Signal Analyzer R&S FSIQ

Analysis in frequency, time and modulation domain in one box

- Spectrum analysis with ultrawide dynamic range for sophisticated ACPR measurements
  NF = 18 dB/TOI = +20 dBm
  (R&S FSIQ 7)
- Integrated vector signal analyzer for universal analysis of digital and analog modulated signals BPSK to 16QAM, (G)MSK, AM, FM, φM
- Vector signal analyzer for WCDMA/3GPP
- Symbol rate up to 6.4 Msymbol/s
- High-speed synthesizer with 5 ms sweep time for FULL SPAN
  (R&S FSIQ 3/7)
- High display update rate
  up to 25 sweeps/s
- Large colour display with high resolution (24 cm/9.5" TFT)
- 75 dB ACPR for WCDMA
- 82 dB ACPR in alternate channel for WCDMA
- True RMS detector for precise and repeatable measurements of any signal type

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R&S FSIQ – the signal analyzer for the 3rd mobile radio generation

Features in brief

- 3 models and frequency ranges
  R&S FSIQ3: 20 Hz to 3.5 GHz
  R&S FSIQ7: 20 Hz to 7 GHz
  R&S FSIQ26: 20 Hz to 26.5 GHz
- Resolution bandwidth 1 Hz to 10 MHz in 1/2/3/5 steps
- 5-pole resolution filters with high selectivity
- FFT filter with 1 Hz to 1 kHz RBW for fast measurements
- Displayed average noise floor –150 dBm typ. in 10 Hz bandwidth
- Third-order intercept
  +20 dBm with R&S FSIQ 7,
  +22 dBm with R&S FSIQ26
- Phase noise –150 dBc(1/Hz) at 5 MHz offset
- 75 dB ACPR dynamic range for WCDMA (4.096 MHz integration BW)
- Total level uncertainty <1 dB up to 2.2 GHz, <1.5 dB up to 7 GHz
- RMS detector for high-precision power measurements irrespective of waveform
- Fast spectrum analysis with 5 ms sweep time for full span (R&S FSIQ3/7)
- Fast time domain analysis with 1 µs zero span sweep time
- Integrated broadband vector signal analyzer for all main mobile radio standards and modulation modes with versatile result display: I and Q signal, magnitude and phase, vector and constellation diagrams, spread sheets with numeric evaluation of modulation errors and demodulated bit sequence

R&S FSIQ – the one-box solution in signal analysis

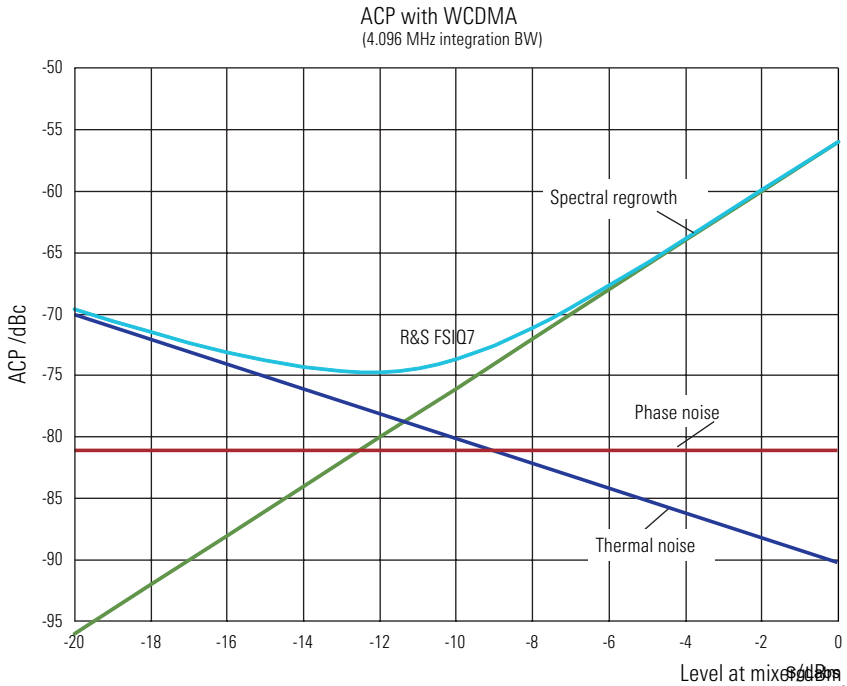
The R&S FSIQ provides in a single unit comprehensive and easy-to-use measurement functions in the

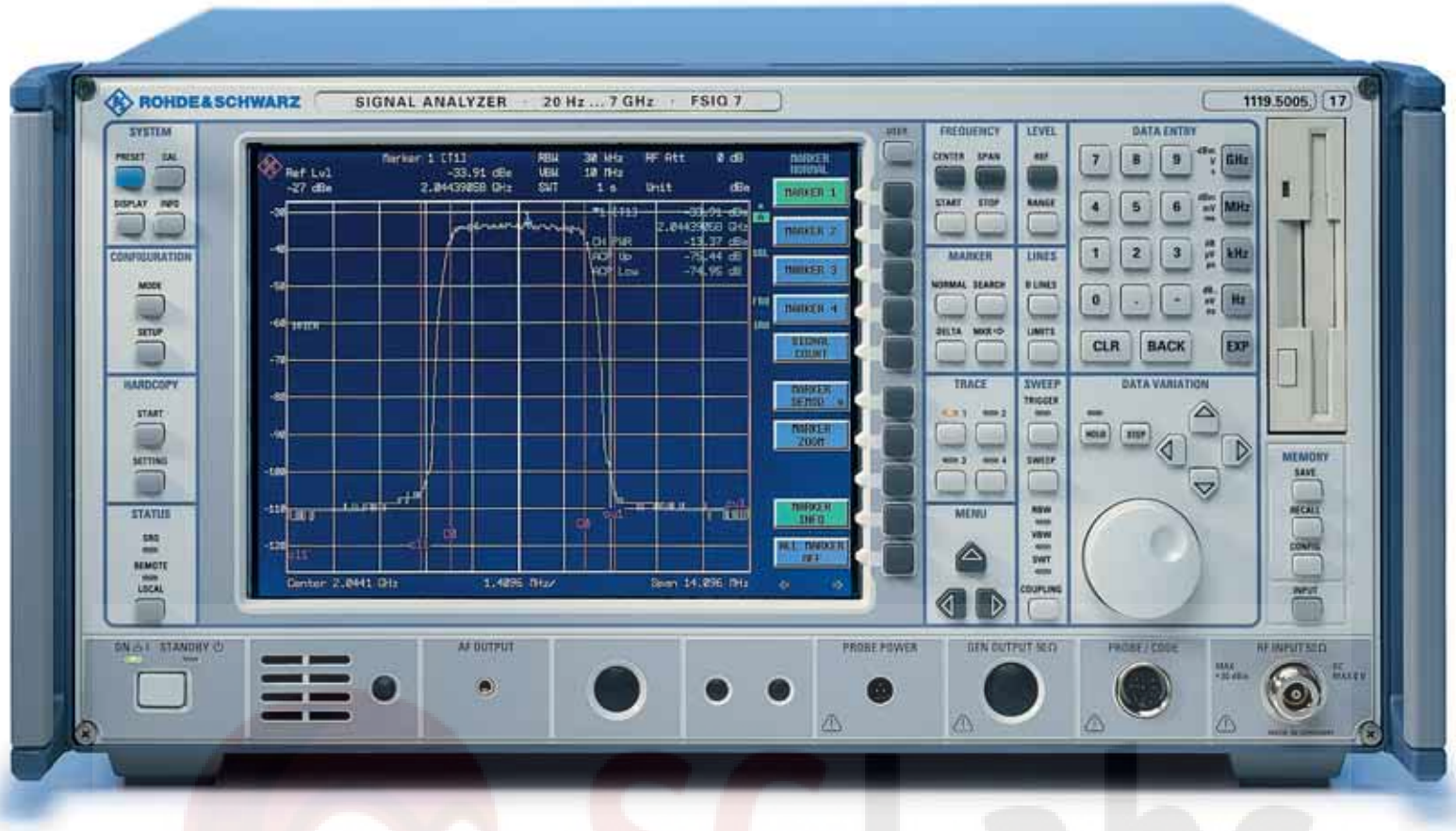
- frequency domain
- time domain
- modulation domain

Frequency domain

In the frequency domain, the R&S FSIQ measures intermodulation and harmonics with great accuracy. The high 3rd-order intercept point in conjunction with the extremely low noise floor yields an intermodulation-free dynamic range of >110 dB and ensures reliable performance of even sophisticated measurements. The excellent dynamic range and the optimized phase noise values make the R&S FSIQ an ideal tool for ACPR (adjacent-channel power ratio) measurements in all mobile radio systems and in particular for WCDMA. The maximum ACPR value for WCDMA in 4.096 MHz bandwidth is 75 dB and is already attained at –12 dBm input level.

