ 1 kHz  
 < -127 dBc/Hz @ 10 kHz  
 < -130 dBc/Hz @ 100 kHz  
 < -142 dBc/Hz @ 1MHz

Test setup:

- connect RF output of the signal generator to RF input of the FSIQ
- connect signal generator EXT REF input to the EXT REF output of the FSIQ and set the generator to external reference

Signal generator settings:

- frequency 498 MHz  
 - level 0 dBm

FSIQ settings:

- [ **SYSTEM PRESET** ]
- [ **CONFIGURATION SETUP** : REFERENCE INT / EXT ]  
 toggle to internal reference (INT)
- [ **FREQUENCY CENTER** : 498 MHz ]
- [ **REF LEVEL** : 0 dBm ]
- [ **INPUT** : RF ATTEN MANUAL : 10 dB ]
- [ **FREQUENCY SPAN** : {span} ]  
 depending on offset, see table below for values of span.
- [ **SWEEP COUPLING** : COUPLING RATIO : RBW/VBW NOISE ]
- [ **SWEEP COUPLING** : RES BW MANUAL : {RBW} ]  
 depending on offset, see table below for values of RBW.
- [ **TRACE 1** : AVERAGE ]
- [ **SWEEP** : SWEEP COUNT : 20 : ENTER ]
- [ **MARKER NORMAL** ]
- set marker to peak of signal  
 [ **MARKER SEARCH**: PEAK ]
- activate phase noise marker  
 [ **MARKER DELTA**: PHASE NOISE ]
- [ **FREQUENCY CENTER** : {498 MHz + offset} ]  
 see table below for values of offset.
- [ **REF LEVEL** : {reference level} ]  
 depending on offset, see table below for values of reference level.
- [ **INPUT** : RF ATTEN MANUAL : {a<sub>FSIQ</sub>} ]  
 depending on offset, see table below for values of a<sub>FSIQ</sub>.
- set phase noise marker  
 [ **MARKER DELTA** : {offset} ]  
 see table below for values of offset.

**Note:** Please make sure not to measure on a spurious signal.

Evaluation: The phase noise is display by the reading 'Delta 1 [T1 NOI]'. Compare the measured values with the limits given in table 1-2 (item 18) of performance test report

Phase noise measurement settings				
Offset	Span	RES BW	Reference Level	a <sub>FSIQ</sub>
100 Hz	20 Hz	10 Hz	0 dBm	10 dB
1 kHz	200 Hz	100 Hz	0 dBm	10 dB
10 kHz	2 kHz	500 Hz	-10 dBm	10 dB
100 kHz	10 kHz	3 kHz	-20 dBm	0 dB
1 MHz	100 kHz	30 kHz	-20 dBm	0 dB

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

## Checking the Tracking Generator – Option FS-B8/B9/B10/B11

### Checking the Output Level

Test equipment:	N-connecting cable (Table 1-1, item 15)
Test setup:	➤ Connect output of tracking generator to RF-input of FSIQ.
FSIQ settings:	<ul style="list-style-type: none"> <li>- [ <b>MODE TRACKING</b> ]</li> <li>- [ <b>FREQUENCY CENTER : 120 MHz</b> ]</li> <li>- [ <b>FREQUENCY SPAN : 0 MHz</b> ]</li> <li>- [ <b>SWEEP COUPLING : RES BW MANUAL : 20 kHz</b> ]</li> <li>- [ <b>SWEEP COUPLING : VIDEO BW MANUAL : 20 kHz</b> ]</li> <li>- [ <b>LEVEL RANGE : LOG 50 dB</b> ]</li> <li>- [ <b>MODE TRACKING : SOURCE ON</b> ]</li> <li>- [ <b>MODE TRACKING : SOURCE POWER {level}</b> ]</li> </ul> <p>Values for {level} : 0 dBm; -3 dBm; -6 dBm; -10 dBm; -20 dBm</p>
Evaluation:	Compare measured values with values from Table 1-2, item no. 19.

### Checking the Frequency Response

Test equipment:	N-connecting cable (Table 1-1, item 15)
Test setup:	➤ Connect output of tracking generator to RF-input of FSIQ.
FSIQ settings:	<ul style="list-style-type: none"> <li>- [ <b>MODE TRACKING</b> ]</li> <li>- [ <b>FREQUENCY START : 1 MHz</b> ]</li> <li>- [ <b>FREQUENCY STOP : 3.5(7) MHz</b> ]</li> <li>- [ <b>SWEEP COUPLING : RES BW MANUAL : 20 kHz</b> ]</li> <li>- [ <b>SWEEP COUPLING : VIDEO BW MANUAL : 20 kHz</b> ]</li> <li>- [ <b>SWEEP COUPLING : SWEEP TIME MANUAL : 100 ms</b> ]</li> <li>- [ <b>LEVEL RANGE : LOG 50 dB</b> ]</li> <li>- [ <b>MODE TRACKING : SOURCE ON</b> ]</li> <li>- [ <b>MODE TRACKING : SOURCE POWER 0 dBm</b> ]</li> </ul>
Evaluation:	Compare measured values with limits from Table 1-2, item no. 20.



## Checking the I/Q Modulator

Test equipment:                   - 2 DC power sources (Table 1-1, item 16)  
    - 2 DC-voltmeters (Table 1-1, item 17)

Test setup:                       ➤ Connect DC power sources to the I and Q input of the analyzer.  
    ➤ Use DC-voltmeter to measure voltage at the I and Q inputs.

Power source settings           ➤ Set voltage to 250 mV ± 3 mV.

FSIQ settings:                   - [ **MODE TRACKING** ]  
    - [ **FREQUENCY CENTER : 120 MHz** ]  
    - [ **FREQUENCY SPAN : 0 MHz** ]  
    - [ **SWEEP COUPLING : RES BW MANUAL : 20 kHz** ]  
    - [ **SWEEP COUPLING : VIDEO BW MANUAL : 20 kHz** ]  
    - [ **REF : REF LEVEL : 0 dBm** ]  
    - [ **MODE TRACKING : SOURCE POWER 0 dBm** ]  
    - [ **MARKER NORMAL** ]

Rated value:..... -6 dBm ± 0.5 dB  
 This value serves as a reference for the following measurements.

### Measurements

Measurement of the residual carrier   - [ **LEVEL RANGE : 100 dB** ]

- Short-circuit I and Q voltages (do not remove!)  
 The voltmeter must indicate a value < 0.1 mV.

Rated value: ..... < -50 dBm

Imbalance measurement (imbalance between the I and Q paths)   - [ **LEVEL RANGE : 10 dB** ]

- Apply ±250 mV at the Q input, short-circuit at the I input.

Rated value:..... (reference value – 3 dB) ±0.5 dB.

- Apply ±250 mV at the I input, short-circuit at the Q input.

Rated value: .....(reference value - 3dB) ±0.5 dB.

Measurement of the quadrature offset   ➤ Apply +250 mV at the I input, -250 mV at the Q input.

Rated value: ..... reference value ±0.5 dB.

- Apply +250 mV at the Q input, -250 mV at the I input.

Rated value: ..... reference value ± 0.5 dB.

## External Mixer Output - Option FSE-B21

### Checking the LO Level

- Test equipment:
- power sensor (table 1-1, item 9)
    - frequency range 7.5 MHz to 15.2 GHz
    - maximum power  $P_{\max} \geq 40$  mW
    - RSS  $\leq 2.5\%$  referred to indicated power
    - impedance  $Z = 50 \Omega$
  - power meter (table 1-1, item 7)
  - attenuator with 10 dB fixed attenuation (table 1-1, item 13)
- Power meter settings:
- Connect power sensor to power meter and carry out function 'ZERO' when no signal is applied to the power sensor.
- FSIQ settings:
- [ **SYSTEM PRESET** ]
  - [ **MENU** ↑ : ANALYZER ]
  - Activate external mixer measurement and toggle to BAND LOCK OFF
  - [ **INPUT** : MIXER EXTERNAL : BAND LOCK ON / OFF ]
  - [ **INPUT** : MIXER EXTERNAL : HARMONIC# : **20** : **ENTER** ]
  - [ **INPUT** : MIXER EXTERNAL : BIAS : BIAS OFF ]
  - [ **FREQUENCY SPAN** : ZERO SPAN ]
  - [ **FREQUENCY CENTER** : { $f_{\text{Center}}$ } ]

see table 5.2.1 (item 22) of performance test report for values of  $f_{\text{Center}}$

- Test setup:
- Connect power sensor via 10 dB-attenuator to port 'LO OUT / IF IN' of the FSIQ.
- Measurement:
- Determine level of the LO-signal  $L_{\text{LO,meas}}$  with the power meter. Due to the harmonic number ( $n = 20$ ) the center frequency  $f_{\text{Center}}$  is twenty times higher than the frequency of the LO-signal. See table 5.2-1 (item 22) of the performance test report for values of  $f_{\text{Center}}$ . To achieve higher accuracy it is recommended to compensate the frequency response of the power sensor.

The LO-level  $L_{\text{LO}}$  can be calculated as

$$L_{\text{LO}} = L_{\text{LO,meas}} + 10 \text{ dB}$$

See table 1-2 (item 22) of performance test report for nominal level.

## 1 dB Attenuator - Option FSE-B13

- Test equipment:
- Signal generator (chapter 5, table 1-1, item 3)
    - Frequency 5 MHz
    - Maximum level  $\geq 6$  dBm
  - External attenuator (chapter 5, table 1-1, item 13)
    - Frequency 5 MHz
    - Attenuation 0 to 70 dB
    - Steps 1 dB
    - Maximum attenuation error  $< 0.05$  dB
- Test setup:
- Connect the RF output of the signal generator to the RF input of the external attenuator
  - Connect the RF output of the external attenuator to the RF input of the instrument
- Settings on signal generator:
- Frequency 5 MHz
  - Level 0 dBm
- Settings on the external attenuator:
- Attenuation 60 dB
- Settings on the instrument:
- [ **SYSTEM PRESET** ]
  - [ **FREQUENCY CENTER : 5 MHz** ]
  - [ **FREQUENCY SPAN : 500 Hz** ]
  - [ **SWEEP COUPLING : RES BW MANUAL : 3 kHz** ]
  - [ **SWEEP COUPLING : VIDEO BW MANUAL : 100 Hz** ]
  - [ **INPUT : RF ATTEN MANUAL : 10 dB** ]
  - [ **INPUT : ATTEN STEPSIZE : 1 dB** ]
  - [ **LEVEL REF : -30 dBm** ]
  - [ **MARKER SEARCH : PEAK** ]
  - Adjust the output level of the signal generator until the marker level is exactly at  $-60.0$  dBm.

### Measurement

Settings on the external attenuator: Attenuation  $\{a_{ATT}\}$   
See table below for values of  $a_{ATT}$ .

Settings on FSE:

- [ **INPUT : RF ATTEN MANUAL :  $\{a_{FSE}\}$  ]**
- [ **LEVEL REF :  $\{\text{reference level}\}$  dBm ]**
- [ **MARKER SEARCH : PEAK** ]

See table below for values of  $a_{FSE}$  and reference level.

Evaluation: Compare level of marker 1 with the limits of the performance test protocol.

$a_{ATT}$	20 dB	19 dB	18 dB	17 dB	16 dB	15 dB	14 dB	13 dB	12 dB	11 dB
$a_{FSE}$	50 dB	51 dB	52 dB	53 dB	54 dB	55 dB	56 dB	57 dB	58 dB	59 dB
Reference level	+10 dBm	+11 dBm	+12 dBm	+13 dBm	+14 dBm	+15 dBm	+16 dBm	+17 dBm	+18 dBm	+19 dBm

## Digital Demodulation

### Absolute Accuracy at 120 MHz

Test equipment: Power sensor (table 1-1, item 7)

Test setup:

- Connect power sensor to power meter and perform the ZERO function in the absence of a signal at the sensor.
- Connect sensor to the RF output of the signal generator.  
Generator settings:
  - Level -10dBm
  - Frequency 120 MHz
- Determine output power of signal generator with power meter.
- Connect signal generator to RF input of FSIQ.

