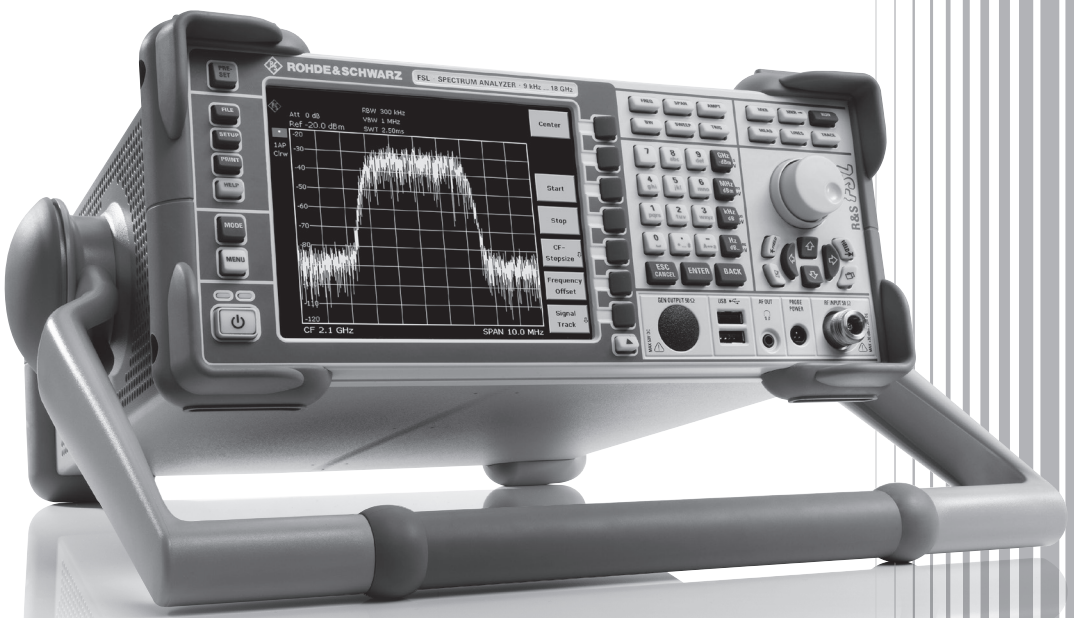
R&S®FSL
Spectrum Analyzer
Specifications



ROHDE&SCHWARZ

Test & Measurement

Data Sheet | 11.00

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Specifications apply under the following conditions:
15 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to.
Data without tolerances: typical values only. Data designated 'nominal' applies to design parameters and is not assured by Rohde & Schwarz.

Frequency

Frequency range	R&S®FSL3	9 kHz to 3 GHz
	R&S®FSL6	9 kHz to 6 GHz
	R&S®FSL18	9 kHz to 18 GHz (overrange 20 GHz)
Frequency resolution		1 Hz

Reference frequency, internal, nominal		
Aging per year		1×10^{-6}
Temperature drift	0 °C to +50 °C	1×10^{-6}

Reference frequency, internal, nominal	R&S®FSL-B4 OCXO reference frequency option, standard with the R&S®FSL18	
Aging per year		1×10^{-7}
Temperature drift	0 °C to +50 °C	1×10^{-7}

Frequency readout		
Marker resolution		1 Hz
Uncertainty		±(marker frequency × reference uncertainty + 10 % × resolution bandwidth + ½ (span / (sweep points – 1)) + 1 Hz)
Marker tuning frequency step size	default	span / 500
	marker step size = sweep points	span / (sweep points – 1)
Frequency counter resolution		1 Hz
Count uncertainty	S/N > 25 dB	±(frequency × reference uncertainty + ½ (last digit))
Frequency span		0 Hz, 10 Hz to 3/6/20 GHz
Span uncertainty		3 %

Spectral purity SSB phase noise		f = 500 MHz
Carrier offset	1 kHz	typ. –95 dBc (1 Hz)
	10 kHz	< –98 dBc (1 Hz), typ. –103 dBc (1 Hz)
	100 kHz	< –98 dBc (1 Hz), typ. –105 dBc (1 Hz)
	1 MHz	< –115 dBc (1 Hz), typ. –120 dBc (1 Hz)

Sweep time

Sweep time	span = 0 Hz	1 µs to 5 µs in 125 ns steps 5 µs to 16000 s in 5 % steps
	10 Hz ≤ span ≤ 3.2 kHz	2.5 ms to 5 s/Hz × span
	3.2 kHz < span ≤ 1.5 GHz	2.5 ms to 16000 s
	1.5 GHz < span ≤ 3 GHz	5 ms to 16000 s
	span > 3 GHz	10 ms to 16000 s
Uncertainty	span = 0 Hz	nominal 0.1 %
	span ≥ 10 Hz	nominal 3 %

Resolution bandwidths

Sweep filters		
Resolution bandwidths		300 Hz to 10 MHz (–3 dB) in 1/3 sequence
	with R&S®FSL-B7 option	10 Hz to 10 MHz (–3 dB) in 1/3 sequence
	zero span	20 MHz (–3 dB) additionally
Resolution bandwidth uncertainty		nominal < 3 %
Resolution filter shape factor 60 dB : 3 dB		nominal < 5 (Gaussian type filters)

EMI filters		
6 dB bandwidths		9 kHz, 120 kHz, 1 MHz
	with R&S®FSL-B7 option	200 Hz, 9 kHz, 120 kHz, 1 MHz
Bandwidth uncertainty		nominal < 3 %
Shape factor 60 dB : 3 dB		nominal < 6

FFT filters		
3 dB bandwidths		300 Hz to 30 kHz in 1/3 sequence
	with R&S®FSL-B7 option	1 Hz to 30 kHz in 1/3 sequence
Bandwidth uncertainty		nominal 5 %
Shape factor 60 dB : 3 dB		nominal 2.5

Channel filters		
Bandwidths	300; 500 Hz; 1; 1.5; 2; 2.4; 2.7; 3; 3.4; 4; 4.5; 5; 6; 8.5; 9 kHz 10; 12.5; 14; 15; 16; 18 (RRC); 20; 21; 24.3 (RRC); 25; 30; 50; 100; 150; 192; 200; 300; 500 kHz 1; 1.228; 1.28 (RRC); 1.5; 2; 3; 3.84 (RRC); 4.096 (RRC); 5 MHz (RRC = root raised cosine)	
	with R&S®FSL-B7 option	100 Hz, 200 Hz additionally

Video bandwidths	1-pole lowpass RC filters	1 Hz to 10 MHz in 1/3 sequence

Demodulation bandwidth		nominal 28 MHz

Level

Display range		displayed noise floor to +20 dBm

Maximum rated input level R&S®FSL3 and R&S®FSL6		
DC voltage		50 V
CW RF power		30 dBm (= 1 W)
Peak RF power		36 dBm (= 4 W) < 3 s
Max. pulse voltage		150 V
Max. pulse energy	pulse width 10 µs	10 mWs

Maximum rated input level R&S®FSL18 with RF attenuation ≥ 10 dB		
DC voltage		50 V
CW RF power		30 dBm (= 1 W)
Peak RF power		36 dBm (= 4 W) < 3 s
Max. pulse voltage		100 V
Max. pulse energy	pulse width 10 µs	2 mWs

Maximum rated input level R&S®FSL18 with RF attenuation < 10 dB		
DC voltage		30 V
CW RF power		20 dBm (= 100 mW)
Peak RF power		26 dBm (= 400 mW)
Max. pulse voltage		30 V
Max. pulse energy	pulse width 10 µs	0.2 mWs

Intermodulation R&S®FSL3 and R&S®FSL6		
Third-order intermodulation (TOI)	intermodulation-free dynamic range, level 2 × –20 dBm, reference level –10 dBm	
	f_{in} < 30 MHz	> 54 dBc (TOI +7 dBm, typ. +12 dBm)
	f_{in} ≥ 30 MHz	> 60 dBc (TOI +10 dBm, typ +18 dBm)
Second harmonic intercept (SHI)	f_{in} = 20 MHz to 3 GHz	nominal +35 dBm
1 dB compression of input mixer	0 dB RF attenuation, f > 200 MHz	nominal +5 dBm

Intermodulation R&S®FSL18		
Third-order intermodulation (TOI)	intermodulation-free dynamic range, level 2 × –20 dBm, reference level –10 dBm	
	f_{in} < 50 MHz	> 54 dBc (TOI +7 dBm, typ. +10 dBm)
	50 MHz ≤ f_{in} ≤ 6 GHz	> 60 dBc (TOI +10 dBm, typ +13 dBm)
	f_{in} > 6 GHz	nominal 60 dBc (TOI +10 dBm)
Second harmonic intercept (SHI)	f_{in} = 20 MHz to 9 GHz	nominal +35 dBm
1 dB compression of input mixer	0 dB RF attenuation, f > 200 MHz	nominal +5 dBm

Displayed average noise level R&S®FSL3 and R&S®FSL6		
	0 dB RF attenuation, termination 50 Ω, RBW = 1 kHz, VBW = 1 Hz, sample detector, log scaling, tracking generator OFF, normalized to 1 Hz	
	frequency	preamplifier = OFF
	9 kHz to 1 MHz	< –100 dBm (1 Hz)
	1 MHz to 10 MHz	< –115 dBm (1 Hz)
	10 MHz to 50 MHz	< –130 dBm (1 Hz)
	50 MHz to 3 GHz	< –140 dBm (1 Hz)
	3 GHz to 5 GHz	< –136 dBm (1 Hz)
	5 GHz to 6 GHz	< –130 dBm (1 Hz)
	frequency	preamplifier = ON
	9 kHz to 1 MHz	< –115 dBm (1 Hz)
	1 MHz to 10 MHz	< –130 dBm (1 Hz)
	10 MHz to 50 MHz	< –145 dBm (1 Hz)
	50 MHz to 3 GHz	< –152 dBm (1 Hz)
	3 GHz to 5 GHz	< –146 dBm (1 Hz)
	5 GHz to 6 GHz	< –140 dBm (1 Hz)
	frequency	preamplifier = ON, typical values
	500 MHz	–162 dBm (1 Hz)
	1 GHz	–160 dBm (1 Hz)
	3 GHz	–158 dBm (1 Hz)
	6 GHz	–147 dBm (1 Hz)