The RMS detector available for all bandwidths up to 10 MHz is the ideal tool for precise power measurements whatever the waveform. Channel power and adjacent-channel power can accurately be measured and displayed irrespective of any signal statistics. Measurement challenges such as repeatability of power measurement of modulated signals (e.g. CDMA) can thus be eliminated.





Time domain

In the time domain, the R&S FSIQ features all modern capabilities of burst analysis in TDMA systems; gate functions, trigger delay and integrated RF trigger in conjunction with a short sweep time of 1 µs ensure precise measurement of the timing characteristics of all main mobile radio systems.

Thanks to the wide range of bandwidths available up to 10 MHz the effect of the measuring instrument becomes negligible, in particular in the case of measurements on broadband systems.

Various marker functions in conjunction with editable gated sweeps allow RMS, average and peak measurements to be carried out over any selectable time.

Modulation domain

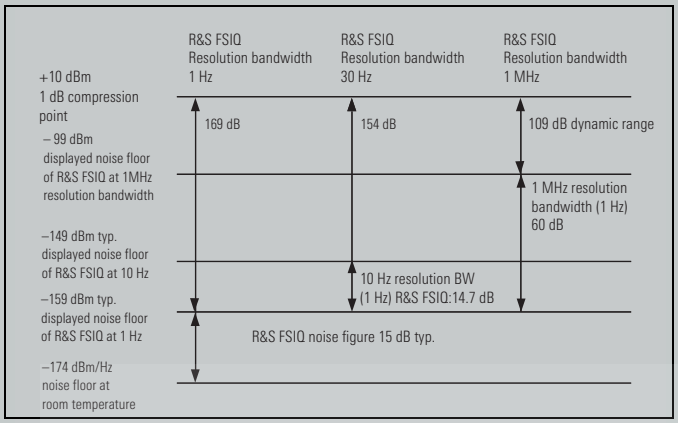
In the modulation domain, the integrated vector signal analyzer provides diverse measurements on signals with digital or analog modulation. The variety of settings that can be called simply at a keystroke covers 18 mobile radio standards from GSM, NADC, IS95 through to WCDMA. These convenient presettings make it superfluous for the user to spend valuable time in looking up specifications and go towards enhancing the measurement reliability.

Display of the results caters to practically each and every need: in addition to vector and constellation diagrams, I/Q signal and eye/trellis diagrams, tables with modulation errors including the demodulated bit sequence are particularly useful. EVM (error vector magnitude), phase and frequency error, waveform factor and I/Q offset are output as numeric values, with RMS and peak value being shown separately.

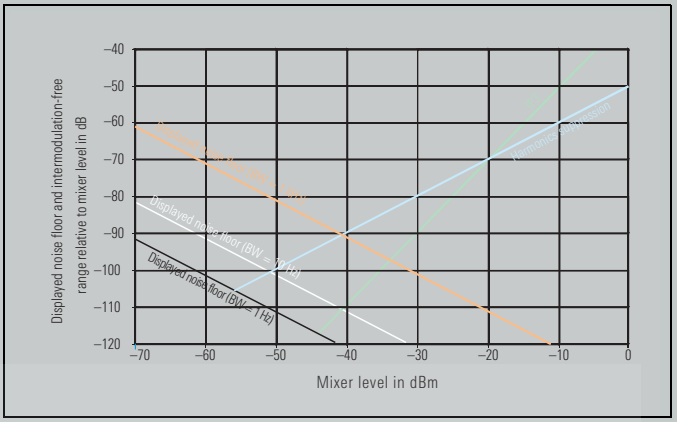
Besides the mobile radio standards, the R&S FSIQ can also be used as a general-purpose measurement demodulator for non-standard modulation methods. The list of the 13 digital demodulators available ranges from BPSK, QPSK and (G)MSK through to 16QAM. With a symbol rate selectable up to 6.4 Msymbol/s and cosine and root-cosine filters adjustable in 0.01 step width, configuration of customized systems is no problem.

The analog demodulators using digital technique throughout feature longterm and temperature-independent measurements, e.g. of transmitter transients, or convenient measurement of incidental phase modulation (AM to φM conversion) e.g. on travelling wave tubes.

R&S FSIQ – the signal analyzer for the 3rd mobile radio generation



Dynamic range, noise, and 1 dB compression point of Signal Analyzer R&S FSIQ



Dynamic range, noise, 3rd-order intercept point

High measurement speed for use in development and production

- The minimum sweep time for FULL SPAN is 5 ms (R&S FSIQ 3/7). The sweep is synthesizer-controlled for all frequency settings, thus providing high frequency accuracy of the displayed spectra
- The shortest sweep time in ZERO SPAN mode is 100 ns/div which is ideal for high-resolution time measurements on burst edges
- Up to 25 sweeps/s is an optimal prerequisite for applications in production or fast alignments
- High throughput on GPIB interface saves time and costs in production

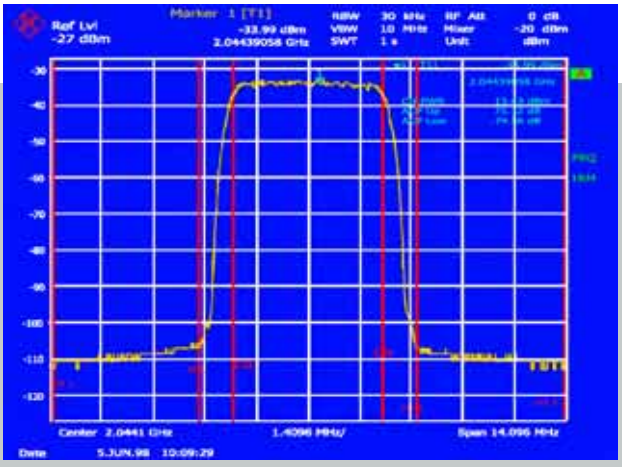
Versatile test routines – convenient measurements

The R&S FSIQ excels in its wide variety of sophisticated test routines and evaluation tools which considerably enhance measurement reliability and speed:

- Automatic measurement of channel power, adjacent-channel power ratio (ACPR) and occupied bandwidth with free choice of channel bandwidths and detector to be used. For the ACPR measurement the availability of an RMS detector is of vital importance especially with modern WCDMA systems
- Marker functions for direct measurement of:
  - phase noise
  - C/N, C/N_0
  - PEAK/NEXT PEAK (LEFT/RIGHT)/ MIN/NEXT MIN, etc
  - bandwidth and shape factor
- Frequency counter with selectable resolution
- Up to four simultaneously active traces
- Split screen with independent measurement windows: time domain analysis/frequency analysis, frequency analysis/modulation analysis, etc
- Level, frequency and threshold lines as well as user-definable limit lines with pass/fail check
- Comprehensive documentation of results with hardcopy output on a wide variety of printers or as WMF or BMP files
- High-contrast 24 cm (9.5") TFT colour display with VGA resolution and user-friendly display of all important instrument settings for reliable and strain-free work