FSIQ settings:

- [LEVEL REF: -7 DBM]
- [FREQUENCY CENTER: 120 MHZ]
- [MODE: VECTOR ANALYZER: DIGITAL STANDARDS:GSM]
- [MEAS RESULT: MAG CAP BUFFER]
- [TRIGGER: FIND BURST: OFF]
- [MARKER SEARCH: SUMMARY MRK ON, SUMMARY MARKER ↓: MEAN, AVG/HOLD ON, SWEEP COUNT: 10]
- [SWEEP:SINGLE SWEEP]

Measurement: The difference between the level displays of power meter and FSIQ is the absolute error at 120 MHz.  
Check absolute error  $_{120\text{ MHz}} = L_{\text{FSIQ}} - L_{\text{power meter}}$  according to the performance test protocol

### Display Linearity

Test equipment:

- Signal generator (Table 1-1, item 3)
- RF Step Attenuator RSG (Table 1-1, item 12)

Test setup:

- Connect signal generator via the attenuator to the RF input of FSIQ.
  - Frequency 5 MHz
  - Level +6 DBM
  - Setting of attenuator 16 DB.

Settings FSIQ:

- [LEVEL REF: -7 DBM]
- [FREQUENCY CENTER: 5 MHZ]
- [MODE: VECTOR ANALYZER: DIGITAL STANDARDS:GSM]
- [MEAS RESULT: MAG CAP BUFFER]
- [TRIGGER: FIND BURST: OFF]
- [MARKER SEARCH: SUMMARY MRK ON, SUMMARY MARKER ↓↓: MEAN, AVG/HOLD ON, SWEEP COUNT: 10]
- [SWEEP:SINGLE SWEEP]

- Measurement: Reference level = level measured with FSIQ (SUMMARY MARKER:MEAN) with 16 dB attenuation of step attenuator.
- Increase attenuation of step attenuator by 10, 30 and 50 dB in compliance with the performance test report; to trigger a measurement on FSIQ enter [SWEEP: SINGLE SWEEP].
  - Check the difference between the displayed level [SUMMARY MARKER MEAN] and the [reference level reduced by attenuation set on step attenuator] and compare to performance test report.

### Checking the Dynamic Range for Burst Measurements

- Test equipment: Signal generator (Table 1-1, item 3)
- Test setup: ➤ Connect signal generator to RF input of FSIQ
- frequency: 1GHz
  - level: -10 dBm
- FSIQ settings:
- [LEVEL REF: -10 dBm]
  - [ATTEN AUTO LOW NOISE]
  - [FREQUENCY CENTER: 1 GHz]
  - [MODE: VECTOR ANALYZER]
- Set modulation standard according to performance test report:
    - [DIGITAL STANDARDS:.....]
    - [MEAS RESULT: MAG CAP BUFFER]
    - ↑:[RANGE: REF VALUE Y AXIS:-5 dBm]
    - [MARKER SEARCH: SUMMARY MARKER↓: MEAN, AVG/HOLD: ON, SWEEP COUNT: 10]
    - [TRIGGER: FIND BURST OFF]
    - [SWEEP: SINGLE SWEEP]
  - Increase signal generator level (separately for each standard) in 1 dB steps until IFOVLD is displayed, then reduce again by 1 dB (press the *SINGLE SWEEP* softkey after each level step).
  - Note down the displayed summary marker MEAN value.
  - Determine dynamic range MAG CAP BUFFER according to table:
    - Set signal generator level to minimum (-139 dBm) and determine the summary marker MEAN value averaged over 10 sweeps [*SWEEP: SINGLE SWEEP*].
    - The difference between the summary marker values at -1 dB below the displayed OVLD and at a transmitter level -140 dBm is the available dynamic range. Check the value for compliance with the performance test report for standard GSM and NADC FWDD CH (after changing the standard the vector analyzer must be set again).

## Checking the Residual Error (no FSK signals)

- Test equipment:
- Signal generator (Table 1-1, item 3)
  - ADS (Table 1-1, item 19)
  - IQSIM Software (Table 1-1, item 20)
- Test setup:
- Connect signal generator to RF input of FSIQ.
  - Synchronize FSIQ and ADS externally with SMHU
    - ADS settings: **SPECIAL FUNCTION: NEXT: NEXT: NEXT: REF: EXT: 10 MHz.**
    - connect ADS output 1 to I-input, output 2 to Q-input of SMHU using a 3dB attenuator and cables of exactly the same length.
  - Modulate signal generator with ADS I/Q
  - SMHU settings: frequency 1 GHz; level -7 dBm; IQ modulated.
- FSIQ settings:
- [**SETTINGS: REFERENCE: EXT**]
  - [**FREQUENCY CENTER: 1 GHz, SPAN: 400 kHz**]
  - [**LEVEL REF: -10 dBm:ATTEN AUTO LOW NOISE**]
  - [**COUPLING: RES BW MANUAL 5 kHz**]
- Calibration of signal generator:
- Calibrate the I/Q modulator of SMHU (shift special 320) and adjust offset on ADS (special function/NEXT/NEXT/DIAG/CAL 0).
  - Set on ADS: output frequency 100 kHz, 1 V, sinewave signal on both ADS channels, phase -90° for channel 1 and filter OFF for both channels. Adjust carrier suppression (1 GHz) to > 63 dB by gradually varying the CAL D/A converter of both channels and note down set values.  
(To do so press the keys **SPECIAL FUNCTION: NEXT: NEXT:DIAGN:D/A:CAL** and adjust the D/A converter values for both channels using the spinwheel).
  - Eliminate the difference between the I and Q channels by entering special function 301 on SMHU and varying I>Q (FM key), and the QUAD offset (φM key) by adjusting the 2nd sideband (carrier frequency - 100 kHz) to > 63 dB using the spinwheel.
  - Repeat the previously noted settings of the two CAL D/A converters for channel 1 and 2 after selecting a DIGITAL STANDARD on ADS.

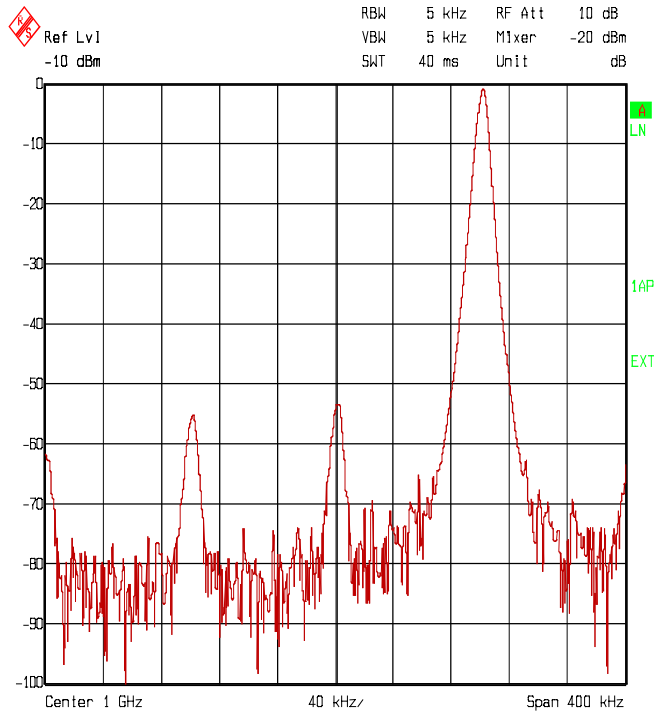


Fig 1-1: Typical SMHU output spectrum before calibration adjustment

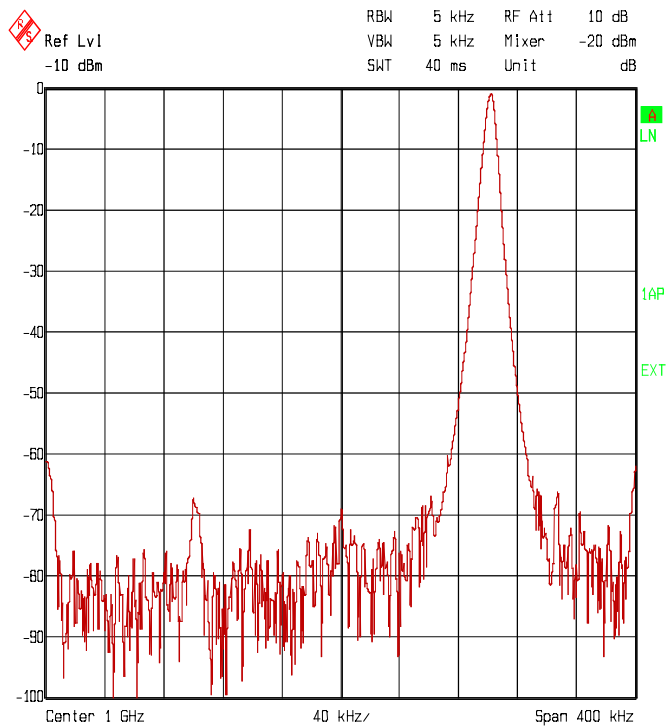


Fig 1-1: Typical spectrum of SMHU after calibration adjustment

**Checking the residual error (no FSK signals) with ADS**

- FSIQ settings: Same as before but:
- [LEVEL REF: -4 dBm]
  - [MODE: VECTOR ANALYZER]
- Set frequency of FSIQ and modulation standard according to table:
- [FREQUENCY CENTER: ..... MHz]
  - [MODE: DIGITAL STANDARD: .....]
  - [MEAS RESULT: SYMB TABLE/ERRORS],
  - [TRACE: AVERAGE, SWEEP COUNT: 10, SINGLE SWEEP]

- Measurement:
- Generate on ADS with I/Q SIM the standard test signals listed in the table below and check the residual error. Set the signal generator frequency to the  $f_{RF}$  given in the table.
- Trigger the measurement by entering [SWEEP: SINGLE SWEEP].

(After transmitting all the standard test signals to the ADS, reset the calibration values for the CAL D/A converters of channel 1 and 2 obtained in the preceding calibration.)

	ADS test signal
<b>GMSK</b> symbol rate: 270.833 kHz, $f_{RF} = 2 \text{ GHz}$ [DIGITAL STANDARD: GSM]	GSMSTAN.IQS
<b><math>\pi/4</math>-DQPSK</b> symbol rate: 24.3 kHz $f_{RF} = 1 \text{ GHz}$ , [DIGITAL STANDARD: NADC FORWARD CH, TRIGGER: FIND SYNC ON]	NADC_S1.IQS
<b><math>\pi/4</math>-DQPSK,</b> $f_{RF} = 1\text{GHz}$ symbol rate 18 kHz [DIGITAL STANDARD: TETRA]	TETRA2.IQS
<b><math>\pi/4</math>-DQPSK</b> symbol rate: 192 kHz, $f_{RF} = 2 \text{ GHz}$ [DIGITAL STANDARD: PHS]	PHS1.IQS
<b>QPSK</b> symbol rate 1.2288 MHz $f_{RF} = 1 \text{ GHz}$ [DIGITAL STANDARD: IS95-CDMA FWD CH]	QCDMA_F1.IQS
<b>OQPSK</b> symbol rate 1.2288 MHz $f_{RF} = 1 \text{ GHz}$ [DIGITAL STANDARD: IS95-CDMA REV CH]	QCDMA_R1.IQS



**Checking the residual error (no FSK signals) with AMIQ**

- Test equipment:
- Arbitrary waveform generator AMIQ (Section 5.1; item 21)
  - Software WinIQSIM (Table 1-1; item 22)
- Test setup:
- Connect AMIQ output I to RF input of FSIQ.
- FSIQ settings:
- Same as before but:
- **[LEVEL REF: -4 dBm]**
  - **[MODE: VECTOR ANALYZER]**
- Set frequency of FSIQ and modulation standard according to table:
    - **[FREQUENCY CENTER: ..... MHz]**
    - **[MODE: DIGITAL STANDARD: .....]**
    - **[MEAS RESULT: SYMB TABLE/ERRORS]**
    - **[RESULT LENGTH:200], [TRACE: AVERAGE, SWEEP COUNT: 10, SINGLE SWEEP]**
    - **[SWEEP:TRIGGER:FIND BURST:ON]**
- Measurement:
- Generate on AMIQ with WinIQSIM the standard test signals listed in the table below and check the residual error. Set the signal generator frequency to the  $f_{RF}$  given in the table. Trigger the measurement by entering [SWEEP: SINGLE SWEEP].