Displayed average noise level R&S®FSL18		
	0 dB RF attenuation, termination 50 Ω, RBW = 1 kHz, VBW = 1 Hz, sample detector, log scaling, tracking generator OFF, normalized to 1 Hz	
	frequency	preamplifier = OFF
	9 kHz to 1 MHz	< –100 dBm (1 Hz)
	1 MHz to 10 MHz	< –115 dBm (1 Hz)
	10 MHz to 50 MHz	< –130 dBm (1 Hz)
	50 MHz to 3 GHz	< –140 dBm (1 Hz)
	3 GHz to 12 GHz	< –136 dBm (1 Hz)
	12 GHz to 18 GHz	< –130 dBm (1 Hz)
	18 GHz to 20 GHz	< –123 dBm (1 Hz)
	frequency	preamplifier = ON
	9 kHz to 1 MHz	< –115 dBm (1 Hz)
	1 MHz to 10 MHz	< –130 dBm (1 Hz)
	10 MHz to 50 MHz	< –145 dBm (1 Hz)
	50 MHz to 3 GHz	< –152 dBm (1 Hz)
	3 GHz to 5 GHz	< –149 dBm (1 Hz)
	5 GHz to 6 GHz	< –145 dBm (1 Hz)
	frequency	preamplifier = ON, typical values
	500 MHz	–162 dBm (1 Hz)
	1 GHz	–161 dBm (1 Hz)
	3 GHz	–158 dBm (1 Hz)
	6 GHz	–152 dBm (1 Hz)

Immunity to interference		
Image frequency	f_{in} – 2 × 48.375 MHz	< –80 dBc, typ. –90 dBc
	f_{in} – 2 × 838.375 MHz	< –60 dBc, typ. –80 dBc
	f_{in} – 2 × 7158.375 MHz	typ. –60 dBc
Intermediate frequency	48.375 MHz, 838.375 MHz, 7158.375 MHz	< –60 dBc, typ. –80 dBc
Spurious response, inherent	f > 30 MHz, without input signal, RF attenuation = 0 dB, RBW ≤ 10 kHz	< –90 dBm
Spurious response	related to local oscillators	
	f ≤ 6 GHz	
	Δf < 100 kHz	typ. –60 dBc
	Δf ≥ 100 kHz	< –60 dBc
	f > 6 GHz	
	Δf < 100 kHz	typ. –48 dBc
	Δf ≥ 100 kHz	< –48 dBc
	f = receive frequency	
Spurious response	related to A/D conversion	typ. < –70 dBc
Spurious response	related to subharmonic of first LO (spur at 7158.375 MHz – 2 × f_{in})	typ. –60 dBc
Spurious response at mixer level < –10 dBm	related to harmonic of first LO (spur at f_{in} – 3579.1875 MHz)	typ. –60 dBc

Level display		
Logarithmic level axis		10 dB to 100 dB
Linear level axis		0 % to 100 %/10 divisions
Number of traces		4
Trace detectors		max peak, min peak, auto peak, sample, RMS, quasi peak, average
Number of measurement points	default value	501
	range	125 to 32001 in steps of about a factor of 2
Trace functions		clear/write, max hold, average, min hold, view
Setting range of reference level	logarithmic level display	–80 dBm to 20 dBm in steps of 2 dB, 5 dB or 10 dB
	linear level display	–80 dBm to 20 dBm, 0 % to 100 %
Units of level axis	logarithmic level display	dBm, dBmV, dBµV, dBµA, dBpW
	linear level display	µV, mV, V, µA, mA, A, pW, nW, µW, mW, W

Level measurement uncertainty		
	95 % confidence level, +20 °C to +30 °C, S/N > 16 dB, 0 dB to –50 dB from reference level	
	10 MHz < f ≤ 3 GHz	< 0.5 dB
	3 GHz < f ≤ 6 GHz	< 0.8 dB
	6 GHz < f ≤ 18 GHz	< 1.2 dB
Absolute uncertainty at 65.83 MHz		< 0.3 dB
Frequency response (+20 °C to +30 °C)	9 kHz ≤ f < 30 kHz	nominal 1.5 dB
	30 kHz ≤ f ≤ 3 GHz	< 0.5 dB, typ. 0.3 dB
	3 GHz < f ≤ 6 GHz	< 0.8 dB, typ. 0.3 dB
	6 GHz < f ≤ 18 GHz	< 1.2 dB, typ. 0.6 dB
	f > 18 GHz	nominal 2 dB
Attenuator uncertainty		< 0.3 dB
Uncertainty of reference level setting		nominal < 0.1 dB

Display nonlinearity		
Logarithmic level display	S/N > 16 dB 0 dB to –50 dB	 < 0.2 dB
Bandwidth switching uncertainty	reference: RBW = 10 kHz	nominal < 0.1 dB

Trigger functions

Trigger		
Trigger source		free run, video, external, IF power
External trigger level		TTL level

I/Q data

Interface		LAN
	R&S®FSL-B10	LAN or GPIB
Memory length		max. 512 ksample I and Q
Sample rate		10 kHz to 65.8 MHz
Signal bandwidth	sample rate 65.8 MHz	nominal 28 MHz

Inputs and outputs

RF input R&S®FSL3 and R&S®FSL6		
Impedance		50 Ω
Connector		N female
VSWR	RF attenuation ≥ 10 dB	
	10 MHz ≤ f ≤ 1 GHz	nominal 1.2
	1 GHz < f ≤ 6 GHz	nominal 1.5
Input attenuator		0 dB to 50 dB in 5 dB steps

RF input R&S®FSL18		
Impedance		50 Ω
Connector		N female
VSWR	RF attenuation ≥ 10 dB	
	10 MHz ≤ f ≤ 8 GHz	nominal 1.2
	8 GHz < f ≤ 16 GHz	nominal 1.5
	f > 16 GHz	nominal 2
Input attenuator		0 dB to 40 dB in 5 dB steps

AF output		
Connector		3.5 mm mini jack
Output impedance		< 100 Ω
Open-circuit voltage		up to 1.5 V, adjustable

Tracking generator (models .13, .16 and .28 only)		
Connector		N female, 50 Ω
Output power setting range	R&S®FSL3, R&S®FSL6	–50 dBm to 0 dBm in 1 dB steps
	R&S®FSL18	–30 dBm to 0 dBm in 10 dB steps
Frequency range	R&S®FSL3	1 MHz to 3 GHz
	R&S®FSL6	1 MHz to 6 GHz
	R&S®FSL18	10 MHz to 18 GHz
Dynamic range for isolation measurements	RF attenuation = 0 dB, source power 0 dBm	
	10 MHz to 2 GHz	nominal 80 dB
	2 GHz to f_{max}	nominal 60 dB
Reverse power		
DC voltage		50 V
CW RF power		30 dBm (= 1 W)
Max. pulse voltage		150 V
Max. pulse energy (10 µs)		10 mWs

External reference		
Connector		BNC female, 50 Ω
Input level		0 dBm to +10 dBm
Output level	with R&S®FSL-B4	typ. 0 dBm
Frequency		10 MHz ±5 ppm

External trigger/gate input		
Connector		BNC female, 50 Ω
Input level		TTL compatible

Probe power		+15 V DC, –12.6 V DC and ground, max. 150 mA, nominal

External monitor		
Connector		VGA

General specifications

Remote control		
LAN interface		10/100BaseT, RJ-45
IEC/IEEE bus (GPIB)	R&S®FSL-B10	SCPI 1997.0

Display		
Resolution		640 × 480 pixels
Pixel failure rate		< 2×10^{-5}

Mass memory		
Mass memory		flash disk (internal), USB memory stick (not supplied)
Data storage		> 500 instrument settings and traces

Temperature		
	operating temperature range	+0 °C to +50 °C
	permissible temperature range	+0 °C to +55 °C
	storage temperature range	–40 °C to +70 °C
Climatic loading		+25 °C/+40 °C at 85 % relative humidity (IEC 60068-2-30)

Mechanical resistance		
Vibration	sinusoidal	IEC 60068-2-6
	random	IEC 60068-2-64
Shock		40 g shock spectrum, in line with MIL-STD-810E, method 516.4 procedure 1, IEC 60068-2-27

Power supply		
Input voltage range, AC, nominal		100 V to 240 V
AC supply frequency		50 Hz to 400 Hz
Input current, AC		0.9 A to 0.3 A
Input voltage range, DC, nominal	R&S®FSL-B30	10 V to 28 V
Input current, DC	R&S®FSL-B30	8.0 A to 2.2 A
Power consumption		typ. 45 W, max. 65 W with all options
Safety		IEC 61010-1, EN 61010-1, UL 61010B-1, CSA C22.2 No. 1010-1
Test mark		VDE, GS, CSA, CSA-NRTL
EMC		EMC Directive 2004/108/EC including: - IEC/EN 61326 class B (emission) - CISPR 11/EN 55011/group 1 class B (emission) - IEC/EN 61326 Table A.1 (immunity, industrial)
Dimensions (W × H × D)	with handle	408.8 mm × 158.1 mm × 465.3 mm (16.09 in × 6.22 in × 18.32 in)
	without handle	342.3 mm × 158.1 mm × 367.0 mm (13.48 in × 6.22 in × 14.45 in)
Weight	without options	< 7 kg (< 15.43 lb)
	with battery pack	< 8 kg (< 17.64 lb)