Applications

Mobile radio – digital and analog



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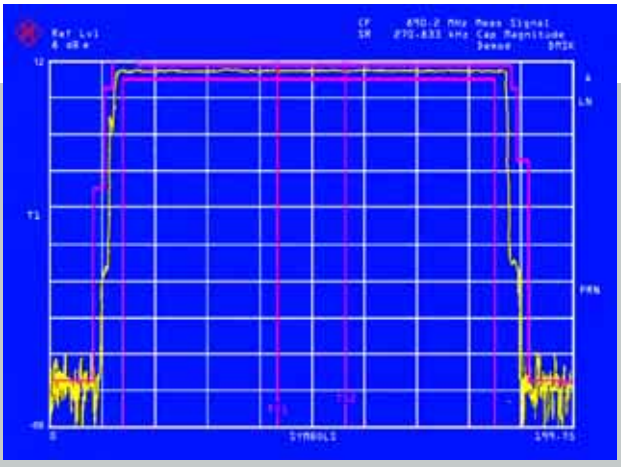

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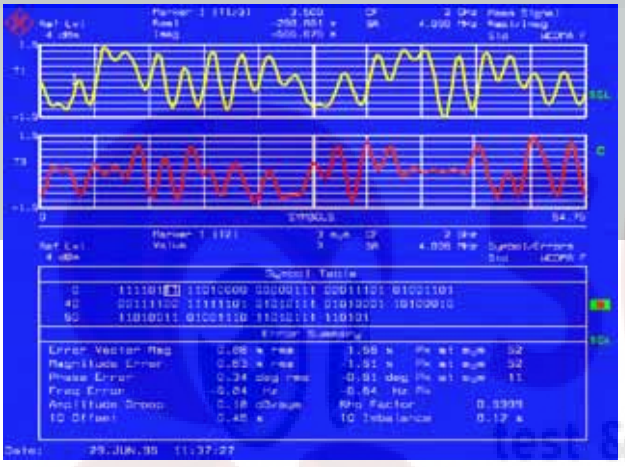

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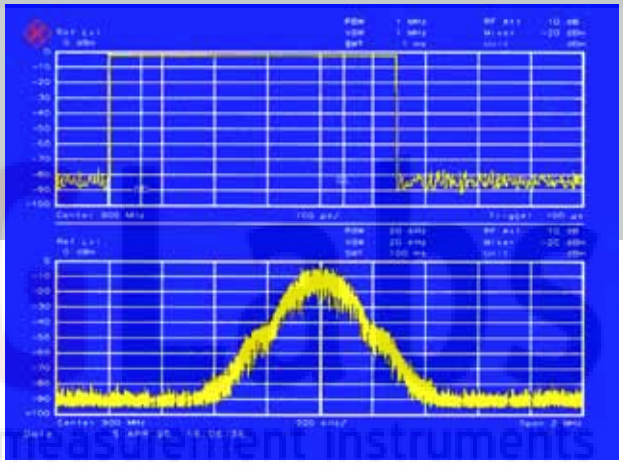

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WCDMA (1, 2)

Modern broadband communication systems place extremely stringent requirements on the spectral purity of all components. Phase noise, intermodulation and spurious suppression all play a role in the measurement of ACPR (adjacent-channel power ratio). The most stringent requirements are normally placed on the component characteristics. The R&S FSIQ is the ideal choice for this measurement; without any additional facility such as preselection it is able to attain an ACPR value of 75 dB at the optimum mixer level and power integration over 4.096 MHz (1). This excellent value is already attained at a mixer level of –12 dBm which means an additional benefit in component testing.

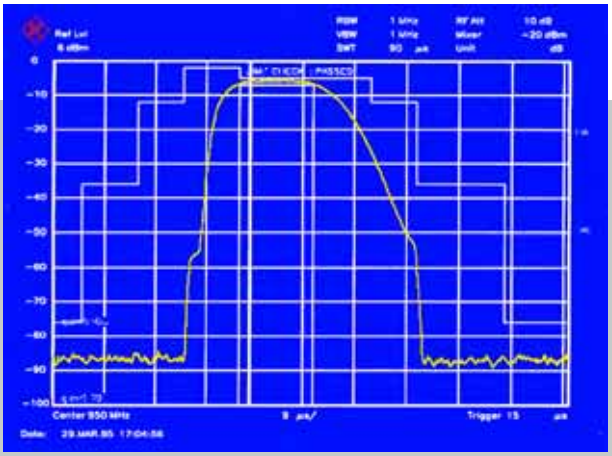
The integrated vector signal analyzer provides high-accuracy offline demodulation of the WCDMA signal so that signal distortion caused by the device under test can quickly and reliably be measured. The I and Q signal characteristics can precisely be measured with the aid of the marker functions (2 above). The numeric error table (2 below) shows all main modulation errors such as EVM or I/Q offset, with the demodulated bit sequence being displayed in addition. Coupled marker functions allow the I/Q signals to be allocated to the demodulated dibits (2).

Power ramp measurement (3)

To perform power ramp measurements (power time template) on TDMA systems such as GSM or NADC in line with standards, reference must be made to synchronization sequences in order to establish a precise time reference (3). The R&S FSIQ supports this task with a wide variety of already programmed as well as user-editable bit sequences.

GATED SWEEP (4)

The GATED SWEEP function in the frequency domain is indispensable for the analysis of TDMA systems. The modulation spectrum (4) of burst signals can be measured without any interference being caused by switching the RF carrier on and off. Imbalance of the modulator under test or spurious emissions can quickly and reliably be determined.



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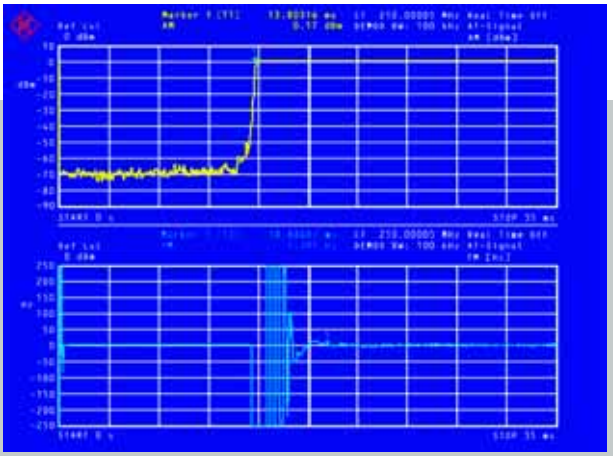

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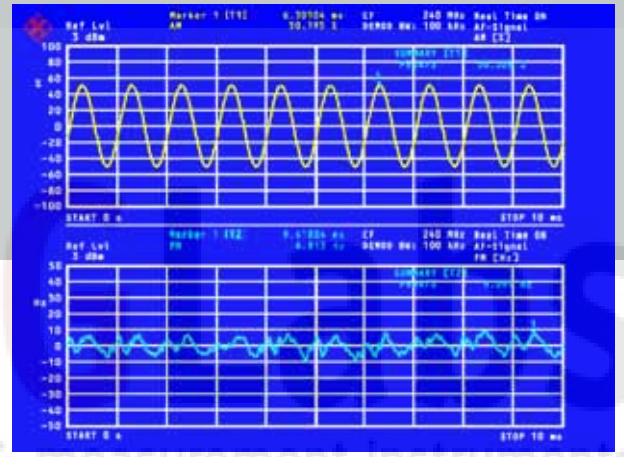
5 GAP SWEEP: simultaneous measurement of pulse rise and fall time with high time resolution

6 Measurement of transmitter transients with an FM squelch of –30 dB

7 Measurement of incidental frequency/phase modulation or AM/φM conversion with simultaneous display of AM and FM component



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GAP SWEEP (5): simultaneous measurement of pulse rise and fall time

The fast sweep time of 100 ns/div as well as the GAP SWEEP and pretrigger functions of the Signal Analyzer R&S FSIQ are the prerequisites for simultaneous measurement of the rise and fall time of an RF pulse with high time resolution. The center of the pulse, which is of no interest, is blanked. Even with a resolution bandwidth of 1 MHz the R&S FSIQ features a dynamic range of over 80 dB thanks to the high 1 dB compression point of +10 dBm.

Transmitter transients (6)

Simultaneous measurement of transmitter frequency and level transients is effectively supported by DC-coupled demodulators and selectable high resolution of the vertical axes (in this example 100 Hz/div). The SPLIT SCREEN mode detects level and deviation in separate windows with independently selectable parameters. Video trigger, trigger delay, pretrigger and squelch level can be adjusted for noise suppression in the absence of a signal level.