	AMIQ test signal
<b>WCDMA</b> symbol rate 4.096 MHz $f_{RF} = 12,288$ MHz <i>[DIGITAL STANDARD: WCDMA 4.096 FWD CH]</i>	WCDMA_F1.WV
<b>QPSK</b> symbol rate 6.4 MHz $f_{RF} = 12$ MHz <i>[REFERENCE FILTER: Raised Cos]</i> <i>[MEAS FILTER: Root Raised Cos]</i> <i>[ALPHA/BT:0,2]</i>	WPSKSIG6.WV

**Checking the Residual Error ( FSK signals)**

- Test equipment:
- Signal generator (Section 5.2, item 3)
  - ADS (Section 5.2, item 19)
  - Software IQSIM (Section 5.2, item 20)

- Test setup:
- Connect signal generator to RF input of FSIQ.
  - Synchronize FSIQ and ADS externally with SMHU
    - ADS settings: **SPECIAL FUNCTION: NEXT: NEXT: NEXT: REF: EXT: 10 MHz.**
    - connect ADS output 1 to I-input, output 2 to Q-input of SMHU using a 3dB attenuator and cables of exactly the same length.
  - Modulate signal generator with ADS I/Q
  - SMHU settings: frequency 1 GHz; level -7 dBm; IQ modulated.
  - Calibrate as described in section 5.3.2.4.

- Settings an FSIQ: **[MODE: VECTOR ANALYZER]**
- Set frequency of FSIQ and modulation standard according to table:
    - [FREQUENCY CENTER: ..... MHz]
    - [MODE: DIGITAL STANDARD: .....]
    - [**LEVEL REF: -10 dB, ATTEN AUTO: LOW NOISE**]
  - Set required modulation standard according to table and also:
    - [RESULT DISPLAY: SYMB TABLE/ERRORS, TRACE: AVERAGE, SWEEP: COUNT: 10, SINGLE SWEEP]

- Measurement:
- Generate on ADS with I/Q SIM the standard test signals listed in the table below and check the residual error. Set the signal generator frequency to the  $f_{RF}$  given in the table. Trigger the measurement by pressing the *SINGLE SWEEP* softkey.

(After transmitting all the standard test signals to the ADS, reset the calibration values for the CAL D/A converters of channel 1 and 2 obtained in the preceding calibration.)

	ADS test signal
<b>4-FSK</b> symbol rate: 3.125 kHz, $f_{RF} = 1 \text{ GHz}$ [DIGITAL STANDARD:ERMES]	ERMES1.IQS
<b>2-FSK</b> symbol rate 72 kHz $f_{RF} = 1 \text{ GHz}$ [DIGITAL STANDARD: CT2]	CT2_1.IQS
<b>2-FSK</b> symbol rate: 1.152 MHz, $f_{RF} = 2 \text{ GHz}$ [DIGITAL STANDARD:DECT]	DECT1.IQS

## Analog Demodulation

- Test equipment: Signal generator SMHU 58 (Table 1-1, item 3)
- Test setup:
- Connect signal generator to RF input of FSIQ (frequency 1 GHz, level: -10 dBm)
  - Connect 10 MHz reference output at the rear to reference input of FSIQ. Set FSIQ to 10 MHz external reference:
- [SETTINGS: REF FREQ: EXTERN]**
- FSIQ settings:
- **[FREQUENCY CENTER: 1 GHz]**
  - **[LEVEL REF: -4 dBm]**
  - **[MODE: VECTOR ANALYZER: ANALOG DEMOD]**
  - **[MEAS RESULT: REAL TIME ON]**

## REAL TIME OFF

### Measurement Error with AM Demodulation

- Settings on SMHU: AM internal 50 %, AF according to performance test report.
- FSIQ settings:
- **[LEVEL REF: -4 dBm]**
  - **[FREQUENCY CENTER: 1000 MHz]**
  - **[MEAS RESULT: AM SIGNAL: MODULATION SUMMARY]**,
  - **[DEMOD BW]** and **[IF BW]** according to performance test report.
- Evaluation: Check displayed AM  $\pm Pk/2$  of modulation summary for compliance with performance test report.

### Spurious AM

- Settings on SMHU: AM Off
- FSIQ settings:
- **[LEVEL REF: -4 dBm]**
  - **[FREQUENCY CENTER: 1000 MHz]**
  - **[MEAS RESULT: AM SIGNAL: MODULATION SUMMARY]**
  - set **[DEMOD BW]** and **[IF BW]** according to performance test report.
- Evaluation: Check displayed AM RMS of modulation summary for compliance with performance test report.

### Measurement Error with FM Demodulation

Settings on SMHU: FM INTERN ON,  
Set AF and frequency deviation according to performance test report.

FSIQ settings: - [LEVEL REF: -4 dBm]  
- [FREQUENCY CENTER:1000 MHz]  
- [MEAS RESULT: FM Signal: MODULATION SUMMARY],  
- set [DEMOD BW] and [IF BW] according to performance test report.

Evaluation: Check displayed FM  $\pm Pk/2$  of modulation summary for compliance with performance test report.

### Residual FM

Settings on SMHU: FM INTERN: OFF

FSIQ settings: - [LEVEL REF: -4 dBm]  
- [FREQUENCY CENTER:1000 MHz]  
- [MEAS RESULT: FM Signal: MODULATION SUMMARY]  
- [MODULATION PARAMETER: AF LOWPASS 5%[DEMOD BW],  
- set [DEMOD BW] and [IF BW] according to performance test report.

Evaluation: Check displayed FM RMS of modulation summary for compliance with performance test report.

### Measurement Error with PM Demodulation

Settings on SMHU: PM internal ON, phase deviation and AF according to performance test report.

FSIQ settings: - [LEVEL REF: -4 dBm]  
- [FREQUENCY CENTER:1000 MHz]  
- [MODE: VECTOR ANALYZER]  
- [MEAS RESULT: PM signal: MODULATION SUMMARY]]  
- [MODULATION PARAMETER: AF LOWPASS: OFF]

Evaluation: Check displayed PM  $\pm Pk/2$  of modulation summary for compliance with performance test report.

### Spurious PM

Settings on SMHU: Frequency: 100 MHz, Modulation Off

FSIQ settings: - [LEVEL REF: -4 dBm]  
- [FREQUENCY CENTER:100 MHz]  
- [MODE: VECTOR ANALYZER]  
- MEAS RESULT: PM SIGNAL: MODULATION SUMMARY]  
- [MODULATION PARAMETER: AF LOWPASS: 5%[DEMOD BW]  
- set [DEMOD BW] and [IF BW] according to performance test report.

Evaluation: Check displayed PM RMS of modulation summary for compliance with performance test report.

### Error of Carrier Power Measurement

Settings on SMHU: Frequency: 1 GHz, modulation Off, level according to performance test report.

FSIQ settings:

- [LEVEL REF: -4 dBm
- [FREQUENCY: CENTER: 1 GHz]
- [MODE: MEAS RESULT: AM SIGNAL: MODULATION SUMMARY]
- set [DEMODO BW] and [IF BW] according to performance test report.

Evaluation: Check displayed CARR PWR of modulation summary for compliance with performance test report.

### Error of Audio Frequency Measurement

Settings on SMHU: AM INTERN 50%, level -10 dBm, AF according to performance test report.

FSIQ settings:

- [LEVEL REF: -4 dBm
- [FREQUENCY: CENTER: 1 GHz]
- [MEAS RESULT: AM SIGNAL: MODULATION SUMMARY]
- set [DEMODO BW] and [IF BW] according to performance test report.

Evaluation: Check displayed audio frequency of modulation summary for compliance with performance test report.

## Analog Demodulation/ REAL TIME ON

### Measurement Error with AM Demodulation

Settings on SMHU: AM INTERN 50 %, frequency: 1 GHz, level: - 10 dBm

FSIQ settings:

- [LEVEL REF. - 4 dBm]
- [FREQUENCY CENTER: 1 GHz]
- [MODE: VECTOR ANALYZER: ANALOG DEMOD]
- [MEAS RESULT: REAL TIME: ON: AM SIGNAL: MODULATION SUMMARY]
- set [DEMODO BW] and [IF BW] according to performance test report.

Evaluation: Check displayed AM  $\pm Pk/2$  of modulation summary for compliance with performance test report.

### Spurious AM

Settings on SMHU: As before but AM INTERN OFF

FSIQ settings: As before

Evaluation: Check displayed AM RMS of modulation summary for compliance with performance test report.

### Measurement Error with FM Demodulation

Settings on SMHU: FM INTERN ON  
Set AF and frequency deviation according to performance test report.

FSIQ settings:

- [LEVEL REF. - 4 dBm]
- [FREQUENCY CENTER: 1 GHz]
- [MODE: VECTOR ANALYZER: ANALOG DEMOD]
- [MEAS RESULT: FM Signal: MODULATION SUMMARY],
- set [DEMODO BW] and [IF BW] according to performance test report.

Evaluation: Check displayed FM  $\pm Pk/2$  of modulation summary for compliance with performance test report.

### Residual FM

Settings on SMHU: FM INTERN: OFF

FSIQ settings:

- [LEVEL REF. - 4 dBm]
- [FREQUENCY CENTER: 1 GHz]
- [MODE: VECTOR ANALYZER: ANALOG DEMOD]
- [MODULATION PARAMETER: AF LOWPASS: 3 kHz:AF HIGHPASS:300 Hz].
- set [DEMODO BW] and [IF BW] according to performance test report.

Evaluation: Check displayed FM RMS value of modulation summary for compliance with performance test report.

### Measurement Error with PM Demodulation

Settings on SMHU: PM internal ON, phase deviation and AF according to performance test report.

FSIQ settings:

- [LEVEL REF. - 4 dBm]
- [FREQUENCY CENTER: 1 GHz]
- [MODE: VECTOR ANALYZER: ANALOG DEMOD]
- [MEAS RESULT: PM Signal: MODULATION SUMMARY]
- [AF LOWPASS: OFF, AF HIGHPASS: 30 Hz].
- set [DEMODO BW] and [IF BW] according to performance test report.

Evaluation: Check displayed PM  $\pm Pk/2$  of modulation summary for compliance with performance test report

### Spurious PM

Settings on SMHU: PM INTERN: OFF

FSIQ settings:

- [LEVEL REF. - 4 dBm]
- [FREQUENCY CENTER: 1 GHz]
- [MODE: VECTOR ANALYZER: ANALOG DEMOD]
- [MODULATION PARAMETER: AF LOWPASS: 3 kHz:AF HIGHPASS: 300 Hz]
- set [DEMOD BW] and [IF BW] according to performance test report.

Evaluation: Check displayed PM RMS of modulation summary for compliance with performance test report.

### Carrier Power

Settings on SMHU: Modulation Off: level according to performance test report.

FSIQ settings:

- [LEVEL REF. - 4 dBm]
- [FREQUENCY CENTER: 1 GHz]
- [MODE: VECTOR ANALYZER: ANALOG DEMOD]
- [MEAS RESULT: AM SIGNAL: MODULATION SUMMARY]
- set [DEMOD BW] and [IF BW] according to performance test report.

Evaluation: Check displayed CARR PWR of modulation summary for compliance with performance test report.

### Audio Frequency Measurement

Settings on SMHU: FM INTERN, deviation and AF according to performance test report.

FSIQ settings:

- [LEVEL REF. - 4 dBm]
- [FREQUENCY CENTER: 1 GHz]
- [MODE: VECTOR ANALYZER: ANALOG DEMOD]
- [MEAS RESULT: FM SIGNAL: MODULATION SUMMARY]
- [MODULATION PARAMETER: AF HIGHPASS: OFF: AF LOWPASS OFF]
- set [DEMOD BW] and [IF BW] according to performance test report.

Evaluation: Check displayed AUDIO FREQ of modulation summary for compliance with performance test report.

### SINAD with AM

Settings on SMHU: AM INTERNAL 50 %, AF according to performance test report.

FSIQ settings:

- [LEVEL REF. -4 dBm]
- [FREQUENCY CENTER: 1 GHz]
- [MODE: VECTOR ANALYZER: ANALOG DEMOD]
- [MEAS RESULT: AM SIGNAL: MODULATION SUMMARY]
- [SUMMARY SETTINGS: SINAD: ON]
- [MODULATION PARAMETER: AF HIGHPASS: 300 Hz, AF LOWPASS:3 kHz]
- set [DEMOD BW] and [IF BW] according to performance test report.