Recommended calibration interval		
		1 year
	operation with external reference	2 years

R&S®FSL-B5 additional interfaces

User port		
Connector		9-pin D-Sub male
Output		TTL-compatible, 0 V/5 V, max. 15 mA
Input		TTL-compatible, max. 5 V

Noise source control		
Connector		BNC female
Output		0 V/28 V, max. 100 mA, switchable, supply for noise source

Power sensor		
Connector		6-pin LEMOSA female for supported R&S®NRP-Zxx power sensors

IF/video out		
Connector		BNC female, 50 Ω
IF out		
Bandwidth		nominal 28 MHz
IF frequency	RBW 20 MHz, center frequency > 20 MHz, span 0 Hz	17.45833 MHz (nominal) ±2 MHz, dependent on center frequency
Output level (gain versus RF input)	RF attenuation 0 dB, RF preamplifier = OFF, span 0 Hz, RBW 20 MHz	
	center frequency	
	100 MHz	approx. +3 dB
	3 GHz	approx. –1 dB
	6 GHz	approx. –7 dB
Video out		
Bandwidth		equal to VBW setting, max. RBW/2
Output scaling		log scaling with display scale set to log, lin scaling with display scale set to lin
Output level	center frequency > 10 MHz, span 0 Hz, signal at reference level and center frequency	
	video 1 V	1 V ±10 % (open circuit) (nominal)
	video 200 mV	200 mV ±10 % (open circuit) (nominal)

R&S®FSL-K7 AM/FM/φM measurement demodulator

Measurement of analog modulation signals		
Demodulation bandwidth		100 Hz to 6.4 kHz, binary steps 12.5 kHz to 1.6 MHz, binary steps 3 MHz, 5 MHz, 8 MHz, 10 MHz, 18 MHz
Recording length	maximum	512 ksample
Recording time	demodulation bandwidth	
	100 Hz	3276.8 s
	6.4 kHz	51.2 s
	12.5 kHz	26.6 s
	1.6 MHz	200 ms
	3 MHz	100 ms
	5 MHz	50 ms
	8 MHz	25 ms
	10 MHz	12.5 ms
	18 MHz	12.5 ms
Display	frequency versus time (FM), amplitude versus time (AM), phase versus time (φM), RF power versus time, RF spectrum (FFT), AF spectrum (FFT), table with numeric values for: modulation deviation (peak, RMS), modulation frequency, carrier offset, carrier power (power of unmodulated carrier), THD, SINAD	

AF (modulation frequency)		
Range		≤ 9 MHz max. 0.5 × demodulation bandwidth
Resolution		5 digits
Measurement uncertainty		0.1 %
AF filters		
Lowpass		3 kHz, 15 kHz, 150 kHz, 5 %, 10 %, 25 % of demodulation bandwidth
Highpass		50 Hz, 300 Hz
Deemphasis		25 µs, 50 µs, 75 µs, 750 µs

AM demodulation		
Measurement range	modulation depth	0 % to 100 %
Modulation depth uncertainty	AF ≤ 1 MHz	< 3 % of reading + residual AM
Residual AM	demodulation bandwidth ≤ 200 kHz, RMS, RF ≤ 3 GHz, RF input level ≥ (RF attenuation/dB – 30) dBm	0.2 %
Distortion	10 Hz ≤ AF ≤ 100 kHz	0.3 %
FM rejection	AF ≤ 1 MHz and AF + deviation ≤ 0.5 × demodulation bandwidth	typ. 1 % + residual AM

FM demodulation		
Measurement range	frequency deviation	≤ 9 MHz
Deviation uncertainty	AF ≤ 1 MHz and AF + deviation ≤ 0.5 × demodulation bandwidth	< 3 % of reading + residual FM
Residual FM	demodulation bandwidth ≤ 100 kHz, RMS, RF input level ≥ (RF attenuation/dB – 30) dBm	
	RF ≤ 1 GHz	150 Hz
	RF = 3 GHz	200 Hz
Distortion	10 Hz ≤ AF ≤ 100 kHz, deviation < 400 kHz	0.3 %
AM rejection	100 Hz ≤ AF ≤ 1 kHz, modulation depth 50 %	30 Hz

φM demodulation		
AF		≤ 5 MHz, max. 0.5 × demodulation bandwidth
Measurement range	phase deviation	< 1000 rad
Residual φM	demodulation bandwidth ≤ 100 kHz, RMS, RF = 1 GHz, highpass 300 Hz, RF input level ≥ (RF attenuation/dB – 30) dBm	5 mrad
Deviation uncertainty	AF ≤ 1 MHz and AF + deviation ≤ 0.5 × demodulation bandwidth	3 % of reading + residual φm

Carrier power versus time		
Display range		noise floor to +20 dBm
Measurement uncertainty	unmodulated carrier, S/N > 16 dB, RF: 50 kHz to 3 GHz	typ. 1 dB
Maximum dynamic range	demodulation bandwidth 200 kHz	typ. 75 dB
Display linearity	S/N > 16 dB	typ. 0.2 dB

AF spectrum		
Span		≤ 9 MHz
Resolution bandwidth		1 Hz to 10 MHz

RF spectrum		
Span		≤ 18 MHz
Resolution bandwidth		1 Hz to 10 MHz
Shape factor	60 dB : 3 dB	2.5, nominal

Modulation distortion		
Measurement functions		THD, SINAD
Measurement range		–100 dB to 0 dB
Resolution		0.01 dB
Measurement uncertainty		typ. 0.5 dB
AF frequency range		10 Hz to 5 MHz

Trigger		
Trigger functions		RF level, AM, FM, φM demodulation

R&S®FSL-K8 Bluetooth® TX measurements

The specifications below are based on the data sheet specifications of the R&S®FSL spectrum analyzer and have not been checked separately. Specifications apply under the following conditions: Unless otherwise stated, these specifications are with RF input level +20 dBm to –40 dBm within the Bluetooth® band (ISM) 2400 MHz to 2483.5 MHz and default settings.

Output power		
Measurements		average and peak power in line with Bluetooth® RF test specification 2.0.E.3, 5.1.3
Level range		–40 dBm to + 20 dBm
Level uncertainty		< 0.7 dB
Packet type		longest supported (DH1, DH3, DH5)
Payload		PRBS9
Synchronization		RF burst, access code
Trigger		IF power, external, free run

Modulation characteristics		
Measurements		FM deviation in line with Bluetooth® RF test specification 2.0.E.3, 5.1.9 Δf_{1max}, Δf_{2max}, Δf_{1avg}, Δf_{2avg} and $\Delta f_{2avg}/\Delta f_{1avg}$
Deviation range		±250 kHz
Deviation uncertainty	signal level > –25 dBm, 10 averages	< 6 kHz
Packet type		all supported (DH1, DH3, DH5)
Payload		10101010 and 11110000, auto detect
Synchronization		access code
Trigger		IF power, external, free run

Initial carrier frequency tolerance (ICFT)		
Measurements		ICFT in line with Bluetooth® RF test specification 2.0.E.3, 5.1.10
Measurement range		±250 kHz
Measurement uncertainty	signal level > –30 dBm	< 3 kHz + carrier frequency × reference error
Packet type		DH1 and all supported (DH1, DH3, DH5)
Payload		PRBS9
Synchronization		access code
Trigger		IF power, external, free run

Carrier frequency drift		
Measurements		carrier frequency drift in line with Bluetooth® RF test specification 2.0.E.3, 5.1.11 drift/packet and drift/50 µs
Measurement range		±250 kHz
Uncertainty	signal level > –30 dBm	< 5 kHz
Packet type		all supported (DH1, DH3, DH5)
Payload		10101010
Synchronization		access code
Trigger		IF power, external, free run

Adjacent channel power (ACP)		
Measurements		adjacent channel power in line with Bluetooth® RF test specification 2.0.E.3, 5.1.8
Level range		max. +20 dBm
Packet type		DH1
Payload		PRBS9
Synchronization		none
Trigger		external, free run

EDR relative TX power		
Measurements		GFSK and DPSK power in line with Bluetooth® RF test specification 2.0.E.3, 5.1.12
Measurement range		–40 dBm to +20 dBm
Level uncertainty		< 0.7 dB
Packet type		2-DHx, 3-DHx, 2-EVx, 3-EVx
Payload		PRBS9
Synchronization		GFSK access code and DPSK synchronization sequence
Trigger		IF power, external, free run

EDR frequency stability		
Measurements		frequency error initial (ω_i), per block (ω_0) and total ($\omega_i + \omega_0$) in line with Bluetooth® RF test specification 2.0.E.3, 5.1.13
Measurement range		±250 kHz
Uncertainty	frequency error initial, signal level > –25 dBm	< 1 kHz + carrier frequency × reference error
	frequency error per block, signal level > –25 dBm	< 1 kHz
Packet type		2-DHx, 3-DHx, 2-EVx, 3-EVx
Payload		PRBS9
Synchronization		
Trigger		IF power, external, free run

EDR modulation accuracy		
Measurements		RMS, peak and 99 % DEVM in line with Bluetooth® RF test specification 2.0.E.3, 5.1.13
Uncertainty	RMS, signal level > –25 dBm	< 3 %
	peak, signal level > –25 dBm	< 8 %
Packet type		2-DHx, 3-DHx, 2-EVx, 3-EVx
Payload		PRBS9
Synchronization		GFSK access code and DPSK synchronization sequence
Trigger		IF power, external, free run

EDR differential phase encoding		
Measurements		bit error detection in line with Bluetooth® RF test specification 2.0.E.3, 5.1.14
Packet type		2-DHx, 3-DHx, 2-EVx, 3-EVx
Payload		PRBS9
Synchronization		GFSK access code and DPSK synchronization sequence
Trigger		IF power, external, free run

EDR in-band spurious emissions		
Measurements		adjacent channel power and power between 1 MHz and 1.5 MHz from carrier in line with Bluetooth® RF test specification 2.0.E.3, 5.1.15
Level range		max. +10 dBm
Packet type		2-DHx, 3-DHx, 2-EVx, 3-EVx
Payload		PRBS9
Synchronization		gated measurement
Trigger		IF power, external, free run

R&S®FSL-K20 cable TV measurements

The R&S®FSL-K20 option for the R&S®FSL spectrum analyzer makes it possible to perform measurements on analog and digital modulated TV signals in cable networks and also simplifies such measurements.