Measurement of incidental phase modulation, AM/φM conversion (7)

In many transmission systems, components such as amplifiers or modulators are operated close to saturation to improve their efficiency. The AM/φM conversion thus occurring causes errors in particular in digital phase-modulated systems.

The low incidental inherent modulation residues allow the AM/φM conversion to be measured up to high frequencies (e.g. 26.5 GHz with th R&S FSIQ26). The R&S FSIQ simultaneously displays the AM component (7 above) and the resulting FM or φM component (7 below). An AM signal with very low incidental FM/φM can be generated by means of I/Q modulation of the Tracking Generators R&S FSE-B9/-B11.

Designation	Type	Use	Functions
Noise Measurement[1] software	R&S FS-K3	Noise figure measurements	Measurement of noise figure and temperature to Y-factor method Measurements on frequency-converting DUTs Frequency range same as basic unit, starting from 100 kHz Editor for ENR tables Runs on the internal controller (option) or on an external PC under Windows 98/NT
Phase Noise Measurement Software[1]	R&S FS-K4	Phase noise measurements	Easy-to-use phase noise measurements Measurement of residual FM and φM Logarithmic plot over 8 decades Runs on the internal controller (option) or on an external PC under Windows 98/NT
Application Firmware[1]	R&S FSE-K10, Mobile R&S FSE-K11, BTS	Mobile radio transmitter measurements to GSM standards 11.10 and 11.20	Power ramp and power template Spectrum due to modulation and due to transients Spurious emissions Mean carrier power measurement Phase/frequency error (with option R&S FSE-B7)
Application Firmware[1][2]	R&S FSE-K20, Mobile R&S FSE-K21, BTS	EDGE capability added to Application Firmware R&S FSE-K10/-K11	Modulation accuracy measurement including – EVM measurement using weighting filter to ETSI – 95:th percentile measurement – Measurement of origin offset suppression Limit lines for EDGE according to ETSI 05.05
Application Firmware[1][3]	R&S FSE-K30, Mobile R&S FSE-K31, BTS	850 MHz extension for R&S FSE-K10/-K11 and R&S FSE-K20/-K21	Extension of frequency range for the GSM/EDGE 850 MHz band
Application Firmware[1]	FSIQ-K71[4], BTS	cdmaOne BTS code domain power measurements	Measurement of – code domain power – timing/phase offset – pilot channel power
Application Firmware[1]	FSIQ-K72[4], BTS FSIQ-K73[4], Mobile (User Equipment UE)	3GPP/FDD transmitter measurements according to TS 25.141 and TS 34.121	Measurement of – code domain power – EVM – peak code domain power – OBW – ACLR – spectrum emission mask – CCDF

1) See separate data sheets.
2) R&S FSE-K10/-K11 required.
3) R&S FSE-K10/-K11 required, for EDGE R&S FSE-K20/-K21 is additionally necessary.
4) R&S FSIQ-B70 required.

Quality management at Rohde&Schwarz

Lasting customer satisfaction is our primary objective. The quality management system of Rohde & Schwarz meets the requirements of ISO 9001 and encompasses virtually all fields of activity of the company.

Certified Quality System
ISO 9001
DQS REG. NO 1954

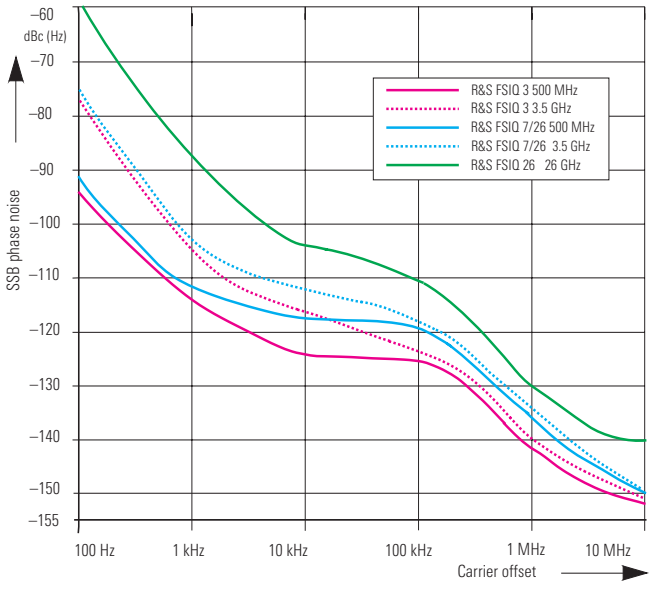
Certified Environmental System
ISO 14001
REG. NO 1954

Rear view of R&S FSIQ

Specifications

	R&S FSIQ3	R&S FSIQ7	R&S FSIQ26
Specifications apply under the following conditions: 30 minutes warmup time at ambient temperature, specified environmental conditions met, calibration cycle adhered to, and total calibration performed. Data without tolerances: typical values only. Data designated "nominal" apply to design parameters and are not tested.			
Frequency			
Frequency range	20 Hz to 3.5 GHz	20 Hz to 7 GHz	20 Hz to 26.5 GHz
Frequency resolution	0.01 Hz		
Reference frequency, internal nominal			
Aging per day [1]	1×10^{-9}		
Aging per year [1]	2×10^{-7}		
Temperature drift (0°C to +50°C)	8×10^{-8}		
Total error (per year)	2.5×10^{-7}		
External reference frequency	10 MHz or n x 1 MHz, n = 1 to 16		
Frequency display	with marker or frequency counter		
Resolution	0.1 Hz to 10 kHz (dependent on span)		
Error limit (sweep time >3 x auto sweep time)	±(marker frequency x reference error + 0.5% x span + 10% x resolution bandwidth + ½ (last digit))		
Frequency counter resolution	0.1 Hz to 10 kHz (selectable)		
Count accuracy (S/N >25 dB)	±(frequency x reference error + ½ (last digit))		
Display range for frequency axis	0 Hz, 10 Hz to 3.5 GHz	0 Hz, 10 Hz to 7 GHz	0 Hz, 10 Hz to 27 GHz
Resolution/error limit of display range	0.1 Hz/1%		
Display range with digital demodulation Number of displayed symbols			
Symbol rate ≤1 MHz	max. 1600 symbols (4 points per symbol)		
Symbol rate >1 MHz to <3.2 MHz	½ x symbol rate / MHz x 1000 symbols in steps of 100 symbols		
Symbol rate ≥3.2 MHz	max. 1600 symbols (4 points per symbol)		
Display range with analog demodulation	3500/(demodulation bandwidth/Hz) s		
Spectral purity (dBc(1Hz)) SSB phase noise, f ≤500 MHz, for carrier offset >1 MHz see diagram below			
Carrier offset 100 Hz	< –87	< –81	< –81
1 kHz	<–107	<–100	<–100
10 kHz	<–120	<–114	<–114
100 kHz [2]	<–119	<–113	<–113
1 MHz [2]	<–138	<–132	<–132
Sweep			
Display range 0 Hz	1 ms to 2500 s in 5% steps		
Display range ≥10 Hz	5 ms to 16000 s in steps ≤10%		
Error limit	<1%		
Sampling rate	50 ns (20 MHz A/D converter)		
Number of pixels (x axis)	500		
Time measurement	with marker and cursor lines (resolution 50 ns)		