Evaluation: Check displayed SINAD of modulation summary for compliance with performance test report.

**SINAD with FM**

Settings on SMHU: AM INTERN OFF,  
FM INTERN, deviation and AF according to performance test report.

FSIQ settings:

- [LEVEL REF. - 4 dBm]
- [FREQUENCY CENTER: 1 GHz]
- [MODE: VECTOR ANALYZER: ANALOG DEMOD]
- [MEAS RESULT: FM SIGNAL: MODULATION SUMMARY]
- [MODULATION PARAMETER: AF HIGHPASS: 300 Hz, AF LOWPASS: 3 kHz]
- set [DEMOD BW] and [IF BW] according to performance test report.

Evaluation: Check displayed SINAD of modulation summary for compliance with performance test report.

**SINAD with PM**

Settings on SMHU: FM INTERN OFF,  
FM INTERN ON, deviation and AF according to performance test report.

FSIQ settings:

- [LEVEL REF. - 4 dBm]
- [FREQUENCY CENTER: 1 GHz]
- [MODE: VECTOR ANALYZER: ANALOG DEMOD]
- [MEAS RESULT: PM SIGNAL: MODULATION SUMMARY]
- [MODULATION PARAMETER: AF HIGHPASS: 300 Hz, AF LOWPASS: 3 kHz]
- set [DEMOD BW] and [IF BW] according to performance test report.

Evaluation: Check displayed SINAD of modulation summary for compliance with performance test report.

**Audio Output Function**

Settings on SMHU: AM INTERN 50%, AF = 1 kHz

FSIQ settings:

- [LEVEL REF. -4 dBm]
- [FREQUENCY CENTER: 1 GHz]
- [MODE: VECTOR ANALYZER: ANALOG DEMOD]
- [MEAS RESULT: AM SIGNAL: REAL TIME ON]
- [DEMOD BW: 200 kHz: IF BW 1 MHz]
- [SENSITIV AF OUTPUT: 100%: VOLUME:---%] according to performance test report.

Evaluation: Carry out acoustic test according to performance test report.





Item No.	Characteristic	Test to page	Min. value	Actual value	Max. value	Unit
3	Return loss RF input RF ATT: 10 dB	1.5				
	<b>FSIQ26 / FSIQ40:</b>		FSIQ26/FSIQ40			
	7000 MHz		6 / 7,4	_____	-	dB
	8000 MHz		6 / 7,4	_____	-	dB
	9000 MHz		6 / 7,4	_____	-	dB
	10 GHz		6 / 7,4	_____	-	dB
	11 GHz		6 / 7,4	_____	-	dB
	12 GHz		6 / 7,4	_____	-	dB
	13 GHz		6 / 7,4	_____	-	dB
	14 GHz		6 / 7,4	_____	-	dB
	15 GHz		6 / 7,4	_____	-	dB
	16 GHz		6 / 7,4	_____	-	dB
	17 GHz		6 / 7,4	_____	-	dB
	18 GHz		6 / 7,4	_____	-	dB
	19 GHz		6 / 7,4	_____	-	dB
	20 GHz		6 / 7,4	_____	-	dB
	21 GHz		6 / 7,4	_____	-	dB
	22 GHz		6 / 7,4	_____	-	dB
	23 GHz		6 / 7,4	_____	-	dB
	24 GHz		6 / 7,4	_____	-	dB
	25 GHz		6 / 7,4	_____	-	dB
	26 GHz		6 / 7,4	_____	-	dB
	26.5 GHz		6 / 7,4	_____	-	dB
	<b>FSIQ40:</b>					
	27 GHz		7,4	_____	-	dB
	28 GHz		7,4	_____	-	dB
	29 GHz		7,4	_____	-	dB
	30 GHz		7,4	_____	-	dB
	31 GHz		7,4	_____	-	dB
	32 GHz		7,4	_____	-	dB
	33 GHz		7,4	_____	-	dB
	34 GHz		7,4	_____	-	dB
	35 GHz		7,4	_____	-	dB
	36 GHz		7,4	_____	-	dB
	37 GHz		7,4	_____	-	dB
	38 GHz		7,4	_____	-	dB
	39 GHz		7,4	_____	-	dB
	39,9 GHz		7,4	_____	-	dB

Item No.	Characteristic	Test to page	Min. value	Actual value	Max. value	Unit
4	1st IF image frequency rejection $f_{in}$  <b>FSIQ3:</b> 11 MHz 100 MHz 1701 MHz 3499 MHz  <b>FSIQ7 / FSIQ26 / FSIQ40:</b> 11 MHz 100 MHz 1701 MHz 3499 MHz 6999 MHz	1.8				
			80	_____	-	dB
			80	_____	-	dB
			80	_____	-	dB
			80	_____	-	dB
			80	_____	-	dB
			80	_____	-	dB
			80	_____	-	dB
			80	_____	-	dB
			80	_____	-	dB
			80	_____	-	dB
			5	2nd IF image frequency rejection $f_{in}$  <b>FSIQ3:</b> 999 MHz  <b>FSIQ7 / FSIQ26 / FSIQ40</b> 999 MHz 7999 MHz	1.9	
80	_____	-				dB
	_____	-				dB
80	_____	-				dB
80	_____	-				dB
80	_____	-				dB
6	1st IF rejection $f_{in}$  <b>FSIQ3:</b> 100 MHz 1701 MHz 3499 MHz  <b>FSIQ7 / FSIQ26 / FSIQ40:</b> 100 MHz 1701 MHz 3500 MHz  <b>FSIQ26 / FSIQ40:</b> 7001 MHz	1.9				
			100	_____	-	dB
			100	_____	-	dB
			100	_____	-	dB
			70	_____	-	dB
			70	_____	-	dB
			70	_____	-	dB
				_____	-	dB
			70	_____	-	dB
			70	_____	-	dB
70	_____	-	dB			

Item No.	Characteristic	Test to page	Min. value	Actual value	Max. value	Unit
7	3rd-order intercept $f_{in}$  <b>FSIQ3 / FSIQ7 /                      FSIQ26 / FSIQ40:</b> 10 MHz 28 MHz 106 MHz 261 MHz 640 MHz 1 GHz 1.7 GHz 2.5 GHz 3.48 GHz  <b>FSIQ7 / FSIQ26 / FSIQ40:</b> 6.98 GHz  <b>FSIQ26 / FSIQ40:</b> 7.5 GHz 15 GHz 25 GHz  <b>FSIQ40:</b> 30 GHz 35 GHz 39 GHz	1.10	3 / 7 , 26  9 / 14 97 / 14 12 / 14 12 / 14 12 / 17 12 / 17 12 / 17 12 / 17  12  12 12 12  10 10 10	  _____ _____ _____ _____ _____ _____ _____ _____  _____  _____ _____ _____  _____ _____ _____	  - - - - - - -  -  - - -  - - -	  dBm dBm dBm dBm dBm dBm dBm dBm  dBm  dBm dBm dBm  dBm dBm dBm
8	2nd-order harmonic distortion $f_{in}$  <b>FSIQ3 / FSIQ7 /                      FSIQ26 / FSIQ40:</b> 9 kHz 35 kHz 99 kHz 19 MHz 28 MHz 107 MHz 262 MHz 453 MHz 640 MHz 1 GHz 1.25 GHz 1.7 GHz  <b>FSIQ7 / FSIQ26 / FSIQ40:</b> 3.4 GHz	1.12	3 / 7 , 26  25 / 25 25 / 25 25 / 25 25 / 25 25 / 25 45 / 25 45 / 40 45 / 40 45 / 40 45 / 40 45 / 40 45 / 40 45 / 40  40	  _____ _____ _____ _____ _____ _____ _____ _____  _____  _____	  - - - - - - - - - - -  -	  dBm dBm dBm dBm dBm dBm dBm dBm dBm dBm dBm dBm dBm  dBm

Item No.	Characteristic	Test to page	Min. value	Actual value	Max. value	Unit
9	IF bandwidths Level error	1.14				
	reference (Ref): 5 kHz		-	_____	-	dBm
	100 Hz		-0,15	_____	+0,15	dB
	1 kHz		-0,15	_____	+0,15	dB
	2 kHz		-0,15	_____	+0,15	dB
	3 kHz		-0,15	_____	+0,15	dB
	10 kHz		-0,15	_____	+0,15	dB
	20 kHz		-0,15	_____	+0,15	dB
	30 kHz		-0,15	_____	+0,15	dB
	50 kHz		-1,0	_____	+1,0	dB
	100 kHz		-0,2	_____	+0,2	dB
	200 kHz		-0,2	_____	+0,2	dB
	300 kHz		-0,15	_____	+0,15	dB
	500 kHz		-0,2	_____	+0,2	dB
	1 MHz		-0,3	_____	+0,3	dB
	2 MHz		-0,3	_____	+0,3	dB
	3 MHz		-0,3	_____	+0,3	dB
5 MHz	-0,3	_____	+0,3	dB		
10 MHz	-0,3	_____	+0,3	dB		
10	IF bandwidths 3-dB bandwidth	1.15				
	100 Hz		-10 %-	_____	+10 %	-
	1 kHz		-10 %-	_____	+10 %	-
	2 kHz		-10 %-	_____	+10 %	-
	3 kHz		-10 %-	_____	+10 %	-
	5 kHz		-10 %-	_____	+10 %	-
	10 kHz		-10 %-	_____	+10 %	-
	20 kHz		-10 %-	_____	+10 %	-
	30 kHz		-10 %-	_____	+10 %	-
	50 kHz		-10 %-	_____	+10 %	-
	100 kHz		-10 %-	_____	+10 %	-
	200 kHz		-10 %-	_____	+10 %	-
	300 kHz		-10 %-	_____	+10 %	-
	500 kHz		-10 %-	_____	+10 %	-
	1 MHz		-10 %-	_____	+10 %	-
	2 MHz		-10 %-	_____	+10 %	-
	3 MHz		-10 %-	_____	+10 %	-
5 MHz	-15 %-	_____	+15 %	-		
10 MHz	-10 %-	_____	+25 %	-		

Item No.	Characteristic	Test to page	Min. value	Actual value	Max. value	Unit
11	IF bandwidths Shape factor	1.16				
	100 Hz		-	_____	6	-
	1 kHz		-	_____	12	-
	2 kHz		-	_____	12	-
	3 kHz		-	_____	12	-
	5 kHz		-	_____	12	-
	10 kHz		-	_____	12	-
	20 kHz		-	_____	12	-
	30 kHz		-	_____	12	-
	50 kHz		-	_____	12	-
	100 kHz		-	_____	12	-
	200 kHz		-	_____	12	-
	300 kHz		-	_____	12	-
	500 kHz		-	_____	12	-
	1 MHz		-	_____	12	-
	2 MHz		-	_____	12	-
	3 MHz		-	_____	7	-
	5 MHz		-	_____	7	-
	10 MHz		-	_____	7	-
12	LO feedthrough	1.17	-	_____	-20	dBm