The option includes a software demodulator for analyzing digital TV signals and an internal TV trigger for analyzing analog TV signals.

General

Frequency		
Range	vision carrier frequency with analog modulation or carrier frequency with digital modulation	5 MHz to 1.5 GHz
Selection of measurement frequency	a channel table is used	selection of a channel and/or direct input of frequency
	no channel table is used	direct input of frequency
Channel tables		
Characteristics	The number of channel tables that can be saved is limited only by the memory capacity of the instrument. Max. 400 channels in each channel table. Channel bandwidths from 0.1 MHz to 10 MHz. Max. 50 modulation standards, i.e. signal characteristic sets, can be present in each channel table. The modulation standard assigned to the active channel automatically configures each measurement. Channel tables can be generated and edited on the instrument at any time. The most important standard channel tables and modulation standards are included.	
Manual measurements	Operation is also possible without channel tables, in which case the user must select the measurement parameters.	

Analog TV

TV standards	B/G, D/K, I, K1, L, M, N	
Color system	PAL/SECAM/NTSC	
Sound systems	B/G	FM 5.5 MONO
		FM 5.5/FM 5.742
		FM 5.5/NICAM 5.85
	D/K/K1	FM 6.5 MONO
		FM 6.5/FM 6.742
		FM 6.5/FM 6.258
		FM 6.5/NICAM 5.85
	I	FM 6.0 MONO
		FM 6.0/NICAM 6.552
	L	AM 6.5 MONO
		AM 6.5/NICAM 5.85
	M, N	FM 4.5 MONO
		FM 4.5/FM 4.724
		FM 4.5 BTSC
		FM 4.5 EIA-J

Measurements		
Spectrum	active channel/signal spectrum	
Carriers	vision carrier	frequency and level absolute; display of deviation from nominal values
	one or two sound carriers	frequency and level relative to vision carrier; display of deviation from nominal values
C/N	carrier to noise; peak level of vision carrier relative to noise in selectable bandwidth; noise floor correction can be activated	
	channel switched ON	in-service mode, measurement next to signal
	channel switched OFF	off-service mode
	channel switched ON, no scrambling	quiet-line mode, measurement during unmodulated line
CSO	composite second order (beat); peak level of vision carrier relative to second-order intermodulation product; noise floor correction can be activated	
	channel switched OFF	off-service mode
	channel switched ON, no scrambling, unmodulated video line present	quiet-line mode, measurement during unmodulated line
CTB	composite triple beat; channel switched OFF; peak level of vision carrier relative to third-order intermodulation product; noise floor correction can be activated	
Video scope	no scrambling, SWT = 25 µs to 100 µs, offset = –50 µs to +50 µs	luminance signal of a selectable video line versus time
Vision modulation	white-reference test line, no scrambling	modulation depth and residual carrier of vision carrier
Hum	no scrambling	modulation depth of unwanted AM, modulation frequency < 1 kHz

Analog TV measurement ranges and measurement uncertainty

Standards	All specified tolerances refer to a modulated TV signal in line with the PAL B/G standard. FM carriers are at 5.5 MHz and 5.742 MHz relative to the vision carrier, each modulated with 3 kHz. Vision carrier frequency range: 10 MHz < f ≤ 1.5 GHz.	
Measurements		
Carriers		
Vision carrier power, absolute	S/N (vision carrier) > 16 dB	typ. < 0.5 dB
Vision carrier frequency offset	|frequency offset| < 10 kHz	±(vision carrier frequency × reference uncertainty + 0.5 Hz)
Sound carrier 1 power, relative	S/N (sound carrier 1) > 16 dB	typ. < 0.7 dB
Intercarrier 1 frequency offset	|intercarrier 1 frequency offset| < 100 Hz S/N (sound carrier 1) > 25 dB	±(intercarrier 1 frequency offset × reference uncertainty + 0.5 Hz)
Sound carrier 2 power, relative	S/N (sound carrier 2) > 16 dB	typ. < 0.7 dB
Intercarrier 2 frequency offset	|intercarrier 2 frequency offset| < 100 Hz S/N (sound carrier 2) > 25 dB	±(intercarrier 2 frequency offset × reference uncertainty + 0.5 Hz)
C/N	channel with vision carrier peak power –2 dBm; noise-reference bandwidth = 4 MHz; carrier and noise with 0 dB attenuation	
C/N (off-service)	preamp = OFF	C/N < 54 dB, typ. < 1 dB
		C/N < 59 dB, typ. < 3 dB
	preamp = ON for noise measurement	C/N < 69 dB, typ. < 1 dB
		C/N < 74 dB, typ. < 3 dB

Digital TV

QAM demodulator	user-configurable, block-based, open-loop software demodulator	
Standards	J.83/A (DVB-C Europe)	
	J.83/B (US cable)	
	J.83/C (Japanese cable)	
Measurements		
Spectrum	active channel/signal spectrum	
Overview	result table, zoom of individual parameters possible	
	modulation error rate (peak and RMS value)	
	error vector magnitude (peak and RMS value)	
	frequency offset	
	symbol rate offset	
Constellation	color constellation diagram with zoom capability	
Modulation errors	result table, zoom of individual parameters possible	
	amplitude imbalance	
	quadrature error	
	carrier suppression	
	phase jitter	
	modulation error rate (peak and RMS value)	
	error vector magnitude (peak and RMS value)	
Channel analysis	–20 × symbol duration to +100 × symbol duration	magnitude of channel impulse response, zoom
Channel power	measurement of channel power	
APD	amplitude probability distribution, special channel filters (5 MHz, 6 MHz, 7 MHz, 8 MHz, 10 MHz)	
CCDF	complementary cumulative distribution function, special channel filters (5 MHz, 6 MHz, 7 MHz, 8 MHz, 10 MHz)	

Digital TV measurement ranges and measurement uncertainty

Demodulator		
Adjustable symbol rate	0.1 Hz steps	0.1 MHz to 7.15 MHz
Permissible symbol rate error	referenced to symbol rate	typ. ±0.1 %
Permissible frequency error		typ. ±30 kHz
Modulation formats	QAM	4/16/32/64/128/256/512/1024
Equalizer	ON/OFF/freeze/reset; fractionally spaced; taps from –5 symbols to +25 symbols	
Receive filter	root raised cosine	roll-off factor = 0.12/0.13/0.15/0.18
Measurements		
Overview		
MER	64QAM, roll-off factor = 0.15, symbol rate = 6.9 MHz, equalizer OFF, R&S®FSL-B4 OCXO option at 200 MHz, 400 MHz, 600 MHz, 800 MHz	typ. residual MER RMS greater (95 %) than 42.0 dB, 39.2 dB, 38.6 dB, 41.6 dB
	256QAM, roll-off factor = 0.12, symbol rate = 5.3605369 MHz, equalizer OFF, R&S®FSL-B4 OCXO option at 200 MHz, 400 MHz, 600 MHz, 800 MHz	typ. residual MER RMS greater (95 %) than 42.3 dB, 40.8 dB, 39.3 dB, 41.9 dB

TV analyzer

Standards	see “Analog TV” and “Digital TV”
Measurements	
Tilt	Display of the power of many channels versus frequency allows level differences/tilt to be detected. Channels are selected by specifying the frequency range and/or modulation characteristics.

R&S®FSL-K30 application firmware for noise figure and gain measurements

Frequency

Frequency range	R&S®FSL3	100 kHz to 3 GHz
	R&S®FSL6	100 kHz to 6 GHz
	R&S®FSL18	100 kHz to 18 GHz (overrange 20 GHz)

Measurement bandwidth	R&S®FSL3/6	300 Hz to 10 MHz (–3 dB) in 1/3 sequence
	R&S®FSL3/6 with R&S®FSL-B7 option	10 Hz to 10 MHz (–3 dB) in 1/3 sequence

Noise figure and gain measurement

Noise figure		
Measurement range		0 dB to 35 dB
Resolution		0.01 dB
Accuracy	instrument uncertainty (95 % confidence level)	
	frequency range 100 kHz to 10 MHz	
	measurement with external preamplifier (gain 50 dB, noise figure < 5 dB), RBW < 10 kHz, DUT noise figure 1 dB to 10 dB and gain >10 dB	0.3 dB
	frequency range >10 MHz to 6 GHz	
	measurement with external preamplifier (gain 30 dB, noise figure < 5 dB), RBW 1 MHz, DUT noise figure 1 dB to 10 dB and gain >10 dB	0.3 dB
	R&S®FSL-B22 (internal preamplifier) active, measurement with external preamplifier (gain 20 dB, noise figure < 5 dB), RBW 1 MHz, DUT noise figure 1 dB to 10 dB and gain >10 dB	0.3 dB
	frequency range >6 GHz to 18 GHz	
	measurement with external preamplifier (gain 30 dB, noise figure < 5 dB), RBW 1 MHz, DUT noise figure 1 dB to 10 dB and gain >10 dB	0.3 dB

Gain		
Measurement range		0 dB to 60 dB
Resolution		0.01 dB
Accuracy	frequency range 100 kHz to 10 MHz	
	measurement with external preamplifier (gain 50 dB, noise figure < 5 dB), RBW < 10 kHz	0.2 dB
	frequency range > 10 MHz to 18 GHz	
	measurement with external preamplifier (gain 30 dB, noise figure < 5 dB), RBW 1 MHz	0.2 dB

Required hardware

Spectrum analyzer		
Noise source supply	via 28 V connector on R&S®FSL rear panel	R&S®FSL-B5
Noise source	recommendation	NoiseCom NC346
Preamplifier, external	frequency range 100 kHz to 3/6/18 GHz	gain approx. 30 dB, noise figure max. 5 dB

R&S®FSL-K72 3GPP FDD base station test

The specifications below are based on the data sheet specifications of the R&S®FSL spectrum analyzer and have not been checked separately. Specifications apply under the following conditions: 15 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to and internal calibration performed. Data with tolerances are measurement uncertainties with a confidence level of 95 %. The specified level measurement errors do not take into account systematic errors due to reduced S/N ratio.