SSB phase noise of the R&S FSIQ models



	R&S FSIQ3	R&S FSIQ7	R&S FSIQ26
Resolution bandwidths with spectrum display			
Analog filters			
3 dB bandwidths	1 Hz to 10 MHz in 1/2/3/5 steps		
Bandwidth error limit			
≤3 MHz	<10%		
5 MHz	<15%		
10 MHz	+25%, –10%		
Shape factor 60 dB:3 dB			
<1 kHz	<6		
1 kHz to 2 MHz	<12		
>2 MHz	<7		
Video bandwidths	1 Hz to 10 MHz in 1/2/3/5 steps		
FFT filters			
3 dB bandwidths	1 Hz to 1 kHz in 1/2/3/5 steps		
Bandwidth error limit	2%, nominal		
Shape factor 60 dB:3 dB	2.5 nominal		
Display range for frequency axis	min. 25 x RBW, max. 100000 x RBW or 2 MHz (whichever is lower)		
Additional level error limit (ref. to RBW = 5 kHz)	<1 dB		
Max. display range	100 dB		
Inherent spurious response	<–100 dBm		
Level			
Display range	displayed noise floor to 30 dBm		
Maximum input level			
RF attenuation 0 dB			
DC voltage	0 V		
CW RF power	20 dBm (=100 mW)		
Pulse spectral density	97 dBµV/MHz		
RF attenuation ≥10 dB			
DC voltage	0 V		
CW RF power	30 dBm (= 1 W)		
Max. pulse voltage	150 V		
Max. pulse energy (10 ms)	1 mWs		0.5 mWs
1 dB compression of input mixer (0 dB RF attenuation)	+10 dBm nominal		
Intermodulation			
3rd-order Intercept (TOI) Intermodulation-free dynamic range, level 2 x –30 dBm, Δf >5 x RBW or 10 kHz, whichever is greater	>64 dBc for f >100 MHz (TOI >12 dBm, 18 dBm typ.)	>70 dBc for f >150 MHz (TOI >15 dBm, 20 dBm typ.)	>74 dBc for f >150 MHz (TOI >17 dBm, 22 dBm typ.) >60 dBc for f >7 GHz (TOI >10 dBm)
Second harmonic intercept point (SHI)	>25 dBm, >40 dBm typ. for f <50 MHz >45 dBm, >50 dBm typ. for f >50 MHz	>25 dBm, >35 dBm typ. for f <150 MHz >40 dBm, >45 dBm typ. for f >150 MHz	
Displayed average noise level (DANL) (0 dB RF attenuation, RBW 10 Hz, VBW 1 Hz, 20 averages, trace average, span 0 Hz, termination 50 Ω)			
Frequency 20 Hz	<–80 dBm	<–74 dBm	
1 kHz	<–110 dBm	<–104 dBm	
10 kHz	<–125 dBm	<–119 dBm	
100 kHz	<–135 dBm	<–129 dBm	
1 MHz	<–145 dBm, –150 dBm typ.	<–142 dBm, –145 dBm typ.	
10 MHz to 6 GHz	<–145 dBm, –150 dBm typ.	<–142 dBm, –147 dBm typ.	<–138 dBm, –140 dBm typ.
6 GHz to 7 GHz	–	<–139 dBm	<–135 dBm, –138 dBm typ.
7 GHz to 18 GHz	–	–	<–138 dBm, –140 dBm typ.
18 GHz to 26.5 GHz	–	–	<–135 dBm, –138 dBm typ.
Maximum dynamic range 1 dB compression to DANL (RBW 1Hz)	170 dB	165 dB	
Immunity to interference			
Image rejection	>80 dB, >90 dB typ.		
Intermediate frequency	>100 dB	>75 dB	

	R&S FSIQ3	R&S FSIQ7	R&S FSIQ26
Spurious response (f >1 MHz, without input signal, 0 dB attenuation)			
Span <30 MHz	<–110 dBm		
Span ≥30 MHz	<–100 dBm		
f_{in} = 25.175 MHz, 25.060 MHz	<–100 dBm		
f_{in} = 60 MHz, 5.7172 GHz	–	<–100 dBm	
f_{in} = 14.1894 GHz, 15.6722 GHz (span >10 MHz)	–		<–90 dBm
Other interfering signals (mixer level <10 dBm)	<–80 dB	<–75 dB	
Level display (spectrum mode)			
Result display	500 x 400 pixel (one diagram), max. 2 diagrams with independent settings		
Log level axis	10 dB to 200 dB, in steps of 10 dB		
Linear level axis	10% of reference level per level division, 10 divisions or logarithmic scaling		
Trace	max. 4 per diagram (with two diagrams on screen, max. 2 per diagram)		
Trace detector	Max Peak, Min Peak, Auto Peak (Normal), Sample, RMS, Average		
Trace functions	Clear/Write, Max Hold, Min Hold, Average		
Setting range of reference level			
Logarithmic level display	–130 dBm to 30 dBm, in steps of 0.1 dB		
Linear level display	7.0 nV to 7.07 V, in steps of 1%		
Units of level axis	dBm, dBµV, dBmV, dBpW (log level display); V, A, W, dBµA (linear level display)		
Level measurement error limit (–40 dBm, RF attenuation 20 dB, ref. level –15 dBm, RBW 5 kHz)	The values are valid for bandwidths from 10 Hz to 30 kHz and 100 kHz to 10 MHz		
Absolute error limit at 120 MHz	<0.3 dB		
Freqency response (10 dB RF atten.)			
<2.2 GHz	<0.5 dB		
2.2 GHz to 3.5/7 GHz	<1 dB		
7 GHz to 18 GHz	–		<2 dB[3)]
18 GHz to 26.5 GHz	–		<2.5 dB [3)]
Attenuator switching error limit	<0.3 dB		
Error of reference level setting	<0.2 dB, typ. 0.1 dB		
Display nonlinearity			
Log level display			
0 dB to –70 dB	<0.2 dB (RBW ≤ 30 kHz), <0.3 dB (RBW ≥100 kHz)		
–70 dB to –95 dB	<1 dB (RBW ≤ 30 kHz)		
Linear level display	5% of reference level		
Bandwidth switching error limit			
1 Hz to 30 kHz/100 kHz to 500 kHz	<0.2 dB		
1 MHz to 10 MHz	<0.3 dB		
Total measurement error limit			
(Temperature range 20 °C to 30 °C, RBW 5 kHz to 30 kHz/300 kHz/1 MHz, stop frequency ≤ 2.2 GHz, signal level 0 dB to 70 dB below reference level, sweep time ≥ 3x auto sweep time)			
10 MHz to 2.2 GHz	≤0.5 dB (with 10 dB RF attenuation), ≤0.6 (with 20 dB, 30 dB, 40 dB RF attenuation)		
(0 dB to –50 dB, span/RBW <100) 95% confidence level			
<2.2 GHz	<1 dB		
2.2 GHz to 3.5/7 GHz	< 1.5 dB		
7 GHz to 18 GHz	–	< 2.5 dB [3)]	
18 GHz to 26.5 GHz	–		< 3 dB [3)]
Measurement of digital modulation signals			
Modulation formats	BPSK, QPSK, offset QPSK, DQPSK, π/4-DQPSK, 8PSK, D8PSK, 3π /8-8PSK, 16QAM MSK, GMSK, 2FSK, 2GFSK, 4FSK, 4GFSK		
Selectable standards	WCDMA, 3GPP, IS95 CDMA Forward/Reverse, GSM, EDGE, NADC, TETRA, PDC, PHS, CDPD, DECT, PWT, APCO25, CT2, ERMES, FLEX, MODACOM, TFTS		
Filtering			
Setting range α/B x T	raised cosine, square root raised cosine, Gaussian 0.14 to 1 in steps of 0.01 (PSK >1 MHz) 0.14 to 1 in steps of 0.01 (FSK >2 MHz)		