Item No.	Characteristic	Test to page	Min. value	Actual value	Max. value	Unit	
13	Noise display $f_n$	1.17					
	<b>FSIQ3:</b>						
	20 Hz		-	_____	-80	dBm	
	1 kHz		-	_____	-110	dBm	
	9.9 kHz		-	_____	-125	dBm	
	95 kHz		-	_____	-135	dBm	
	999 kHz		-	_____	-145	dBm	
	9.99 MHz		-	_____	-145	dBm	
	19.99 MHz		-	_____	-145	dBm	
	49.99 MHz		-	_____	-145	dBm	
	99.99 MHz		-	_____	-145	dBm	
	199.99 MHz		-	_____	-145	dBm	
	499.99 MHz		-	_____	-145	dBm	
	999.9 MHz		-	_____	-145	dBm	
	1999.9 MHz		-	_____	-145	dBm	
	3499.9 MHz		-	_____	-145	dBm	
	<b>FSIQ7:</b>						
	20 Hz		-	_____	-74	dBm	
	1 kHz		-	_____	-104	dBm	
	9.9 kHz		-	_____	-119	dBm	
	95 kHz		-	_____	-129	dBm	
	999 kHz		-	_____	-142	dBm	
	9.99 MHz		-	_____	-142	dBm	
	19.99 MHz		-	_____	-142	dBm	
	49.99 MHz		-	_____	-142	dBm	
	99.99 MHz		-	_____	-142	dBm	
	199.99 MHz		-	_____	-142	dBm	
	499.99 MHz		-	_____	-142	dBm	
	999.9 MHz		-	_____	-142	dBm	
	1999.9 MHz		-	_____	-142	dBm	
3499.9 MHz	-	_____	-142	dBm			
5999.9 MHz	-	_____	-142	dBm			
6999.9 MHz	-	_____	-139	dBm			
13	<b>FSIQ26:</b>	1.17					
	20 Hz		-	_____	-74	dBm	
	1 kHz		-	_____	-104	dBm	
	9.9 kHz		-	_____	-119	dBm	
	95 kHz		-	_____	-129	dBm	
	999 kHz		-	_____	-142	dBm	
	9.99 MHz		-	_____	-138	dBm	
	19.99 MHz		-	_____	-138	dBm	
	49.99 MHz		-	_____	-138	dBm	
	99.99 MHz		-	_____	-138	dBm	
	199.99 MHz		-	_____	-138	dBm	
	499.99 MHz		-	_____	-138	dBm	
	999.9 MHz		-	_____	-138	dBm	
	1999.9 MHz		-	_____	-138	dBm	
	3499.9 MHz		-	_____	-138	dBm	
	5999.9 MHz		-	_____	-138	dBm	
	6999.9 MHz		-	_____	-135	dBm	
	7199.9 MHz		-	_____	-138	dBm	
11999.9 MHz	-	_____	-138	dBm			
17999.9 MHz	-	_____	-138	dBm			
21999.9 MHz	-	_____	-135	dBm			
26399.9 MHz	-	_____	-135	dBm			

Item No.	Characteristic	Test to page	Min. value	Actual value	Max. value	Unit
13	<b>FSIQ40:</b> 20 Hz	1.17	-	_____	-74	dBm
	1 kHz		-	_____	-104	dBm
	9,9 kHz		-	_____	-119	dBm
	95 kHz		-	_____	-129	dBm
	999 kHz		-	_____	-142	dBm
	9,99 MHz		-	_____	-138	dBm
	19,99 MHz		-	_____	-138	dBm
	49,99 MHz		-	_____	-138	dBm
	99,99 MHz		-	_____	-138	dBm
	199,99 MHz		-	_____	-138	dBm
	499,99 MHz		-	_____	-138	dBm
	999,9 MHz		-	_____	-138	dBm
	1999,9 MHz		-	_____	-138	dBm
	3499,9 MHz		-	_____	-138	dBm
	5999,9 MHz		-	_____	-138	dBm
	6999,9 MHz		-	_____	-135	dBm
	7199,9 MHz		-	_____	-134	dBm
	11999,9 MHz		-	_____	-134	dBm
	17999,9 MHz		-	_____	-134	dBm
	21999,9 MHz		-	_____	-131	dBm
	26499,9 MHz		-	_____	-131	dBm
27000 MHz	-	_____	-120	dBm		
29999 MHz	-	_____	-120	dBm		
30000 MHz	-	_____	-116	dBm		
35000 MHz	-	_____	-116	dBm		
40000 MHz	-	_____	-116	dBm		
14	Frequency response RF attenuation (a <sub>ATT</sub> ): <b>FSIQ3 / FSIQ7 / FSIQ26 / FSIQ40:</b> 120 MHz (absolute error)	1.18	10 dB	_____	+0,2	dB
	$f_{\text{resp}}$ 1 MHz		-0,3	_____	+0,3	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
	2200 MHz		-0,3	_____	+0,3	dB
	2500 MHz		-1	_____	+1	dB
	3000 MHz		-1	_____	+1	dB
3499 MHz	-1	_____	+1	dB		



Item No.	Characteristic	Test to page	Min. value	Actual value	Max. value	Unit
14	<b>FSIQ7 / FSIQ26 / FSIQ40:</b> 4000 MHz 4500 MHz 5000 MHz 5500 MHz 6000 MHz 6500 MHz 6999 MHz	1.18	-1 -1 -1 -1 -1 -1 -1	_____ _____ _____ _____ _____ _____ _____	+1 +1 +1 +1 +1 +1 +1	dB dB dB dB dB dB dB
14	<b>FSIQ26 / FSIQ40:</b> 8000 MHz 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 26499 MHz	1.18	-2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2.5 -2.5 -2.5 -2.5 -2.5 -2.5 -2.5 -2.5 -2.5 -2.5	_____ _____	+2 +2 +2 +2 +2 +2 +2 +2 +2 +2 +2 +2 +2.5 +2.5 +2.5 +2.5 +2.5 +2.5 +2.5 +2.5 +2.5 +2.5	dB dB
14	<b>FSIQ40:</b> 27000 MHz 28000 MHz 29000 MHz 30000 MHz 31000 MHz 32000 MHz 33000 MHz 34000 MHz 35000 MHz 36000 MHz 37000 MHz 38000 MHz 39000 MHz 40000 MHz	1.18	-3 -3 -3 -3 -3 -3 -3 -3 -3 -3 -3 -3 -3 -3 -3	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____	+3 +3 +3 +3 +3 +3 +3 +3 +3 +3 +3 +3 +3 +3 +3	dB dB dB dB dB dB dB dB dB dB dB dB dB dB dB

Item No.	Characteristic	Test to page	Min. value	Actual value	Max. value	Unit					
14	Frequency response RF attenuation ( $a_{ATT}$ ): <b>FSIQ3 / FSIQ7 /</b> <b>FSIQ26 / FSIQ40:</b> 120 MHz (absolute error) $f_{resp}$ 1 MHz 10 MHz 50 MHz 100 MHz 200 MHz 300 MHz 400 MHz 500 MHz 600 MHz 700 MHz 800 MHz 900 MHz 1000 MHz 1500 MHz 2000 MHz 2200 MHz	1.18	20 dB	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____	+0,2	dB					
			-0,2		+0.45						
			-0.45		+0.45						
			-0.45		+0.45						
			-0.45		+0.45						
			-0.45		+0.45						
			-0.45		+0.45						
			-0.45		+0.45						
			-0.45		+0.45						
			-0.45		+0.45						
			-0.45		+0.45						
			-0.45		+0.45						
			-0.45		+0.45						
			-0.45		+0.45						
			-0.45		+0.45						
			-0.45		+0.45						
			-0.45		+0.45						
			-0.45		+0.45						
			14		Frequency response RF attenuation ( $a_{ATT}$ ): <b>FSIQ3 / FSIQ7 /</b> <b>FSIQ26 / FSIQ40:</b> 120 MHz (absolute error) $f_{resp}$ 1 MHz 10 MHz 50 MHz 100 MHz 200 MHz 300 MHz 400 MHz 500 MHz 600 MHz 700 MHz 800 MHz 900 MHz 1000 MHz 1500 MHz 2000 MHz 2200 MHz 2200 MHz		1.18	30 dB	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____	+0,2	dB
								-0,2		+0.45	
-0.45	+0.45										
-0.45	+0.45										
-0.45	+0.45										
-0.45	+0.45										
-0.45	+0.45										
-0.45	+0.45										
-0.45	+0.45										
-0.45	+0.45										
-0.45	+0.45										
-0.45	+0.45										
-0.45	+0.45										
-0.45	+0.45										
-0.45	+0.45										
-0.45	+0.45										
-0.45	+0.45										
-0.45	+0.45										

Item No.	Characteristic	Test to page	Min. value	Actual value	Max. value	Unit
14	Frequency response	1.18	40 dB			
	RF attenuation ( $a_{ATT}$ ):					
	<b>FSIQ3 / FSIQ7 /</b>					
	<b>FSIQ26 / FSIQ40:</b>					
	120 MHz		-0,2	_____	+0,2	dB
	(absolute error)					
	$f_{resp}$					
	1 MHz		-0.45	_____	+0.45	dB
	10 MHz		-0.45	_____	+0.45	dB
	50 MHz		-0.45	_____	+0.45	dB
	100 MHz		-0.45	_____	+0.45	dB
	200 MHz		-0.45	_____	+0.45	dB
	300 MHz		-0.45	_____	+0.45	dB
	400 MHz		-0.45	_____	+0.45	dB
	500 MHz		-0.45	_____	+0.45	dB
	600 MHz		-0.45	_____	+0.45	dB
	700 MHz		-0.45	_____	+0.45	dB
800 MHz	-0.45	_____	+0.45	dB		
900 MHz	-0.45	_____	+0.45	dB		
1000 MHz	-0.45	_____	+0.45	dB		
1500 MHz	-0.45	_____	+0.45	dB		
2000 MHz	-0.45	_____	+0.45	dB		
2200 MHz	-0.45	_____	+0.45	dB		
15	Display linearity	1.20				
	$a_{ATT}$					
	6 dB		9.8	_____	10.2	dB
	8 dB		7.8	_____	8.2	dB
	10 dB		5.8	_____	6.2	dB
	12 dB		3.8	_____	4.2	dB
	14 dB		1.8	Reference	2.2	dB
	16 dB		-	_____	-	-
	18 dB		-2.2	_____	-1.8	dB
	20 dB		-4.2	_____	-3.8	dB
	22 dB		-6.2	_____	-5.8	dB
	24 dB		-8.2	_____	-7.8	dB
	26 dB		-10.2	_____	-9.8	dB
	28 dB		-12.2	_____	-11.8	dB
	30 dB		-14.2	_____	-13.8	dB
	32 dB		-16.2	_____	-15.8	dB
	34 dB		-18.2	_____	-17.8	dB
	36 dB		-20.2	_____	-19.8	dB
	38 dB		-22.2	_____	-21.8	dB
	40 dB		-24.2	_____	-23.8	dB
	42 dB		-26.2	_____	-25.8	dB
	44 dB		-28.2	_____	-27.8	dB
	46 dB		-30.2	_____	-29.8	dB
	48 dB		-32.2	_____	-31.8	dB
	50 dB		-34.2	_____	-33.8	dB
	52 dB		-36.2	_____	-35.8	dB
	54 dB		-38.2	_____	-37.8	dB
	56 dB		-40.2	_____	-39.8	dB
	61 dB		-45.2	_____	-44.8	dB
	66 dB		-20.2	_____	-49.8	dB
	71 dB		-22.2	_____	-84.8	dB
	76 dB		-60.2	_____	-89.8	dB
	81 dB		-66.2	_____	-64.8	dB
86 dB	-71.0	_____	-69.0	dB		
91 dB	-76.0	_____	-74.0	dB		
96 dB	-81.0	_____	-79.0	dB		
101 dB	-86.0	_____	-84.0	dB		

Item No.	Characteristic	Test to page	Min. value	Actual value	Max. value	Unit
16	Attenuator (1-dB-attenuator off)  a <sub>ATT</sub> 70 60 50 40 30 20 10 0	1.21	-70.3 -60.3 -50.3 -40.1 -30.1 -20.1 -10.1 -0.3	_____ _____ _____ _____ _____ _____ _____ _____	-69.7 -59.7 -49.7 -39.9 -29.9 -19.9 -9.9 +0.3	dBm dBm dBm dBm dBm dBm dBm dBm
17	IF gain switching  Reference level 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm  -31 dBm -32 dBm -33 dBm -34 dBm -35 dBm -36 dBm -37 dBm -38 dBm -39 dBm	1.22	-10.2 -20.2 -30.2 -40.2 -50.2 -60.2  -41.2 -42.2 -43.2 -44.2 -45.2 -46.2 -47.2 -48.2 -49.2	_____ _____ _____ _____ _____ _____  _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____	-9.8 -19.8 -29.8 -39.8 -49.8 -59.8  -40.8 -41.8 -42.8 -43.8 -44.8 -45.8 -46.8 -47.8 -48.8	dBm dBm dBm dBm dBm dBm  dBm dBm dBm dBm dBm dBm dBm dBm dBm dBm dBm
18	Phase noise offset:  <b>FSIQ3:</b> 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz  <b>FSIQ7 / FSIQ26/ FSIQ40</b> 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	1.24	- - - - -  - - - - -	_____ _____ _____ _____ _____  _____ _____ _____ _____ _____	-87 -107 -120 -119 -138  -81 -100 -114 -113 -132	dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz  dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz
19	option tracking generator output level 0 dBm -3 dBm -6 dBm -10 dBm -20 dBm	1.26	-1 -4 -8 -12 -21	_____ _____ _____ _____ _____	+1 -2 -4 -8 -19	dBm dBm dBm dBm dBm