PMU = permissible measurement uncertainty in line with test specification 3GPP TS 25.141.

Frequency error

Base station output power	**test case 6.2.1**	
Level range		−70 dBm to +30 dBm
Level uncertainty	total power P_{total} > −60 dBm	< 0.5 dB PMU: < 0.7 dB

CPICH power accuracy	**test case 6.2.2**	
Level range of total power		−40 dBm to +30 dBm
Level range of CPICH		−40 dB to 0 dB
Level uncertainty (absolute power)	P_{CPICH} ≥ −10 dB	< 0.52 dB (σ = 0.019) PMU: < 0.8 dB
	P_{CPICH} ≥ −20 dB	< 0.59 dB (σ = 0.024)
Level uncertainty (relative power)	P_{CPICH} ≥ −10 dB	< 0.021 dB (σ = 0.006) PMU: < 0.3 dB
	P_{CPICH} ≥ −20 dB	< 0.088 dB (σ = 0.022)

Frequency error

Frequency error	**test case 6.3**	
Measurement range	CPICH synchronous	±5 kHz PMU: ±1 kHz
	SCH synchronous	±1 kHz
Measurement uncertainty	SNR > 40 dB	< 5 Hz + Δf_{ref} [1] (σ = 2 Hz) PMU: < 12 Hz + Δf_{ref} [1]

Output RF spectrum emissions

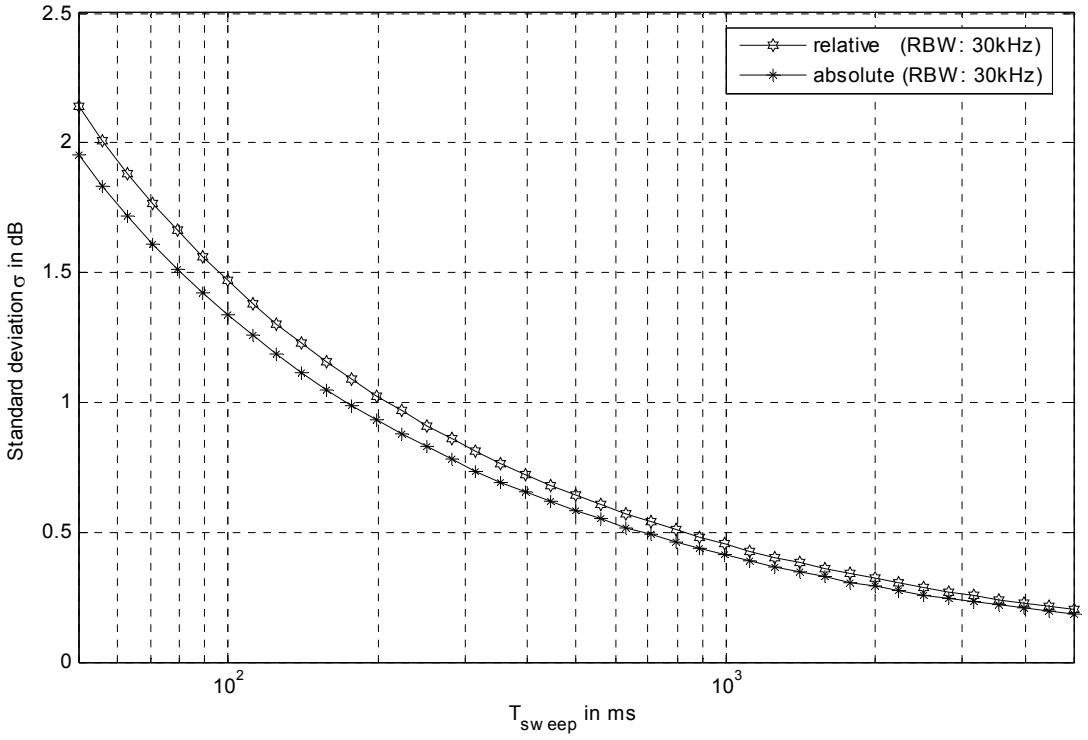
Measured (R&S®FSL) with RBW = 30 kHz, VBW = 300 kHz, OBW = 99 %, SWT = 200 ms, span = 11 MHz

Occupied bandwidth	**test case 6.5.1**	**R&S®FSL**
Measurement uncertainty	P > −40 dBm, span ≤ 10 MHz	< 38 kHz (σ = 18 kHz) PMU: < 100 kHz

Measured (R&S®FSL) with RBW = 30 kHz, VBW = 300 kHz, span = 11 MHz

Spectrum emission mask	**test case 6.5.2.1**	
Dynamic range	P_{total} > −20 dBm	55 dB
Relative level uncertainty		< 0.25 dB + 2σ (T_{sweep}) [1] PMU: < 1.5 dB
Absolute level uncertainty		< 0.75 dB + 2σ (T_{sweep}) [1] PMU: < 1.5 dB

[1] The standard deviation σ (T_{sweep}) of Gaussian-distributed signals depends on the selected sweep time (T_{sweep}). Increasing the sweep time decreases the standard deviation (σ).



Standard deviation σ of spectrum emission mask measurement as a function of sweep time (T_{sweep})

Transmit modulation

Composite EVM	**test case 6.7.1**	
Measurement range		1.0 % to 25 %
Inherent EVM		< 1.9 %
Measurement uncertainty	test models 1 to 5 P > –40 dBm	< 1 % (σ = 0.3 %) PMU: < 2.5 %

Peak code domain error power (PCDEP)	**test case 6.7.2**	
Measurement range	–50 dB to 0 dB	0 dB to –50 dB
Inherent PCDEP		< −50 dB (σ = 0.95 dB)
Measurement uncertainty	–30 dB < PCDEP	< 0.15 dB (σ = 0.05 dB) PMU: < 1.0 dB
	–40 dB < PCDEP < –30 dB	< 0.15 dB (σ = 0.05 dB) PMU: < 1.0 dB
	–50 dB < PCDEP < –40 dB	< 0.15 dB (σ = 0.05 dB) PMU: < 1.0 dB
	–60 dB < PCDEP < –50 dB	< 0.15 dB (σ = 0.05 dB) PMU: <1.0 dB

R&S®FSL-K82 application firmware for CDMA2000® base station measurements

Frequency

Frequency range	RF input	
	R&S®FSL3	3 MHz to 3 GHz
	R&S®FSL6	3 MHz to 6 GHz [2]
	R&S®FSL18	3 MHz to 18 GHz [2]

Level

Level range	RF input	–60 dBm to +30 dBm
Level setting		auto, manual

Signal acquisition

Supported standards		CDMA2000® BTS IS-95 BTS
Capture length		2 to 12 power control groups
Sweep time	spectrum mask	max. 16000 s, auto
	ACPR (adjacent channel power ratio)	max. 16000 s
Sweep count		1 to 32767
Trigger modes	RF input	free run, external

Measurement parameters

Frequency band	predefined bands	band classes 0 to 17
	unspecified	limits can be user-specified
Link mode		downlink (DL)
Modulation detection		BPSK, QPSK, 8PSK, 16QAM
Predefined channel table	code domain analyzer	The predefined channel table allows the complete channel setup of the user signal for the code domain analyzer.
Spectrum emission mask	standard	in line with band classes 0 to 17
	user	The spectrum emission mask measurement is performed based on either a manual user setting or a user-specified XML file.

Result display

Result summary	min./mean/current/max. values	global results: carrier frequency error (reading in Hz and ppm), chip rate error, trigger to frame, number of active channels
		results for selected power control group: total power, pilot power, rho, composite EVM, I/Q imbalance, I/Q offset
		results for selected power control group: absolute power, relative power, symbol EVM, modulation type, timing offset, phase offset
Code domain power	clear write, max. hold, min. hold, average, view	code domain power versus channel code domain error power versus channel
Peak code domain error	clear write, max. hold, min. hold, average, view	peak code domain error power versus power control group
Power versus power control group	clear write, max. hold, min. hold, average, view	power versus power control group for selected channel

[2] All the values specified for R&S®FSL-K82 in this data sheet are valid up to 3 GHz.