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	R&S FSIQ3	R&S FSIQ7	R&S FSIQ26
Filters to specific standards			
FLEX	Bessel B x T = 1.22 and 2.44		
ERMES	Bessel B x T = 1.25		
CDMA (IS95)	forward and reverse channel		
APCO25 FM			
EDGE	90 kHz root raised cosine (specific to EDGE standard)		
Measurements (except FSK)			
	I and Q signals (filtered, synchronized to frequency and symbol clock) I and Q reference signals (calculated from demodulated bits) I and Q error (magnitude and phase), error vector bit stream/modulation error (symbols demodulated at ideal decision points and table of all modulation errors)		
Measurements with FSK			
	frequency demodulated signals (filtered, synchronized to symbol clock) FSK reference signal (calculated from demodulated data) FSK error signal data/bit stream/modulation error (symbols demodulated at ideal decision points and table of all modulation errors)		
Display modes (except FSK)			
	constellation diagram, vector diagram in-phase and/or quadrature signal magnitude and phase (level) eye diagram, trellis diagram error vector magnitude (EVM) in %, magnitude error, phase/frequency error, in-phase and quadrature error signals		
Numerical error limit read-out (*rms and peak value)	error vector magnitude*, magnitude error*, phase error*, frequency error, I/Q offset, I/Q imbalance, amplitude droop, ρ factor		
Display modes with FSK			
	magnitude (level), frequency deviation, eye diagram (frequency signal), frequency deviation error, magnitude error		
Numerical error limit read-out (*rms and peak value)	deviation error*, magnitude error, FSK frequency deviation, frequency error, FSK reference deviation		
Symbol rate	320 Hz to 6.4 MHz (symbol rate x (1+ α)) < 8 MHz		
Samples/symbol [4]			
Symbol rate ≤200 kHz	1, 2, 4, 8, 16		
200 kHz <symbol rate ≤400 kHz	1, 2, 4, 8		
Symbol rate >400 kHz	1, 2, 4		
Synchronization	internal to symbol clock and frequency/phase		
Memory depth			
IS95 CDMA Forward /Reverse, DECT	600 symbols		
WCDMA, 3GPP, GSM, EDGE, PDC, NADC, TFTS, CT2, ERMES, MODACOM, Flex, APCO25, CDPD	1600 symbols		
Level measurements with digital demodulation			
Peak power range	–60 dBm to +30 dBm		
Absolute level error limit			
Mean power (0 dB to 10 dB below reference level)			
f ≤2.2 GHz	<1 dB		
2.2 GHz to 7 GHz	<1.5 dB		
7 GHz to 18 GHz	–	<2.5 dB[3]	
18 GHz to 26.5 GHz	–	<3 dB[3]	
Relative level error limit			
Mean power (0 dB to 10 dB below reference level)	0.2 dB		
10 dB to 50 dB below reference level	(0.0325/dB – 0.125) dB		
Dynamic range for burst measurement			
(mean power, ref. level ≥ –10 dBm, peak power = ref. level +1 dB, low noise mode, points/symbol <4)	WCDMA 60 dB GSM 74 dB NADC 78 dB TETRA 79 dB		
Time reference (nominal)			
without clock synchronization			
MSK/GMSK modulation	<1/(2 x symbol rate x points/symbol)		
PSK/QAM/FSK modulation	<1/(2 x symbol rate)		

	R&S FSIQ3	R&S FSIQ7	R&S FSIQ26
with clock synchronization	<0.001 x 1/(symbol rate)		
Residual error limit in modulation measurements	(data valid for level from reference level to reference level – 6 dB, S/N >60 dB, α/BT = 0.3 to 0.7, number of demodulated symbols >100, averaging ≥10, analog bandwidth >10 x symbol rate, input frequency >15 x symbol rate, local suppression at 0 Hz input frequency)		
General modulation modes (except FSK)			
Error vector magnitude (EVM) and magnitude error (f <1 GHz) [4]			
Symbol rate ≤30 kHz	0.5% rms	0.7% rms	
Symbol rate 30 kHz to 300 kHz	1% rms	1.4% rms	
Symbol rate 300 kHz to 1 MHz	2% rms	2.8% rms	
Symbol rate 1 MHz to 4.2 MHz	2% rms	2% rms	
Symbol rate 4.2 MHz to 6.4 MHz	2.4% rms	2.4% rms	
Phase error (f <1 GHz) [5]			
Symbol rate ≤ 30 kHz	0.3° rms	0.4° rms	
Symbol rate 30 kHz to 300 kHz	0.5° rms	0.7° rms	
Symbol rate 300 kHz to 1 MHz	1.5° rms	2° rms	
Symbol rate 1 MHz to 4.2 MHz	1,5° rms	2°rms	
Symbol rate 4.2 MHz to 6.4 MHz	2° rms	2.8° rms	
Frequency error	± (symbol rate × 5 × 10^{-6} + 0.1 Hz + reference error × carrier frequency)		
I/Q offset error	0.2% (–54 dB)		
Errors with modulation standards			
GSM, DCS1800, PCS1900	phase error ≤ 0.5° rms, <1.5° peak typ.		
NADC, CDPD	EVM ≤ 0.5% rms, <1.5% peak typ.		
TETRA, PDC, PHS	EVM ≤ 0.7% rms, <2% peak typ.		
PWT	EVM ≤ 1% rms, < 3% peak typ.		
IS95 CDMA, forward/reverse channel	ρ factor ≥ 0.9995		
WCDMA	EVM ≤ 1.8% rms, < 5% peak typ.		
General FSK modulation modes (input level ≥10 dBm, low-noise mode, f≤1 GHz)			
Symbol rate < 300 kHz Deviation error limit FSK deviation Magnitude error Frequency offset	1.5% rms + x_{dev} [4] [6] 1.5% of reference deviation[4] 1% rms 0.5% of reference deviation + error of ref. frequency[4]	2% rms + x_{dev} [5] [6] 2% of reference deviation[5] 1.4% rms 0.7% of reference deviation + error of ref. frequency[5]	
Symbol rate 300 kHz to 2 MHz Deviation error limit FSK deviation Magnitude error Frequency offset	2% rms + x_{dev} [4] [6] 2% of reference deviation[4] 2% rms 0.5% of reference deviation + error of ref. frequency[4]	2.8% rms + x_{dev} [5][6] 2.8% of reference deviation[5] 2.8% rms 0.7% of reference deviation + error of ref. frequency[5]	
Symbol rate > 2 MHz (within 8 MHz demodulation BW) Deviation error limit FSK deviation Magnitude error Frequency offset	4% rms + x_{dev} [4] [6] 4% of reference deviation[4] 2% rms 0.5% of reference deviation + error of reference frequency	5.6% rms + x_{dev}. [5][6] 5.6% of reference deviation[5] 2.8% rms 0.7% of reference deviation + error of reference frequency	
FSK standards	input level ≥10 dBm, low-noise mode, all standards, except ERMES; FLEX: 4 points/symbol, ERMES and FLEX: 16 points/symbol		
DECT	≤2% rms, <6% peak typ.		
MODACOM, CT2	≤1.5% rms, typ. <3% peak typ.		
ERMES, FLEX	≤2% rms, typ. <6% peak typ.		
Measurement of analog modulation signals			
Demodulation bandwidth			
Realtime demodulation	5 kHz to 200 kHz in steps of 1,2,3,5		
Offline demodulation	5 kHz to 5 MHz in steps of 1,2,3,5		
Demodulation length (max. sweep time)	3500/(demod. bandwidth/Hz) s		
Read-out	trace with AF signal, carrier power (AM DC-coupled), or modulation summary (table) with numerical display of: peak and rms values of modulation depths or deviations of main demodulation; SINAD value 1 kHz (only with realtime demodulation); AF frequency; carrier power; peak values of incidental modulation		