Item No.	Characteristic	Test to page	Min. value	Actual value	Max. value	Unit
20	option tracking generator frequency response 1 MHz to 1 GHz 1 GHz to 3.5 GHz 3.5 GHz to 7 GHz	1.26	-2 -3 -3	_____ _____ _____	2 3 3 (typ)	dBm dBm dBm
21	option tracking generator I/Q-modulator residual carrier imbalance quadrature offset	1.26	- -10 -7	_____ _____ _____	-49 -8 -5	dBm dBm dBm
22	Option external mixer output LO-level f <sub>Center</sub> 150.7414 GHz 160.7414 GHz 170.7414 GHz 180.7414 GHz 190.7414 GHz 200.7414 GHz 210.7414 GHz 220.7414 GHz 230.7414 GHz 240.7414 GHz 250.7414 GHz 260.7414 GHz 270.7414 GHz 280.7414 GHz 290.7414 GHz 300.7414 GHz 303.6586 GHz	1.28	12.5 12.5 12.5 12.5 12.5 12.5 12.5 12.5 12.5 12.5 12.5 12.5 12.5 12.5 12.5 12.5 12.5 12.5 12.5	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____	18.5 18.5 18.5 18.5 18.5 18.5 18.5 18.5 18.5 18.5 18.5 18.5 18.5 18.5 18.5 18.5 18.5 18.5 18.5	dBm dBm dBm dBm dBm dBm dBm dBm dBm dBm dBm dBm dBm dBm dBm dBm dBm dBm dBm dBm
23	Option 1 dB attenuator a <sub>ATT</sub> 20 19 18 17 16 15 14 13 12 11	1.29	-20.15 -19.15 -18.15 -17.15 -16.15 -15.15 -14.15 -13.15 -12.15 -11.15	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____	-19.85 -18.85 -17.85 -16.85 -15.85 -14.85 -13.85 -12.85 -11.85 -10.85	dBm dBm dBm dBm dBm dBm dBm dBm dBm dBm dBm
<b>Digital demodulation</b>						
24	Absolute accuracy of level display	1.30	-0.4	_____	+0.4	dB
25	Linearity of level display  a = 10 dB a = 30 dB a = 50 dB	1.30	-0.2 -0.85 -1.5	_____ _____ _____	+0.2 +0.85 +1.5	dB dB dB
26	Useful dynamic range GSM NADC FORWARD CH	1.31	67.3 72	_____ _____	- -	dB dB

Item No.	Characteristic	Test to page	Min. value	Actual value	Max. value	Unit
<b>Residual error - no FSK; FSIQ 3:</b>		1.32				
27	<b>GSM</b> EVM rms Magnitude error rms Phase Error rms Phase Error pk I/Q offset Freq error		- - - - - -1.45	_____ _____ _____ _____ _____ _____	1 1 0.5 2.1 0.2 1.45	% % ° ° % Hz
28	<b>NADC (PDC, TETRA)</b> EVM rms EVM pk Magnitude error rms I/Q offset Freq error		- - - - -0.22	_____ _____ _____ _____ _____	0.5 2.1 0.5 0.2 + 0.22	% % % % Hz
29	<b>PHS</b> EVM rms EVM pk Magnitude error rms I/Q offset Freq error		- - - - -1.06	_____ _____ _____ _____ _____	1 4.5 1 0.2 + 1.06	% % % % Hz
30	<b>IS95 CDMA FWD CH:</b> EVM rms: EVM pk: Magnitude error rms: I/Q offset: Freq error: RHO factor		- - - - -6.2 0.9995	_____ _____ _____ _____ _____ _____	2 9 2 0.2 + 6.2 -	% % % % Hz -
31	<b>IS95 CDMA REV CH:</b> EVM rms: EVM pk: Magnitude error rms: I/Q offset: Freq error: RHO factor		- - - - -6.2 0.9995	_____ _____ _____ _____ _____ _____	2 9 2 0.2 + 6.2 -	% % % % Hz -
32	<b>W-CDMA 4.096 FWD CH:</b> EVM rms: EVM pk: Magnitude error rms: I/Q offset: Freq error: RHO factor		- - - - -20 0.9995	_____ _____ _____ _____ _____ _____	2 9 2 0.2 + 20 -	% % % % Hz -

Item No.	Characteristic	Test to page	Min. value	Actual value	Max. value	Unit
33	<b>QPSK 6.4M:</b>  EVM rms: EVM pk: Magnitude error rms: I/Q offset: Freq error: RHO factor		- - - - <b>-20</b> <b>0.9995</b>	_____ _____ _____ _____ _____ _____	<b>2</b> <b>9</b> <b>2</b> <b>0.2</b> <b>+ 20</b> -	% % % % <b>Hz</b> -
<b>Residual error-no FSK; FSIQ7, FSIQ26, FSIQ40:</b>		1.32				
34	<b>GSM</b>  EVM rms: Magnitude error rms: Phase Error rms: Phase Error pk: I/Q offset: Freq error:		- - - - - <b>-2</b>	_____ _____ _____ _____ _____ _____	<b>1.4</b> <b>1,4</b> <b>0.7</b> <b>3</b> <b>0.28</b> <b>2</b>	% % ° ° % <b>Hz</b>
35	<b>NADC (PDC, TETRA)</b>  EVM rms: EVM pk: Magnitude error rms: I/Q offset: Freq error:		- - - - <b>-0.3</b>	_____ _____ _____ _____ _____	<b>0.7</b> <b>3</b> <b>0.7</b> <b>0.28</b> <b>+ 0.3</b>	% % % % <b>Hz</b>
36	<b>PHS</b>  EVM rms: EVM pk: Magnitude error rms: I/Q offset: Freq error:		- - - - <b>-1.4</b>	_____ _____ _____ _____ _____	<b>1.4</b> <b>6.3</b> <b>1.4</b> <b>0.28</b> <b>+ 1.4</b>	% % % % <b>Hz</b>
37	<b>IS95 CDMA FWD CH:</b>  EVM rms: EVM pk: Magnitude error rms: I/Q offset: Freq error: RHO factor		- - - - <b>-8.7</b> <b>0.9993</b>	_____ _____ _____ _____ _____ _____	<b>2.8</b> <b>12.7</b> <b>2.8</b> <b>0.28</b> <b>+ 8.7</b> -	% % % % <b>Hz</b> -
38	<b>IS95 CDMA REV CH:</b>  EVM rms: EVM pk: Magnitude error rms: I/Q offset: Freq error: RHO factor		- - - - <b>-8.7</b> <b>0.9993</b>	_____ _____ _____ _____ _____ _____	<b>2.8</b> <b>12.7</b> <b>2.8</b> <b>0.28</b> <b>+ 8.7</b> -	% % % % <b>Hz</b> -

Item No.	Characteristic	Test to page	Min. value	Actual value	Max. value	Unit
39 (FSIQ7 only)	<b>W-CDMA 4.096 FWD CH:</b> EVM rms: EVM pk: Magnitude error rms: I/Q offset: Freq error: RHO factor		- - - - -20 0.9995	_____ _____ _____ _____ _____ _____	2 9 2 0.2 + 20 -	% % % % Hz -
40 (FSIQ7 only)	<b>QPSK 6.4M:</b> EVM rms: EVM pk: Magnitude error rms: I/Q offset: Freq error: RHO factor		- - - - -20 0.9995	_____ _____ _____ _____ _____ _____	2 9 2 0.2 + 20 -	% % % % Hz -
<b>Residual error FSK; FSIQ 3:</b>		1.36				
41	<b>ERMES:</b> Magnitude error rms: FSK Dev Error rms FSK DEV of nom. Frequency error		- - -70.3 -23.4	_____ _____ _____ _____	1 93.8 70.3 23.4	% Hz Hz Hz
42	<b>CT2:</b> Magnitude error rms: FSK Dev Error rms FSK DEV of nom. Frequency error		- - -270 -90	_____ _____ _____ _____	1 270 270 90	% Hz Hz Hz
43	<b>DECT:</b> Magnitude error rms: FSK Dev Error rms FSK DEV of nom. Frequency error		- - -5.76 -1.44	_____ _____ _____ _____	2 5.76 5.76 1.44	% kHz kHz kHz
<b>Residual error FSK; FSIQ7, FSIQ26, FSIQ40</b>		1.36				
44	<b>ERMES:</b> Magnitude error rms: FSK Dev Error rms FSK DEV of nom. Frequency error		-- - -98.4 -32.7	_____ _____ _____ _____	1.4 131.3 98.4 32.7	% Hz Hz Hz
45	<b>CT2:</b> Magnitude error rms: FSK Dev Error rms FSK DEV of nom. Frequency error		-- -- -378 -126	_____ _____ _____ _____	1.4 378 378 126	% Hz Hz Hz



Item No.	Characteristic	Test to page	Min. value	Actual value	Max. value	Unit
46	<b>DECT:</b> Magnitude error rms: FSK Dev Error rms FSK DEV of nom. Frequency error		- - -8 -2	_____ _____ _____ _____	2.8 8 8 2	% kHz kHz kHz
<b>Analog demodulation</b>						
<i>All FSIQ models, measurements marked with *) with FSIQ3 only.</i>						
	<b>REAL TIME OFF</b>	1.37				
47	<b>Measurement error with AM demodulation</b>	1.37				
	DEMOM BW 5 kHz IF BW 30 kHz AF 500 Hz		47.5	.....	52.5	% AM
	DEMOM BW 200 kHz IF BW 1 MHz AF 10 kHz		47.5	.....	52.5	% AM
	Demod BW 2 MHz IF BW 10 MHz AF 50 kHz		47.5	.....	52.5	% AM
48	<b>Spurious AM</b>	1.37				
	DEMOM BW 5 kHz IF BW: 30 kHz		--	.....	0.2	% AM
	DEMOM BW 200 kHz IF BW 1MHz		--	.....	0.28	% AM
	DEMOM BW 2 MHz IF BW: 10 MHz		--	.....	0.89	% AM
49	<b>Measurement error with FM Demodulation</b>	1.38				
	DEMOM BW 200 kHz IF BW 1 MHz AF 1kHz $\Delta f=40$ kHz		38	.....	42	kHz
	Demod BW 2 MHz IF BW 10 MHz AF 100 kHz $\Delta f= 200$ kHz		190	.....	210	kHz
50	<b>Spurious FM *)</b>	1.38				
	DEMOM BW: 200 kHz IF BW: 1 MHz		--	.....	10	Hz
51	<b>Measurement error with PM Demodulation</b>	1.38				
	DEMOM BW: 500 kHz IF BW: 3 MHz Phasenhub= 10 rad AF= 1kHz		9.5	.....	10.5	rad

Item No.	Characteristic	Test to page	Min. value	Actual value	Max. value	Unit
52	<b>Spurious PM *)</b>	1.38				
	DEMOD BW: 5 kHz IF BW: 30 kHz		--	.....	0.03	rad
	DEMOD BW: 200 kHz IF BW: 1 MHz		--	.....	0.03	rad
53	<b>Carrier Power</b>	1.39				
	DEMOD BW: 200 kHz IF BW: 1 MHz Level: -10 dBm		-11.5	.....	-8.5	dBm
	DEMOD BW: 200 kHz IF BW: 1 MHz Level: -50 dBm		-41.5	.....	-38.5	dBm
54	<b>Audio frequency measurement</b>	1.39				
	DEMOD BW: 5 kHz IF BW: 30 kHz Hub 2kHz, AF 10 Hz		9.993	.....	10.007	Hz
	DEMOD BW: 2 MHz IF BW: 1 MHz Hub 100 kHz, AF 100 kHz		99.9979	.....	100.003	kHz
	<b>REAL TIME ON</b>	1.39				
55	<b>Measurement error with AM Demodulation</b>	1.39				
	DEMOD BW 200 kHz IF BW 1 MHz AF 30 Hz		47.5	.....	52.5	% AM
	DEMOD BW 200 kHz IF BW 1 MHz AF 1k Hz		47.5	.....	52.5	% AM
	DEMOD BW 200 kHz IF BW 1 MHz AF 20 kHz		47.5	.....	52.5	% AM
56	<b>Spurious AM</b>	1.39				
	DEMOD BW 5 kHz IF BW: 30 kHz		--	.....	0.2	% AM
	DEMOD BW 200 kHz IF BW 1MHz		--	.....	0.28	% AM
57	<b>Measurement error with FM Demodulation</b>	1.40				
	DEMOD BW 200 kHz IF BW 1 MHz AF 30 Hz $\Delta f=40$ kHz		38	.....	42	kHz
	DEMOD BW 200 kHz IF BW 1 MHz AF 1KHz $\Delta f=40$ kHz		38	.....	42	kHz