Channel table	clear write, max. hold, min. hold, average, view	numeric result table for all channels including the following readings per channel: channel type, channel number, spreading factor, symbol rate, radio configuration, state, absolute power, relative power, timing offset, phase offset
Composite EVM	clear write, max. hold, min. hold, average, view	EVM versus power control group
EVM versus symbol	clear write, max. hold, min. hold, average, view	EVM versus symbol for selected channel and power control group
Power versus symbol	clear write, max. hold, min. hold, average, view	power versus symbol for selected channel and power control group
Channel constellation	clear write	constellation diagram for selected channel and power control group
Composite constellation	clear write	constellation diagram for composite signal
Bit stream	clear write	bit stream for selected channel and power control group
Output power	clear write, max. hold, min. hold, average, view, blank	integrated signal power over channel bandwidth
Adjacent channel power Multicarrier adjacent channel power	clear write, max. hold, min. hold, average, view, blank	absolute and relative adjacent channel power
Spectrum emission mask	clear write, max. hold, min. hold, average, view, blank	spectrum mask limit check peak list evaluation
Occupied bandwidth	clear write, max. hold, min. hold, average, view, blank	occupied bandwidth measured in frequency domain
CCDF	clear write, view, blank	CCDF

Measurement specification (nominal)

Composite EVM		
Measurement range		1.7 % to 25 %
Inherent EVM		< 1.7 %
Measurement uncertainty		< 0.7 % of reading
Code domain power		
Measurement range		–60 dBm + 10 dBm
Level uncertainty, total power		< 0.7 dB
Level uncertainty, pilot power		< 0.7 dB
Level uncertainty, channel power, absolute		< 0.7 dB
Level uncertainty, channel power, relative		< 0.2 dB
Frequency error measurement		
Lock range		±1 kHz
Measurement uncertainty		4 Hz + reference frequency uncertainty
Peak code domain error		
Measurement range		0 dB to –50 dB
Inherent PCDE		–50 dB
Trigger to frame		
Measurement range		< 100 µs
Accuracy	relative	±110 ns
Rho		
Measurement uncertainty	0.9 to 1.0	$\pm 5 \times 10^{-4}$
Occupied bandwidth		
Measurement uncertainty	99 % power bandwidth, span 4.2 MHz	±38 kHz
Spectrum emission mask		
Dynamic range	P_{total} > –20 dBm, Δf = 750 kHz	60 dB
Level uncertainty		0.5 dB
Adjacent channel leakage ratio		
Dynamic range	P_{total} > –20 dBm	60 dB
Level uncertainty		0.5 dB

R&S®FSL-K84 1xEV-DO base station measurement

Frequency

Frequency range	RF input	
	R&S®FSL3	3 MHz to 3 GHz
	R&S®FSL6	3 MHz to 6 GHz [3]
	R&S®FSL18	3 MHz to 18 GHz [3]

Level

Level range	RF input	–60 dBm to +30 dBm
Level setting		auto, manual

Signal acquisition

Supported standards		1xEV-DO Revision 0 1xEV-DO Revision A
Capture length		2 to 12 power control groups
Sweep time	spectrum mask adjacent channel power ratio (ACPR)	max. 16000 s, auto max. 16000 s
Sweep count		1 to 32767
Trigger modes	RF input	free run, external

Measurement parameters

Frequency band	predefined bands	band classes 0 to 17,
	unspecified	limits can be user-specified
Link mode		downlink (DL)
Modulation detection		automatic detection of BPSK, QPSK, 8PSK, 16QAM
Predefined channel table	code domain analyzer	The predefined channel table allows the complete channel setup of the user signal for the code domain analyzer
Spectrum emission mask	standard	in line with band classes 0 to 17
	user	The spectrum emission mask measurement is performed based on either a manual user setting or a user-specified XML file

Result display

General results	clear write, max. hold, min. hold, average, view	global results over all slots: carrier frequency error (reading in Hz and ppm), chip rate error, trigger to frame, rho of pilot channel over all slots, rho of MAC channel over all slots, rho of data channel over all slots, rho overall-1 (halfslot boundary), rho overall-2 (quarterslot boundary) results for selected slot: total power, pilot power, MAC power, data power, preamble power, rho, composite EVM

[3] All the values specified for R&S®FSL-K84 in this data sheet are valid up to 3 GHz.

Channel results	clear write, max. hold, min. hold, average, view	results for pilot channel: absolute power, peak code domain error, I/Q imbalance, IQ offset results for selected channel: symbol rate, timing offset, spreading factor, symbol EVM (reading in % RMS and % peak), modulation type, timing offset, phase offset, absolute channel power, relative channel power
Code domain power	clear write, max. hold, min. hold, average, view	code domain power versus channel code domain error power versus channel
Peak code domain error	clear write, max. hold, min. hold, average, view	peak code domain error power versus slot
Channel table	clear write, max. hold, min. hold, average, view	numeric result table for all active channels including the following readings per channel: channel type, channel number, spreading factor, symbol rate, modulation type, absolute power, relative power, timing offset, phase offset
Composite EVM	clear write, max. hold, min. hold, average, view	EVM versus slot
EVM versus symbol	clear write, max. hold, min. hold, average, view	EVM versus symbol for selected channel and slot
Power versus symbol	clear write, max. hold, min. hold, average, view	power versus symbol for selected channel and slot
Channel constellation	clear write	constellation diagram for selected channel and slot
Composite constellation	clear write	constellation diagram for composite signal
Bit stream	clear write	bit stream for selected channel and slot
Output power	clear write, max. hold, min. hold, average, view, blank	integrated signal power over channel bandwidth
Adjacent channel power Multicarrier adjacent channel power	clear write, max. hold, min. hold, average, view, blank	absolute and relative adjacent channel power
Spectrum emission mask	clear write, max. hold, min. hold, average, view, blank	spectrum mask limit check peak list evaluation
Occupied bandwidth	clear write, max. hold, min. hold, average, view, blank	occupied bandwidth measured in frequency domain
CCDF	clear write, view, blank	CCDF
Power versus time	clear write, max. hold, min. hold, average, view, blank	check averaged halfslots against a limit mask in time domain; check separate limits for full slots and idle slots

Measurement specification (nominal)

Composite EVM		
Measurement range		1.7 % to 25 %
Inherent EVM		< 1.7 %
Measurement uncertainty		< 0.7 %
Code domain power		
Measurement range		–60 dBm to +10 dBm
Level uncertainty, total power		< 0.7 dB
Level uncertainty, pilot power		< 0.7 dB
Level uncertainty, channel power	absolute	< 0.7 dB
	relative	< 0.2 dB
Frequency error measurement		
Lock range		±7 kHz
Measurement uncertainty		4 Hz + reference frequency uncertainty
Peak code domain error		
Measurement range		0 dB to –53 dB
Inherent PCDE	pilot	–50 dB
	MAC	–47 dB
	data	–53 dB
	preamble	–50 dB

Trigger to frame		
Measurement range		< 100 µs
Accuracy	relative	±110 ns
Rho		
Measurement uncertainty	0.9 to 1.0	$\pm 5 \times 10^{-4}$
Occupied bandwidth		
Measurement uncertainty	99 % power bandwidth, span 4.2 MHz	±38 kHz
Spectrum emission mask		
Dynamic range	P_{total} > –20 dBm, Δf = 750 kHz	60 dB
Level uncertainty		< 0.5 dB
Adjacent channel leakage ratio		
Dynamic range	P_{total} > –20 dBm	60 dB
Level uncertainty		< 0.5 dB

R&S®FSL-K91 WLAN IEEE 802.11a/b/g/j OFDM analysis
R&S®FSL-K91n WLAN IEEE 802.11n OFDM analysis

The specifications of the R&S®FSL-K91 and R&S®FSL-K91n options are based on the data sheet of the R&S®FSL spectrum analyzer.

Specifications apply under the following conditions: 30 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to, and all internal automatic adjustments performed. "Typical values" are designated with the abbreviation "typ." These values are verified during the final test but are not assured by Rohde & Schwarz. "Nominal values" are design parameters that are not assured by Rohde & Schwarz. These values are verified during product development but are not specifically tested during production.

OFDM analysis (IEEE 802.11a, IEEE 802.11g OFDM, IEEE 802.11j, IEEE 802.11n)

Frequency

Frequency range		
RF input	R&S®FSL3	50 MHz [4] to 3 GHz
	R&S®FSL6	50 MHz [4] to 6 GHz
	R&S®FSL18	50 MHz [4] to 18 GHz (overrange 20 GHz)
Frequency setting		frequency
		channel number

Level

Level range	RF input	up to +30 dBm
Level setting		autorange
		manual

Signal acquisition

Supported standards		IEEE 802.11a, IEEE 802.11g (OFDM), IEEE 802.11n (20 MHz), IEEE 802.11j (10 MHz), IEEE 802.11j (20 MHz)
Modulation format		BPSK, QPSK, 16QAM, 64QAM
Demodulator setting		auto, manual with/without test of signal field
Capture length	continuous	
	IEEE 802.11a, j	24 µs to 15 ms
	IEEE 802.11g, n	24 µs to 11.9 ms
Number of bursts that can be analyzed	manual	1 to 10922
Result length	PVT, spectrum FFT, CCDF	capture length, 1 to 10922 bursts or gate length
	EVM versus symbol and versus carrier, constellation versus symbol/versus carrier spectrum flatness, bit stream, signal field	capture length, 1 to 10922 bursts
Burst length	automatic detection of number of data symbols	1 to 1366 data symbols
	manual	1 to 1366 data symbols
Triggering		free run, IF power, external

[4] 1 MHz to 50 MHz with restricted functionality depending on bandwidth (power trigger, auto level, IF overload).