	R&S FSIQ3	R&S FSIQ7	R&S FSIQ26
The following specifications are valid for demodulation bandwidth ≤2 MHz, resolution bandwidth ≥5 x demodulation bandwidth, RF input level ≤–10 dBm, reference level setting = peak input level + 0 dB to +6 dB.			
Amplitude demodulation			
Range	up to 100%		
AF			
Offline demodulation	0.001 to 0.2 x demod. BW		
Realtime demodulation	30 Hz to 0.2 x demod. BW, max. 20 kHz		
Error	≤ 5% of result + residual AM		
Distortion (realtime demodulation)			
SINAD 1 kHz with m = 80%, LP 3 kHz	>46 dB		
Residual AM			
Demod. BW ≤100 kHz	0.2% rms		
Demod. BW >100 kHz	$0.2\% + \sqrt{\text{demodulationbandwidth}/100\text{kHz}}$ rms		
Incidental AM with FM	≤2% + residual AM (Δf = 0.2 x demod. BW, f_{mod} = 1 kHz, 10 kHz ≤demod. BW ≤200 kHz, lowpass 5% of demod. BW or 3 kHz, center frequency tuning)		
Frequency demodulation			
Deviation range	max. 0.4 x demod. BW		
AF			
Offline demodulation	DC/0.001 to 0.2 x demod. BW		
Realtime demodulation	DC/30 Hz to 0.2 x demod. BW, max. 20 kHz		
Error (AF up to 0.1 x demod. BW)	≤5% of result + residual FM		
Distortion (realtime demodulation) RF ≤1 GHz, demod. BW ≥10 kHz, SINAD 1 kHz with Δf = 0.2 x demod. BW, LP 3 kHz	>50 dB		
Residual FM (demod. BW ≤200 kHz, lowpass 5% of demod. BW or 3 kHz, rms)			
f <1 GHz	≤ 10 Hz	≤ 20 Hz	
f ≥1 GHz	$\leq 10\text{ Hz} \times \sqrt{f/1\text{GHz}}$	$\leq 20\text{ Hz} \times \sqrt{f/1\text{GHz}}$	
Incidental FM with AM (demod. BW ≤200 kHz, m = 50%, f mod = 1 kHz, lowpass 5% of demodulation BW or 3 kHz)			
f ≤100 MHz	≤50 Hz + residual FM	≤100 Hz + residual FM	
f ≥100 MHz	≤50 Hz x f/100 MHz + residual FM	≤100 Hz x f/100 MHz + residual FM	
Phase demodulation			
Deviation range	up to 10 rad		
AF			
Offline demodulation	DC/ 0.001 x demod. BW to 0.1 x demod. BW, max. 0.4 x demod. BW)/(phase deviation/rad) smaller limit value applies		
Realtime demodulation	200 Hz to 15 kHz, max. 0.1 x demod. BW, max. 0.4 x demod. BW, max. 0.4 x demod. BW/(phase deviation/rad), smaller limit value applies		
Error	≤5% of result + residual φM		
Distortion[4] (realtime demod.) RF≤1 GHz, demod. BW ≥10 kHz, SINAD 1 kHz with phase deviation/ rad = 0.2 x demod. BW/1 kHz, HP 300 Hz, LP 3 kHz	>50 dB		
Residual φM Demod. BW ≤200 kHz, offline demodulation, lowpass 5% of demod. BW, rms f <100 MHz	≤0.03 rad	≤0.03 rad	
f >100 MHz	≤0.03 rad x f/100 MHz	≤0.06 rad x f/100 MHz	
Realtime demodulation (HP 300 Hz, LP 3 kHz, rms)			
f <1 GHz	≤0.01 rad	≤0.02 rad	
f >1 GHz	$\leq 0.01\text{ rad} \times \sqrt{f/1\text{GHz}}$	$\leq 0.02\text{ rad} \times \sqrt{f/1\text{GHz}}$	
Incidental jM with AM demod. BW ≤200 kHz, m = 50%, f_{mod} = 1 kHz, lowpass 5% of demod. BW or 3 kHz	≤0.05 rad + residual φM		
Measurement of unmodulated carrier power			
Measurement error limit, (ref. level to ref. level –30 dB)	1.5 dB		
SINAD measurements			
Realtime demodulation, AF = 1 kHz ± 4 x 10^{-4} x demod. BW			
Error with 6 dB to 54 dB SINAD	±1 dB + error due to demodulator SINAD		

	R&S FSIQ3	R&S FSIQ7	R&S FSIQ26
Display of AF frequencies			
Range			
Offline demodulation	0.001 to 0.3 x demod. BW		
Realtime demodulation	30 Hz to 0.3 x demod. BW, max. 20 kHz		
Resolution	1 mHz to 1 Hz		
Error (S/N ≥40 dB)	1 x 10^{-6} x demod. BW + error of reference frequency +1 mHz ±1 digit		
AF filters			
Realtime demodulation			
Lowpass	3 kHz, 15 kHz (Butterworth, 12 dB/oct.)		
Highpass	30 Hz, 300 Hz (6 dB/oct.)		
Weighting filters	CCITT P.53, C message		
Offline demodulation			
Lowpass	5%, 10%, 25% of demod. BW (12 dB/oct.)		
Audio demodulation			
Modulation modes	AM and FM		
Audio output	speaker and phone jack		
Marker stop time in spectrum mode	100 ms to 60 s		
Trigger functions			
Trigger			
Span ≥10 Hz	free run, line, video, RF level, external		
Span = 0 Hz	plus pretrigger, posttrigger, trigger delay		
with digital demodulation	plus burst trigger and synchronization to bit sequence (max. 32 symbols)		
with analog demodulation	plus trigger to demodulated AF		
Delayed sweep			
Trigger source	calculated		
Delay time	100 ns to 10 s, resolution min. 1 µs or 1% of delay time		
Error of delay time	±(1 µs + (0.05% x delay time))		
Delayed sweep time	2 µs to 1000 s		
Gated sweep			
Trigger source	external, RF level		
Gate delay	1 µs to 100 s		
Gate length	1 µs to 100 s, resolution min. 1 µs or 1% of gate length		
Error of gate length	±(1 µs + (0.05% x gate length))		
Gap sweep (span = 0 Hz)			
Trigger source	free run, line, video, RF level, external		
Pretrigger	1 µs to 100 s, resolution 50 ns, dependent on sweep time		
Trigger to gap time	1 µs to 100 s, resolution 50 ns, dependent on sweep time		
Gap length	1 µs to 100 s, resolution 50 ns		
Inputs and outputs (front panel)			
RF input	N female, 50 Ω	N female, 50 Ω	adapter system, 50 Ω, N male and female 3.5 mm male and female
VSWR (RF attenuation ≥10 dB)			
f <3.5 GHz	<1.5		
f <7 GHz	–	<2.0	
f <26.5 GHz	–		<3
Attenuator	0 dB to 70 dB, selectable in 10 dB steps		
Probe power supply	+15 V DC, –12.6 V DC and ground, max. 150 mA		
Supply and coding connector for antennas, etc (antenna code)	12-pin Tuchel		
Supply voltages	±10 V, max. 100 mA, ground		
AF output	Z_{out} = 10 Ω, jack plug		
Open-circuit voltage	adjustable up to 1.5 V		

	R&S FSIQ3	R&S FSIQ7	R&S FSIQ26
Inputs & outputs (rear panel)			
IF 21.4 MHz	Z_{out} = 50 Ω, BNC female, bandwidth >1 kHz or resolution bandwidth		
Level	0 dBm at reference level, mixer level >–60 dBm		
Video output	Z_{out} = 50 Ω, BNC female		
Voltage (RBW ≥1 kHz)	0 V to 1 V, full scale (open-circuit voltage); log scaling		
Reference frequency			
Output, usable as input	BNC female		
Output frequency	10 MHz		
Level	10 dBm nominal		
Input	1 MHz to 16 MHz, integer MHz		
Required level	>0 dBm from 50 Ω		
Other data			
Sweep output	BNC female, 0 V to +10 V, proportional to displayed frequency		
Power supply connector for noise source	BNC female, 0 V and 28 V, switched		
External trigger/gate input	BNC female, >10 kΩ		
Voltage	–5 V to +5 V, adjustable		
GPIB remote control	interface to IEC 60625 (IEEE 488.2)		
Command set	SCPI 1994.0		
Connector	24-pin Amphenol female		
Interface functions	SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C11		
Serial interface	RS-232-C (COM1 and COM2), 9-pin female connectors		
Mouse interface	PS/2 compatible		
Printer interface	parallel (Centronics compatible) or serial (RS-232-C)		
Keyboard connector	5-pin DIN female for MF2 keyboard		
User interface	25-pin Canon female		
Connector for external monitor (VGA)	15-pin female		
General data			
Display	24 cm TFT colour display (9.5")		
Resolution	640 x 480 pixels (VGA resolution)		
Mass memory	1.44 Mbyte 3½" floppy disk drive, hard disk		
Operating temperature range			
Nominal temperature range	+5°C to +40°C		
Limit temperature range	0°C to +50°C		
Storage temperature range	–40°C to +70°C		
Humidity	+40°C at 95% relative humidity (IEC 60068)		
Mechanical stress			
Sinusoidal vibration	5 Hz to 150 Hz, max. 2 g at 55 Hz; 0.5 g from 55 Hz to 150 Hz; to IEC 600686, IEC 601010, MIL-T-28800D, class 5		
Random vibration	10 Hz to 300 Hz, acceleration 1.2 g rms		
Shock	40 g shock spectrum, to MIL-STD-810D and MIL-T-28800D, classes 3 and 5		
Recommended calibration interval	1 year (2 years for operation with external reference)		
RFI suppression	to EMC directive of EU (89/336/EEC) and German EMC legislation		
Power supply			
AC supply	200 V to 240 V: 50 Hz to 60 Hz, 100 V to 120 V: 50 Hz to 400 Hz, protection class I to VDE 411		
Power consumption	195 VA	210 VA	245 VA
Safety	to EN 61010-1, UL 3111-1, CDA C22.2 No. 1010-1, IEC 601010		
Test mark	VDE, GS, UL, cUL		
Dimensions in mm (W x H x D)	435 x 236 x 460		435 x 236 x 570
Weight	24 kg	24.5 kg	26.5 kg