Item No.	Characteristic	Test to page	Min. value	Actual value	Max. value	Unit
	DEMOD BW 200 kHz IF BW 1 MHz AF 20 KHz $\Delta f=40$ kHz		38	.....	42	kHz
58	<b>Spurious FM *)</b>	1.40				
	DEMOD BW: 200 kHz IF BW: 1 MHz		--	.....	10	Hz
59	<b>Measurement error with PM Demodulation</b>	1.41				
	DEMOD BW: 200 kHz IF BW: 1 MHz Phase deviation = 10 rad AF= 8 kHz		9.5	.....	10.5	rad
60	<b>Spurious PM *)</b>	1.41				
	DEMOD BW: 200 kHz IF BW: 1 MHz		--	.....	0.01	rad
61	<b>Carrier Power</b>	1.41				
	DEMOD BW: 200 kHz IF BW: 1 MHz Level: -10 dBm		-11.5	.....	-8.5	dBm
	DEMOD BW: 200 kHz IF BW: 1 MHz Level: - 40 dBm		-41.5	.....	-38.5	dBm
62	<b>Audio frequency measurement</b>	1.41				
	DEMOD BW: 10 kHz IF BW: 50 kHz AF 30 Hz		29.988	.....	30.012	Hz
	DEMOD BW: 200 kHz IF BW: 1 MHz AF: 20 kHz		19.9997	.....	20.0003	kHz
63	<b>SINAD with AM:</b> DEMOD BW: 200kHz IF BW: 1 MHz, AF= 1kHz	1.41	46	.....	--	db
64	<b>SINAD with FM:</b> $\Delta f=10$ kHz AF=1 kHz DEMOD BW: 200kHz IF BW: 1 MHz	1.42	50	.....	--	dB
65	<b>SINAD with PM:</b> Phase deviation= 10 rad AF= 1kHz DEMOD BW: 200kHz IF BW: 1 MHz	1.42	50	.....	--	dB

Item No.	Characteristic	Test to page	Min. value	Actual value	Max. value	Unit
66	<b>Function AUDIO output</b> Volume 0%	1.42	no audible tone	.....	--	--
	Volume 50 %		audible 1 kHz tone	.....	--	--
	<b>FSIQ7, FSIQ26, FSIQ40</b>					
	<b>REAL TIME OFF</b>					
67	<b>Spurious FM</b>	1.38				
	DEMOD BW: 200 kHz IF BW: 1 MHz		--	.....	20	Hz
68	<b>Spurious PM</b>	1.38				
	DEMOD BW: 5 kHz IF BW: 30 kHz		--	.....	0.06	rad
	DEMOD BW: 200 kHz IF BW: 1 MHz		--	.....	0.06	rad
	<b>REAL TIME ON</b>					
69	<b>Spurious FM</b>	1.40				
	DEMOD BW: 200 kHz IF BW: 1 MHz		--	.....	20	Hz
70	<b>Spurious PM</b>	1.41				
	DEMOD BW: 200 kHz IF BW: 1 MHz		--	.....	0.02	rad

# **Contents - Chapter 2 "Adjustment"**

**2 Adjustment..... 2.1**



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## 2 Adjustment

All boards have been adjusted before being supplied and do not require readjustment after a board replacement in the instrument.

The correction and setting data for the boards are contained in an EEPROM on each board and are thus replaced with board replacement.

Switch off the instrument before replacing a board.

Some boards provide additional adjustment facilities which should be checked with servicing:

- Fracsyn: adjustment for calibration level -40dBm
- RF-Converter Unit: adjustment of the YIG oscillator characteristic and dynamic
- MW-Converter Unit: adjustment of the YIG filter characteristic and dynamic
- 2nd IF-Converter: no adjustment
- IF filter: no adjustment, all values are determined with calibration
- Detector: no adjustment
- LowPhaseNoise: no adjustment

Adjustment of the reference frequency is explained in Section 8 (Maintenance) of the Operating Manual.





## Contents - Chapter 3 "Function Description/Selftest"

### 3 Function Description/Selftest

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## 3 Function Description/Selftest

This chapter describes the design of the FSIQ and simple measures for monitoring the function of the instrument. A selftest is available for troubleshooting and diagnosis.

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

### Function Description of Overall Instrument

This section informs on the theory of operation of this instrument.

#### Modules of the Analog Unit

All modules of the analog unit contain an individually programmed EEPROM indicating the model and correction data, such as frequency response, filter parameters, insertion gain. The analog unit consists of the following modules:

- RF modules with RF converter and YIG sampler forming part of the RF module
- MW converter modules (for instruments with a frequency range > 7 GHz)
- 2nd IF converter
- IF filter
- Digital IF
- I/Q-demodulator
- Fracsyn with static transputer module
- Low phase noise
- Detector board with dynamic transputer module and DSP module
- Analog motherboard

#### Modules of the Digital Unit

The boards of the digital unit do not contain any particular correction data. The digital unit is independent of the type of instrument, the only difference is the amount and type of plug-in boards fitted such as network board or IEC/IEEE board. The digital unit consists of the following modules:

- Main processor
- Graphic board
- Digital motherboard (containing the interface drivers such as IEC bus, LPT and COM)
- Hard disk
- Floppy disk
- LC display
- Keypad
- VGA board
- Option 2nd IEEE-bus
- Option LAN interface

## Description of the Analog Unit

The FSIQ has been conceived as analyzer with triple conversion. Special importance has been attached to reaching high display dynamics, i.e., the individual amplifier stages have not only been trimmed to minimum displayed noise level but adjusted such that they provide good intermodulation characteristics with an acceptable noise factor.

The input signal passes a switchable input divider (attenuation range 0 to 70dB in steps of 10dB), which also switches the internal calibration and test signal.

In the RF converter, the signal (7.9414 to 14.9414 GHz ;FSIQ3: 4,3414 to 7,8414GHz) is converted to the 1st IF (7.9414, FSIQ3: 4.3414)), using the 1st LO after having passed the input lowpass in the 1st mixer. Following the 1st IF filter and the IF gain, the signal is converted to the 2nd IF of 741.4MHz.

By those FSIQ models having a frequency range greater than 7 GHz, the signal is divided, after the input divider, in a switchable diplexer. The portions of the signal below 7 GHz are further processed in the RF converter. The portions of the signal above 7 GHz are fed via a YIG filter to the MW converter. The conversion of the IF of 741.4 MHz takes place in this module. The LO required for the conversion comes from the RF converter and, depending on the frequency range, is either fed directly or via a doubler to the mixer.

The next module in the signal path is the 2nd IF Converter, which provides for conversion of the second IF to the third IF of 21.4 MHz and generation of the second and third LO. Apart from several amplifiers it contains a filter on 741.4 MHz with a 3-dB bandwidth of 10 MHz. This filter serves as resolution filter if the resolution bandwidth is 10 MHz and it reflects the image frequency which might be generated by the third conversion.

The resolution filters for bandwidths between 1 kHz and 5 MHz are located on the IF filter board . With the 10-MHz bandwidth, the filter stages of the board are bypassed. Crystal filters are used for bandwidths between 1 and 30 kHz, LC filters are provided for bandwidths of 50 kHz or above. The individual filter stages have been decoupled from each other by means of amplifiers which is why they act as Gaussian filter. Subsequent to the first two filter stages, switchable IF amplifiers (Step Gain) and two independent calibration amplifiers are fitted. The step gain can be switched in 0.1-dB steps from 0 to 50 dB and is used to amplify the signal on the reference level. One of the two calibration amplifiers is used to compensate for the deviations of amplification with different bandwidth or step-gain settings. This amplifier is controlled via the serial interface of the level transputer and a D/A converter on the IF filter board. The second calibration amplifier is controlled by an analog voltage, which is modified by the frequency transputer during the sweep according to the frequency response of the input stages.

The IF filters are followed by the log module, which provides for a dynamic of 110 dB. The video signal thus created is passed to the detector board. There, it is through-connected to the rear panel.

If resolution bandwidths are < 1kHz, the signal path via the log module remains unused. The signal is still filtered by the IF filter board to a bandwidth of 3 kHz, but then converted to a 25-kHz IF and filtered digitally on the module. An 18-bit A/D converter is provided on the digital IF for sampling with the 25-kHz IF.

A measuring A/D converter with a sampling rate of 20 MHz is provided on the detector board. Due to the high sampling rate of the A/D converter the analog peak detectors are not required, they are digitally simulated following the converter. Video filtering is carried out digitally, too, in the noise filter gate-array on the detector board. For video bandwidths  $\leq$  20 kHz, additional filtering is carried out using a DSP, which remains disabled above 20 kHz.

## Processor Structure

Apart from a pentium-CPU, the FSIQ is provided with four T805-32-bit transputers and a 16-bit transputer T225. Two DSPs are provided in the basic instrument for digital signal processing.

The pentium-CPU controls the complete data exchange with the periphery, such as keyboard entry, representation of the softkeys and operation via the IEC bus. The transputers independently control the test procedure, calculate correction factors and display the measuring curve on the screen. The transputers are provided with the current instrument settings by the pentium-CPU via a link adapter, which connects the ISA bus of the CPU board with a transputer link of the T805 on the graphic board (called GTP = graphic transputer in the following). Other transputer links couple the T225 and one T805 on the graphics board and the two T805 on the detector board (LTP = level transputer) and the Fracsyn (FTP = frequency transputer) to the GTP. T225 is exclusively used as interface between the GTP and the chipset for graphics.

### Tasks of the Level Transputer

The PTP receives the level-dependent settings from the graphic transputer and causes the corresponding switchovers in the hardware to be made via a serial interface. The PTP has the following functions: making the level-dependent settings such as attenuation of the attenuator, the bandwidths on the IF filter and level correction with the calibration frequency (120 MHz) and, on the other hand, programming of the DSPs, obtaining the measured values and passing the measured values to the graphic transputer via the transputer link. To meet these requirements, the PTP is provided with its individual serial bus to those boards which require level-dependent settings. I.e., the modules IF filter, digital IF, attenuator control board.

### Tasks of the Frequency Transputer

The FTP receives the current sweep setting from the graphic transputer via the PTP and calculates the required synthesizer settings. For settings which have to be made during a sweep, the FTP is fitted with a fast parallel bus on the fracyn module, which also addresses the sweep synthesizer. The subsequent settings have to be made: the frequency-dependent level correction, coarse tuning of the YIG oscillator and control of the sweep output. The fracyn module therefore accommodates D/A converters which are programmed parallelly during the sweep and which provide control voltages. The voltage for the sweep output is applied to the rear panel where it provides a sawtooth voltage which starts at 0V at the sweep start and increases to 10 V at the end of sweep. The voltage for frequency-response correction is passed to a voltage-controlled amplifier on the IF filter board which compensates for the frequency-dependent attenuation characteristic of the input stages. The third tuning voltage leads to the RF module where the main coil of the YIG oscillator which is integrated in the YIG sampler is controlled by means of a voltage-controlled current source, thus controlling the coarse tuning of the first LO. D/A converters which are required for options are provided in the basic FSIQ model. A serial bus is available for the FTP to use when controlling time-critical settings.

## Monitoring the Function of the FSIQ

### Switch-on Test

Following switch-on of the instrument a selftest of the processor functions is executed first. Subsequently, the transputer net is initialized, which adopts control of the analog modules.