Result display

Result list	min./mean/max. values	EVM all carriers
		EVM pilots
		EVM payload
		I/Q offset
		gain imbalance
		quadrature error
		center frequency error
		symbol clock error
		mean burst power
		crest factor
Power versus time		full burst
		rising/falling edge
EVM		EVM versus symbol
		EVM versus carrier
Error versus preamble		frequency error versus preamble
		phase error versus preamble
Spectrum		spectrum mask (IEEE & ETSI), ACP (IEEE 802.11j: abs./rel.), spectrum FFT
		spectrum flatness
Constellation		constellation diagram
		constellation versus carrier
Statistics		bit stream
		signal field
		CCDF
Limit check	values in line with standard	result list
		EVM
		spectrum mask
		ACP

Adjustable parameters

Pilot tracking		phase ON/OFF
		timing ON/OFF
		level ON/OFF
Channel estimation		data
		preamble

Measurement uncertainty (nominal) [5]

Residual EVM	level –23 dBm to +15 dBm, average of 20 bursts	IEEE 802.11a/g/j signal	IEEE 802.11n signal 20 MHz
	input RF, f = 2.4 GHz/5 GHz		
	channel estimation = preamble	–37 dB/–35 dB	–36 dB/–33 dB
	channel estimation = data	–40 dB/–38 dB	–40 dB/–36 dB
Frequency error			
Lock range		40 ppm	
Uncertainty		1 Hz + reference frequency uncertainty	
Level uncertainty	test of spectrum mask	0.2 dB	
	output power		
	f < 3 GHz	0.5 dB	
	3 GHz ≤ f ≤ 6 GHz	0.8 dB	
	ACPR	0.5 dB	
Spectrum flatness		0.5 dB	

[5] Valid for R&S®FSL3 without tracking generator: serial number ≥ 100838, R&S®FSL6 without tracking generator: serial number ≥ 100675, R&S®FSL3 with tracking generator: serial number ≥ 100704, R&S®FSL6 with tracking generator: serial number ≥ 100605.

DSSS/CCK/PBCC analysis (IEEE 802.11b, IEEE 802.11g CCK)

Frequency

Frequency range		
RF input	R&S®FSL3	50 MHz [6] to 3 GHz
	R&S®FSL6	50 MHz [6] to 6 GHz
	R&S®FSL18	50 MHz [6] to 18 GHz (overrange 20 GHz)
Frequency setting		frequency
		channel number

Level

Level range	RF input	up to +30 dBm
Level setting		autorange
		manual

Signal acquisition

Supported standards		IEEE 802.11b, IEEE 802.11g (CCK)
Modulation format		DBPSK, DQPSK, CCK, short PLCP, long PLCP 5.5 Mbps, 11 Mbps PBCC
Demodulator setting		auto
		manual with/without test of signal field
Capture length	continuous	24 µs to 11.9 ms
Number of bursts that can be analyzed	manual	1 to 10922
Result length	PVT, spectrum FFT, CCDF	capture length, 1 to 10922 bursts or gate length
	EVM versus symbol and versus carrier constellation versus symbol bit stream PLCP header	capture length, 1 to 10922 bursts
Burst length	automatic detection of number of data symbols	1 to 4095 bytes
	manual	1 to 4095 bytes
Triggering		free run, IF power, external

[6] 1 MHz to 50 MHz with restricted functionality depending on bandwidth (power trigger, auto level, IF overload).

Result display

Result list	min./mean/max. values	peak vector error
	min./mean/max. values	burst EVM I/Q offset gain imbalance quadrature error center frequency error chip clock error rise time fall time mean burst power peak burst power crest factor
Power versus time		up ramp/down ramp
EVM		EVM versus symbol
Error versus preamble		frequency error versus preamble phase error versus preamble
Spectrum		spectrum mask, ACPR, spectrum FFT
Constellation		constellation diagram
Statistics		bit stream PLCP header CCDF
Limit check	values in line with standard	result list, power versus time, EVM, spectrum mask, ACP

Adjustable parameters

Tracking		phase ON/OFF timing ON/OFF level ON/OFF

Measurement uncertainty (nominal)

Residual EVM	level −23 dBm to +15 dBm average of 20 bursts, 11 Mbps CCK with short PLCP, burst EVM	
	f = 2.442 GHz	1.8 %
Frequency error		
Lock range		±0.6 MHz
Uncertainty		1 Hz + reference frequency uncertainty
Level uncertainty	test of spectrum mask	0.2 dB
	output power	
	f < 3 GHz	0.5 dB
	3 GHz ≤ f ≤ 6 GHz	0.8 dB
	ACPR	0.5 dB

R&S®FSL-K92 WiMAX™ IEEE 802.16 OFDM analysis (IEEE 802.16-2004, IEEE 802.16-2004/Cor1-2005, IEEE 802.16e-2005, P802.16-Rev2/D3 WiMAX™)

The specifications of the R&S®FSL-K92 WiMAX measurement application are based on the data sheet specifications of the R&S®FSL and R&S®ETL signal and spectrum analyzers, have not been checked separately and are not verified during instrument calibration. The specified level measurement errors do not take into account systematic errors due to reduced signal to noise ratio (S/N). Specifications apply under the following conditions: 30 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to, and all internal automatic adjustments performed.

"Typical values" are designated with the abbreviation "typ.". These values are verified during the final test but are not assured by Rohde & Schwarz.

"Nominal values" are design parameters that are not assured by Rohde & Schwarz. These values are verified during product development but are not specifically tested during production.

Data without tolerance limits is not binding.

Frequency

Frequency range	RF input		
	R&S®FSL3		9 kHz [7] to 3 GHz
	R&S®FSL6		9 kHz [7] to 6 GHz
	R&S®FSL18		9 kHz [7] to 18 GHz
	R&S®ETL		500 kHz [7] to 3 GHz
Frequency setting			frequency, channel number
Sampling rate F_s	model	serial number or lower	1.44 MHz to 20 MHz
	R&S®FSL3 [8]	100703	
	R&S®FSL6 [8]	100604	
	R&S®FSL3	100945	
	R&S®FSL6	100759	
	R&S®ETL		
	model	serial number or higher	1.44 MHz to 32 MHz
	R&S®FSL3 [8]	100704	
	R&S®FSL6 [8]	100605	
	R&S®FSL3	100946	
	R&S®FSL6	100760	
	R&S®FSL18		1.44 MHz to 32 MHz

Level

Level range	RF input	−60 dBm to +30 dBm
Level setting		auto, manual

7 Restricted IF overload, power trigger and auto level functionality depending on carrier frequency and bandwidth at carrier frequencies < 50MHz.

8 With tracking generator.

Signal acquisition

Supported standards		IEEE 802.16-2004 OFDM, IEEE 802.16e-2005 OFDM P802.16-Rev2/D3 OFDM
Capture length		24 µs to 15.6 ms
Gate length		24 µs to capture length
Number of analyzed bursts		1 to 10922 bursts
Result length	power versus time, EVM versus symbol, EVM versus carrier, frequency error versus preamble, phase error versus preamble, constellation versus symbol, constellation versus carrier, spectrum flatness, spectrum flatness difference, group delay, bit stream, burst summary	capture length [9]
	FFT spectrum, CCDF	capture length or gate length
	result summary	capture length [9] or 1 to 10922 bursts
Burst length	number of data symbols automatically detected, manually adjustable	1 to 2425
Sweep time	spectrum mask	2.5 ms to 16000 s, auto
	adjacent channel power ratio (ACPR)	10 ms to 16000 s
Sweep count		1 to 32767
Trigger modes	RF input	free run, external, power

Measurement parameters

Frequency band	predefined bands	preset combinations of sampling rate (F_s) and nominal channel bandwidth (BW) in line with standard
	unspecified	standard-compliant or user-defined F_s/BW ratios
Sampling rate (F_s), channel bandwidth (BW)		If one of the parameters is set, the other is automatically set as required for the selected standard. The frequency band setting is taken into account
Guard period ratio G = T_g/T_b		1/4, 1/8, 1/16, 1/32
Link mode		downlink (DL), uplink (UL)
Modulation detection		none, first symbol, user, all (auto demod.)
Modulation format		BPSK, QPSK, 16QAM, 64QAM
Subchannelization	uplink	ON/OFF
Subchannel index	uplink	1 to 31
UL physical modifier	uplink	0 to 255
Pilot tracking		phase ON/OFF
		timing ON/OFF
		level ON/OFF
Channel estimation		preamble, preamble and payload
Spectrum emission mask	standard	IEEE, ETSI
	user-definable	The spectrum emission mask is measured in line with the user setting files

Result display

Result summary	min./mean/max. values	EVM all carriers, EVM data carriers, EVM pilot carriers, I/Q offset, gain imbalance, quadrature error, frequency error, clock error, burst power, crest factor, RSSI, RSSI standard deviation, CINR, CINR standard deviation
Power versus time		full burst
		start/end
		burst view depending on selected burst
EVM	min./mean/max. values	EVM versus symbol
		EVM versus carrier

9 Max. 2000 bursts per capture buffer.

Error versus preamble	min./mean/max. values	frequency error versus preamble
		phase error versus preamble
Spectrum	min./mean/max. values	spectrum flatness
		spectrum flatness difference
	min./mean/max. values	group delay
	clear write, max. hold	IEEE [10], ETSI [11], user-definable spectrum mask
	clear write, max. hold	ACPR (absolute/relative)
	clear write	FFT spectrum
Constellation		constellation versus symbol
		constellation versus carrier
Statistics		CCDF
		bit stream
		burst summary list
		modulation format, burst length in symbols, power, EVM

Limit check	values in line with standard	result list
		EVM, I/Q offset, frequency error, clock error
		spectrum flatness
		spectrum flatness difference
		spectrum mask
		IEEE [12], ETSI [13], user-definable

Measurement uncertainty R&S®FSL (nominal)

Residual EVM [14]	level –30 dBm to +15 dBm, average of 20 bursts	
	f = 2.4 GHz	
	DL [15], UL [16] channel estimation: preamble and payload	–40 dB
	f = 5 GHz	
	DL [15], UL [16] channel estimation: preamble and payload	–37 dB
Frequency error		
Max. measurement frequency window	DL [15], UL [16]	50 ppm
Uncertainty		1 Hz + R&S®FSL frequency uncertainty (see R&S®FSL reference frequency)
Level uncertainty	test of spectrum mask	like the R&S®FSL (see R&S®FSL total measurement uncertainty)
	output power	like the R&S®FSL (see R&S®FSL total measurement uncertainty)
	adjacent channel power ratio (ACPR)	like the R&S®FSL (see R&S®FSL total measurement uncertainty)

[10] In line with [1] IEEE 802.16-2004.