1) After 30 days of operation.
2) Valid for span >100 kHz.
3) For frequencies >7 GHz: error limit after calling peaking function. For sweep times <10 ms/GHz: additional error 1.5 dB.
4) For frequencies >1 GHz the specified values have to be multiplied by $10^{0.552 \times \lg (f/\mathrm{GHz} / 1\ \mathrm{GHz})}$.
5) For frequencies >1 GHz the specified values have to be multiplied by $10^{0.354 \times \lg (f/\mathrm{GHz} / 1\ \mathrm{GHz})}$.
6) $x_{dev} = 2 \times 10^{-4} \times f_{Symb}$ x (points per symbol) Hz.

Specifications of options

Option	
1 dB Input Attenuator R&S FSE-B13	
Frequency range	0 Hz to 7 GHz (stop frequency ≤7 GHz)
Setting range of RF attenuation	0 dB to 70 dB
Step width	1 dB
Additional attenuation error limit	<0.1 dB
External Mixer Output R&S FSE-B21	
LO output /IF input (front)	SMA connector female, 50 Ω
LO signal	7.5 GHz to 15.2 GHz
Level	+15.5 dBm ±3 dB
IF signal	741.4 MHz
Full-scale level	–20 dBm
IF input (front)	SMA connector female, 50 Ω
IF signal	741.4 MHz
Full-scale level	–20 dBm
Level measurement error limit at IF inputs (IF level –30 dBm, reference level –20 dBm, RBW 30 kHz)	<1 dB

Ordering information

Order designation	**Type**	**Order No.**
Signal Analyzer 20 Hz to 3.5 GHz	R&S FSIQ 3	1119.5005.13
Signal Analyzer 20 Hz to 7 GHz	R&S FSIQ 7	1119.5005.17
Signal Analyzer 20 Hz to 26.5 GHz	R&S FSIQ 26	1119.6001.27
Accessories supplied		
Keyboard, mouse, power cable, operating manual, spare fuses	R&S FSIQ 3/7/26	
Only R&S FSIQ 26		
Test-port adapter N female		1021.0512.00
3.5 mm female		1021.0535.00

Options

Order designation	**Type**	**Order No.**
Hardware		
7 GHz Frequency Extension for R&S FSIQ 3	R&S FSE-B2	1073.5044.02
Tracking Generator 3.5 GHz for R&S FSIQ 3	R&S FSE-B8[1)]	1066.4469.02
Tracking Generator 3.5 GHz with I/Q Modulator for R&S FSIQ 3	R&S FSE-B9[1)]	1066.4617.02
Tracking Generator 7 GHz for R&S FSIQ 7/26	R&S FSE-B10[1)]	1066.4769.02
Tracking Generator 7 GHz with I/Q Modulator for R&S FSIQ 7/26	R&S FSE-B11[1)]	1066.4917.02
Switchable Attenuator for Tracking Generator	R&S FSE-B12[2)]	1066.5065.02
1 dB Attenuator	R&S FSE-B13[2)]	1119.6499.02
Ethernet Interface, 15-contact AUI connector	R&S FSE-B16	1073.5973.02
Ethernet Interface, Thin-wire BNC connector	R&S FSE-B16	1073.5973.03
Ethernet Interface, RJ45 (twisted pair)	R&S FSE-B16	1073.5973.04
2nd IEC/IEEE Bus Interface	R&S FSE-B17	1066.4017.02
Removable Harddisk	R&S FSE-B18[3)]	1088.6993.02
2nd Hard Disk for R&S FSE-B18	R&S FSE-B19	1088.7248.02
External Mixer Input/Output for R&S FSIQ 26	R&S FSE-B21	1084.7243.02
DSP and I/Q Memory Extension 2 x 512 k	R&S FSIQ-B70	1119.6747.02
Harmonic Mixer 40 GHz to 60 GHz	R&S FS-Z60[1)]	1089.0799.02
Harmonic Mixer 50 GHz to 75 GHz	R&S FS-Z75[1)]	1089.0847.02
Harmonic Mixer 60 GHz to 90GHz	R&S FS-Z90[1)]	1089.0899.02
Harmonic Mixer 75 GHz to 110 GHz	R&S FS-Z110[1)]	1089.0947.02

Order designation	Type	Order No.
Software		
Noise Measurement Software	R&S FS-K3[1)]	1057.3028.02
Phase Noise Measurement Software	R&S FS-K4[1)]	1108.0088.02
GSM Application Firmware, Mobile	R&S FSE-K10[1)]	1057.3092.02
GSM Application Firmware, BTS	R&S FSE-K11[1)]	1057.3392.02
EDGE Application Firmware Extension, Mobile	R&S FSE-K20[1)4)]	1106.4086.02
EDGE Application Firmware Extension, BTS	R&S FSE-K21[1)5)]	1106.4186.02
850 MHz Application Firmware Extension, GSM mobile test	R&S FSE-K30[6)]	1140.5098.02
850 MHz Application Firmware Extension, GSM BTS test	R&S FSE-K31[7)]	1140.5198.02
Application Firmware for cdmaOne BTS code domain power measurement	R&S FSIQ-K71[1)8)]	1126.4498.02
WCDMA/3GPP Application Firmware, BTS	R&S FSIQ-K72[1)8)]	1126.4746.02
WCDMA/3GPP Application Firmware, Mobile (UE)	R&S FSIQ-K73[1)8)]	1153.1009.02

1) See separate data sheets.
2) R&S FSE-B12 and R&S FSE-B13 cannot be installed simultaneously.
3) Cannot be retrofitted, factory fitted only.
4) R&S FSE-K10 required.
5) R&S FSE-K11 required.
6) R&S FSE-K10 required, for EDGE R&S FSE-K20 is additionally necessary.
7) R&S FSE-K11 required, for EDGE R&S FSE-K21 is additionally necessary.
8) R&S FSIQ-B70 required. Additional modifications may be required if the R&S FSIQ-B70 is retrofitted.

Recommended extras

Order designation	Type	Order No.
Service Kit	R&S FSE-Z1	1066.3862.02
DC Block, 5 MHz to 7 GHz, N connector	R&S FSE-Z3	4010.3895.00
DC Block 10 kHz to 18 GHz, N connector	R&S FSE-Z4	1084.7443.02
Microwave Measurement Cable and Adapter Set for R&S FSIQ 26	R&S FSE-Z15	1046.2002.02
Headphones	–	0708.9010.00
IEC/IEEE Bus Cable, 1 m	R&S PCK	0292.2013.10
IEC/IEEE Bus Cable, 2 m	R&S PCK	0292.2013.20
19" Rack Adapter with front handles	R&S ZZA-95	0396.4911.00
Matching Pads, 75 Ω		
L Section	R&S RAM	0358.5414.02
Series Resistor, 25 Ω	R&S RAZ	0358.5714.02
SWR Bridge, 5 MHz to 3000 MHz	R&S ZRB2	0373.9017.52
SWR Bridge, 40 kHz to 4 GHz	R&S ZRC	1039.9492.52
High-Power Attenuators, 100 W		
3/6/10/20/30 dB	R&S RBU 100	1073.8820.XX (XX = 03/06/10/20/ 30)
High-Power Attenuators, 50 W		
3/6/10/20/30 dB	R&S RBU 50	1073.8895.XX (XX = 03/06/10/20/ 30)
Preamplifier, 20 MHz to 1000 MHz	R&S ESV-Z3	0397.7014.52
For R&S FSIQ 26 only:		
Test-Port Adapter, N male	–	1021.0541.00
Test-Port Adapter, 3.5 mm male	–	1021.0529.00

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