### Monitoring of the Synthesizers and Signal Levels

The FSIQ is provided with a large amount of selftest points which can be switched to an A/D converter via multiplexer. Most of these test points are located on the analog modules and, by means of level detectors, allow for monitoring the levels in the signal path, the output levels of the LO drivers and the tuning voltages of the oscillators. The selftest voltages which are required for proper functioning, are additionally monitored by comparators. The output signals of these comparators are stored and checked by the level transputer during each request of a measured value. If one of these comparators responds, one of the following error messages is output:

Message	Meaning	see Section
Reference unlock	Reference oscillator not synchronized	"Error Messages of the Synthesizer"
LO UNL	First LO not synchronized	"Error Messages of the Synthesizer"
2nd/3rd LO unlock	Second and third LO not synchronized	"Error Messages of the Synthesizer"
Level 1st LO	LO level at first mixer too small	"Error Messages of the Synthesizer"
Level 2nd LO	LO level at second mixer too small	"Error Messages of the Synthesizer"
Level 3rd LO	LO level at third mixer too small	"Error Messages of the Synthesizer"
OVLD	Input signal too large	"Overload Messages"
IF OVLD	Signal following IF amplifier too large	"Overload Messages"

## Error Messages of the Synthesizer

When the message LO UNL is displayed, the instrument continues operating, however, the signals indicated may have been shifted on the frequency axis. In particular, when the instrument is operated at about the maximum or minimum operating temperature, it may occur, after ageing of the instrument, that the tuning voltage of the voltage-controlled oscillators drift at the limit of the permitted range. Therefore, correction of the pretuning is provided for the first LO (YIG oscillator) and the third LO (VCO) which is performed during total calibration of the instrument, thus eliminating the error. Correction is not required for the second LO, since it is obtained by multiplication of the third LO. For measuring accuracy reason, it is recommended with very cold or hot environment to call the total calibration of the instrument (after a warm-up period of at least 30 minutes).

When the message "Reference unlock" is output and if the analyzer is set to external reference, check that the latter is applied with the correct frequency and sufficient level at connector EXT REF IN/OUT. If the instrument is set to internal reference, the message should only occur during a short warm-up phase following switch-on.

The message Level Lo means that the level at the LO gate of one of the mixers is too low, which may lead to dips in the conversion attenuation. In any case, this message indicates a fault inside the instrument.

## Overload Messages

The messages OVLD and IF-OVLD indicate an overload in the signal path of the instrument. These messages are a warning that the instrument indication will seem to be wrong, because one stage in the signal path is operated with the 1-dB compression or above.

The message OVLD indicates that one stage preceding the variable IF amplifier is operated with an exceeded level. The level can only be reduced by an increased attenuation of the input attenuator (RF Attenuation). Overload at the input mixer and in the subsequent stages frequently occurs, if pulsed or highly modulated signals are applied. Such signals have a high peak value compared to the input bandwidth and this may lead to compression of these stages.

If this message is output without an input signal being applied, the input mixer is defective. The LO feedthrough (= the level display with input frequency zero) depends to a large extent on the balance of the input mixer. Since a partially faulty mixer becomes very unbalanced, thus providing very high LO feedthrough, this may lead to overload of the subsequent stages and thus to output of the message OVLD.

The message IF-OVLD indicates compression in one stage following the switchable IF amplifier. This can be remedied even with fixed input attenuation by increasing the reference level. In analyzer mode, the IF amplification depends on the reference level and the RF attenuation.

## Selftest

The selftest allows for checking the instrument functions without using additional test instruments. When an instrument error occurs, the module which caused the error is indicated on the screen. The following measures are taken to localize an error:

- An additional A/D converter is provided which allows for measuring voltages on the various modules.
- While the selftest is being performed, important dc voltages, on-board supply voltages and amplifier operating points are measured and compared to their rated values.
- Level detectors check the oscillator levels required for operating the mixers
- The calibration generator generates a 120-MHz signal with a level of 0 dBm at the RF input of the instrument. The on-board level detectors in the signal path allow for processing of the input signal in the individual RF and IF stages.

## Operation

Operation of the selftest is explained in the Operation Manual , Chapter 2, Section "Selftest Functions".

## Testing the Processor Functions

The test of the processor functions comprises testing of the interface chips and the dynamic RAM, test of the graphic board and the connected transputers.

If the CPU, the dynamic RAM or the hard disk are defective, the instrument may not be able any more to output a detailed error message.

## Testing the Synthesizers

Correct functioning of all oscillators is absolutely necessary for checking the signal path. Therefore, all synthesizer modules are checked next. The synthesizer modules are tested in the following order:

1. Test of the reference frequencies with 10 MHz and 120 MHz and the derived signals with 20, 30 and 60 MHz.
2. Measurement of the signals applied to the YIG sampler (output signal of fracsyn and output signal of sampler)
3. Test of the YIG main loop with the cutoff frequencies by measuring the YIG tuning voltage
4. Check of the LO levels and of the operating points of the LO drivers

In case of an error the selftest is aborted since it does not make sense measuring the signal path if e.g., no LO level is provided.



## Testing the Signal Path

Subsequently, the modules in the signal path are checked. The fracsyn module accommodates a 120-MHz calibration generator, the output power of which is checked using individual test points. This signal is connected into the signal path via a changeover switch in the input attenuator of the FSIQ. The test sequence is as follows:

1. Check of the RF attenuator
2. Check of the RF converter by testing the operating points of the amplifiers
3. Check of the 2nd IF converter by testing the operating point of the amplifier for the second IF and reading out of the level detectors in the signal path.
4. Check of the IF filters by testing the supply voltages for the individual filter circuits, the tuning voltages for the filter bandwidths and the level detectors.
5. Check of detector board

Though the selftest provides high measuring depth, it cannot be assumed that the module which has been found out to be faulty is always really faulty. A faulty cable, e.g., has the same effect as an interrupt in the input attenuator. Therefore, have the faulty function checked by an R&S servicing shop when an error message occurs.



**Contents - Chapter 4 "Software Update/Installing Options"**

**4 Software Update/Installing Options**

**New Installation of the FSIQ Software..... 4.1**

**Installing the Options ..... 4.2**



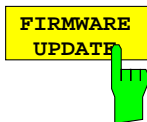
## 4 Software Update/Installing Options

This chapter contains information on extension and modification of the FSIQ. Additional manuals obtained together with a software/firmware update or with subsequently acquired options can be filed here.

### New Installation of the FSIQ Software


The installation of a new firmware version can be performed using the built-in diskette drive. The firmware update kit contains several diskettes. The installation program is called up in the *SETUP* menu.

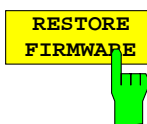
*CONFIGURATION SETUP* sidemenu:



The *FIRMWARE UPDATE* softkey starts the installation program and leads the user through the remaining steps of the update

Performing the update:

- Insert diskette 1 into the drive.
- Press the *SETUP* key.
- Press the menu change key  .  
The *SETUP* side menu is called
- Press the *FIRMWARE UPDATE* key.  
The update is started.



The *RESTORE FIRMWARE* softkey restores the previous firmware version

## Installing the Options

The following options are available with the FSIQ:

7 GHz Frequency Extension for FSIQ3	FSIQ-B2	1073.5044.02
Tracking Generator 3.5 GHz	FSE-B8	1066.4469.02
Tracking Generator 3.5 GHz with I/Q Modulator	FSE-B9	1066.4617.02
Tracking Generator 7 GHz	FSE-B10	1066.4769.02
Tracking Generator 7 GHz with I/Q Modulator	FSE-B11	1066.4917.02
Switchable Attenuator for Tracking Generator	FSE-B12	1066.5065.02
External Mixer Output for FSIQ26 and FSIQ40	FSE-B21	1084.7243.02
Ethernet Interface 15-contact AUI connector	FSE-B16	1073.5973.02
Thin-wire BNC connector	FSE-B16	1073.5973.03
2nd IEC/IEEE Bus Interface	FSE-B17	1066.4017.02

For retrofitting, please note the mounting instructions enclosed with the options. These mounting instructions can be filed at this place in the service manual and are thus easily available whenever they are required.

### Caution!



*Disconnect the instrument from the mains before opening the casing. Also note the safety instructions at the beginning of this manual.*

*The components used in the instrument are sensitive to electrostatic discharges which is why they are to be dealt with according to the ESD regulations.*

When installing hardware options note the following:

- Switch off instrument and pull the mains plug.
- Unscrew the rear feet on left and right
- Push the top and bottom cover backwards using a thin screwdriver.
- After installing the option replace the tube and fasten the rear panel feet again.



### Caution!

*When replacing the covers take care not to damage or pull off cables.*

- Switch on FSIQ.
- 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.

## Contents - Chapter 5 "Documents"

### 5 Documents

<b>Shipping of Instrument and Ordering of Spare Parts .....</b>	<b>5.1</b>
Shipping of Instrument.....	5.1
Shipping of a Module .....	5.1
Ordering Replacement Parts .....	5.2
Replaced Modules .....	5.2
Ordering and Delivery of Replaced Modules .....	5.2
Taking back Defective Replaced Modules .....	5.2
<b>Cable Exchange .....</b>	<b>5.3</b>
Available Power Cables .....	5.3
<b>Documents for FSIQ .....</b>	<b>5.5</b>





## 5 Documents

This chapter provides information on the ordering of spare parts and contains the documents for the FSIQ basic unit. The replacement of modules and the spare part list is described in the service manual, order number 1065.6016.24 (not included).

### Shipping of Instrument and Ordering of Spare Parts

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

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

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

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

### Shipping of Instrument

When shipping the instrument, be careful to provide for sufficient mechanical and antistatic protection

- Repack the instrument as it was originally packed when transporting or shipping. The two protective caps for the front and rear panels prevent the control elements and connectors from being damaged. The antistatic packing foil avoids any undesired electrostatic charging to occur.
- If you do not use the original packaging, provide for sufficient padding to prevent the instrument from slipping inside the package. Wrap antistatic packing foil around the instrument to protect it from electrostatic charging.

### Shipping of a Module

When shipping a module, then, also be also careful to provide for sufficient mechanical and antistatistical protection

- Ship the module in a sturdy, padded box.
- Wrap the board into antistatic foil.

If the packaging is only antistatic but not conductive, additional conductive packaging is required. The additional packaging is not required if the enclosed packaging is conductive.

Exception: If the module contains a battery, the tightly fitting packaging must always consist of antistatic, non-chargeable material to protect the battery from being discharged.

## Ordering Replacement Parts

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

- Stock number (see component lists in this chapter)
- Designation
- Component number according to component list
- Number of pieces
- Instrument type the replacement part belongs to
- Contact person for possible questions

The stock numbers necessary for ordering replacement parts and modules as well as power cables can be found further down.

## Replaced Modules

Replaced modules are an economic alternative for original modules. It should be kept in mind that replaced modules are not new, but repaired and fully tested parts. They may have traces from use but they are electrically and mechanically equivalent to new modules.

To find out which replaced modules are available, please refer to your Rohde & Schwarz representative (or to the central service division, Rohde & Schwarz Munich).

## Ordering and Delivery of Replaced Modules

For ordering replaced modules, the same indications as for ordinary parts are required.

## Taking back Defective Replaced Modules

Defective modules of the replacement program which can be repaired are taken back within **3 months** after delivery of the replaced module. A repurchasing value is credited.

Excluded are parts which can not be repaired, e.g. PCBs that are burnt, broken or damaged by repair attempts, incomplete modules, parts which are heavily damaged mechanically.

The defective parts must be sent back with a **returned accompanying document** containing the following information:

- Stock number, serial number and designation of the dismantled part,
- **Precise** description of the error,
- Stock number, serial number and designation of the instrument the part was dismantled from,
- Date of dismantling,
- Name of the technician who exchanged the part.

A returned accompanying document is provided with each replacement module.

## Cable Exchange

Table 5-1 at lists all power cables available. The stock numbers necessary for ordering replacement parts and modules can be found in the component lists further down.



### Important Note!

*When replacing a module please note the safety instructions and the repair instructions given in chapter 3 and at the beginning of this service manual.*

## Available Power Cables

Table 5-1 List of power cables available

Stock No.	Earthed-contact connector	Preferably used in
DS 006.7013	BS1363: 1967' complying with IEC 83: 1975 standard B2	Great Britain
DS 006.7020	Type 12 complying with SEV-regulation 1011.1059, standard sheet S 24 507	Switzerland
DS 006.7036	Type 498/13 complying with US-regulation UL 498, or with IEC 83	USA/Canada
DS 006.7107	Type SAA3 10 A, 250 V, complying with AS C112-1964 Ap.	Australia
DS 0025.2365 DS 0099.1456	DIN 49 441, 10 A, 250 V, angular DIN 49 441, 10 A, 250 V, straight	Europe (except Switzerland)

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## **Documents for FSIQ**

### **Overall Instrument**

Circuit Diagram