[11] In line with [10] ETSI EN 301 021 V1.6.1 (2003-07).

[12] In line with [1] IEEE 802.16-2004.

[13] In line with [10] ETSI EN 301 021 V1.6.1 (2003-07).

[14] Valid for R&S®FSL3 with tracking generator serial number ≥ 100704, R&S®FSL6 with tracking generator serial number ≥ 100605, R&S®FSL3 serial number ≥ 100946, R&S®FSL6 serial number ≥ 100760, R&S®FSL18.

[15] This result is based on the following downlink signal: BW = 10 MHz, T_g/T_b = 1/8. The downlink subframe contains one burst of 30 OFDM symbols using a QPSK modulation format.

[16] This result is based on the following uplink signal: BW = 10 MHz, T_g/T_b = 1/8. The uplink subframe contains one burst of 30 OFDM symbols using a QPSK modulation format.

Measurement uncertainty R&S®ETL[17] (nominal)

Residual EVM	level −30 dBm to +10 dBm, average of 20 bursts	
	f = 2.4 GHz	
	DL [15], UL [16] channel estimation: preamble and payload	−39 dB
Frequency error		
Max. measurement frequency window	DL [15], UL [16]	50 ppm
Uncertainty		1 Hz + R&S®ETL frequency uncertainty (see R&S®ETL reference frequency)
Level uncertainty	test of spectrum mask	like the R&S®ETL (see R&S®ETL total measurement uncertainty)
	output power	like the R&S®ETL (see R&S®ETL total measurement uncertainty)
	adjacent channel power ratio (ACPR)	like the R&S®ETL (see R&S®ETL total measurement uncertainty)

[17] Valid for R&S®ETL fitted with preselector option R&S®ETL-B203. The preselector state is off.

R&S®FSL-K93 WiMAX™/WiBro IEEE 802.16 OFDMA SISO analysis (IEEE 802.16-2004, IEEE 802.16-2004/Cor1-2005, IEEE 802.16e-2005, P802.16-Rev2/D3 WiMAX™ and WiBro)

The specifications of the R&S®FSL-K93 WiMAX™ measurement application are based on the data sheet specifications of the R&S®FSL and R&S®ETL signal and spectrum analyzers, have not been checked separately and are not verified during instrument calibration. The specified level measurement errors do not take into account systematic errors due to reduced signal to noise ratio (S/N). Specifications apply under the following conditions: 30 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to, and all internal automatic adjustments performed.

"Typical values" are designated with the abbreviation "typ.". These values are verified during the final test but are not assured by Rohde & Schwarz.

"Nominal values" are design parameters that are not assured by Rohde & Schwarz. These values are verified during product development but are not specifically tested during production.

Data without tolerance limits is not binding.

Frequency

Frequency range	RF input		
	R&S®FSL3		9 kHz [18] to 3 GHz
	R&S®FSL6		9 kHz [18] to 6 GHz
	R&S®FSL18		9 kHz [18] to 18 GHz
	R&S®ETL		500 kHz [18] to 3 GHz
Sampling rate F_s	model	serial number or lower	1.44 MHz to 20 MHz
	R&S®FSL3 [19]	100703	
	R&S®FSL6 [19]	100604	
	R&S®FSL3	100945	
	R&S®FSL6	100759	
	R&S®ETL		
	model	serial number or higher	1.44 MHz to 32 MHz
	R&S®FSL3 [19]	100704	
	R&S®FSL6 [19]	100605	
	R&S®FSL3	100946	
	R&S®FSL6	100760	
	R&S®FSL18		1.44 MHz to 32 MHz

Level

Level range	RF input	−60 dBm to +30 dBm
Level setting		auto
		manual

[18] Restricted IF overload, power trigger and auto level functionality depending on carrier frequency and bandwidth at carrier frequencies < 50MHz.

[19] With tracking generator.

Signal acquisition

Supported standards		IEEE 802.16-2004 OFDMA SISO
		IEEE 802.16-2004/Cor1-2005 OFDMA SISO
		IEEE 802.16e-2005 OFDMA SISO
		P802.16-Rev2/D3 OFDMA SISO
		IEEE 802.16e-2005 based WiBro
Capture length		24 µs to 15.6 ms
Gate length		24 µs to capture length
Number of analyzed subframes		1 to 10922 subframes
Result length	EVM versus symbol, burst summary list, constellation versus symbol, bit stream	capture length [20]
	FFT spectrum, CCDF	capture length or gate length
	result summary, power versus time, EVM versus carrier, spectrum flatness, spectrum flatness difference, group delay, frequency error versus sample, phase error versus sample	capture length [20] or 1 to 10922 subframes
Frame length		2 ms to 15 ms
Sweep time	spectrum mask	2.5 ms to 16000 s, auto
	adjacent channel power ratio (ACPR)	10 ms to 16000 s
Sweep count		1 to 32767
Trigger modes	RF input	free run, external, power

Measurement parameters

Frequency band	predefined bands	preset combinations of sampling rate (F_s) and nominal channel bandwidth (BW) in line with standard
	unspecified	standard-compliant or user-defined F_s/BW ratios
Sampling rate (F_s), channel bandwidth (BW)		If one of the parameters is set, the other is automatically set as required for the selected standard. The frequency band setting is taken into account
Guard period ratio G = T_g/T_b		1/4, 1/8, 1/16, 1/32
N_{FFT}		128, 512, 1024, 2048
Zones	downlink (DL)	DL-PUSC, DL-FUSC, DL-AMC 2×3
	uplink (UL)	UL-PUSC, UL-AMC 2×3
Signal analysis	DL	in line with signal DL-MAP (auto demod.), normal DL-MAP, compressed DL-MAP
	DL, UL	in line with user-defined frame configuration
IDcell		0 to 31
Segments	DL-PUSC	0, 1, 2
Preamble	preamble mode, auto	derived from IDcell and segment setting in line with standard
	preamble mode, user	defined by preamble index in line with standard
Subchannel bitmap used	DL-PUSC	6-bit mask allocating subchannel groups to a segment
Burst modulation format		BPSK (pilots only), QPSK, 16QAM, 64QAM
Pilot tracking	DL, UL	phase ON/OFF, timing ON/OFF, level ON/OFF
	DL, UL	use pilots in line with standard [21]
		use detected pilots [22]

[20] Max. 100 zones/subframes per capture buffer, max. 1000 bursts per capture buffer.

[21] The application computes the pilot modulation sequence used for tracking in line with the standard.

[22] The application detects the pilot modulation sequence used for tracking the signal to be analyzed.

Channel estimation range	DL	preamble only
		preamble and payload
		payload only
	UL	payload only
Zone editor		
Zone/segment list	DL, UL	zone type, segment, length in symbols, offset in symbols, PermBase
	DL	PRBS_ID
Zone/segment map		graphical display of frame content defined by zone/segment list
Max. number of zones/segments per subframe/frame		26
Burst editor		
Burst list	DL	modulation, number of subchannels, number of symbols, offset in subchannels, offset in symbols, boosting, burst type: FCH, DL-MAP, data, restricted HARQ
	UL	modulation, duration in slots, offset in subchannels, offset in symbols, burst type: data, restricted fast feedback
Burst map		graphical display of zone/segment content defined by burst list
Max. number of bursts per zone/segment		32
Spectrum emission mask	standard	IEEE, ETSI, TTA
	user-definable	The spectrum emission mask is measured in line with the user setting files.

Result display

Frame configuration	auto demodulation	burst map in line with decoded signal map
Result summary	analyzed subframes min./mean/max. values	center frequency error, clock error, TD power DL preamble, TD power subframe, TD power zone, crest factor, RSSI, RSSI standard deviation, CINR, CINR standard deviation
	analyzed zones/segments min./mean/max. values	BER pilots, EVM data and pilots, EVM data, EVM pilots, unmodulated subcarrier error, I/Q offset, gain imbalance, quadrature error, power DL preamble, power data and pilots, power data, power pilots
Power versus time	min./mean/max. values	full subframe
		rising/falling
EVM	min./mean/max. values	EVM versus symbol
		EVM versus carrier
Error versus sample	min./mean/max. values	frequency error versus sample
		phase error versus sample
Spectrum	min./mean/max. values	spectrum flatness
		spectrum flatness difference
	min./mean/max. values	group delay
	clear write, max. hold	IEEE [23], ETSI [24], TTA, user-definable spectrum mask
	clear write, max. hold	ACP (absolute/relative)
	clear write	FFT spectrum
Constellation		constellation diagram versus symbol

[23] In line with [1] IEEE 802.16-2004.

[24] In line with [10] ETSI EN 301 021 V1.6.1 (2003-07).

Statistics		CCDF
		bit stream
	downlink, uplink	erroneous pilots are highlighted [25]
		burst summary:
		modulation format, burst area in slots, power, EVM
Limit check	values in line with standard	result list
		center frequency error, clock error, EVM data and pilots, EVM data, I/Q offset
		spectrum flatness
		spectrum flatness difference
		spectrum mask
		IEEE [26], ETSI [27], TTA, user-definable

Measurement uncertainty R&S®FSL (nominal)

Residual EVM [28]	level −30 dBm to +15 dBm, average of 20 bursts	
	f = 2.4 GHz	
	DL[29], UL[30] channel estimation: preamble and payload	−40 dB
	f = 5 GHz	
	DL [29], UL [30] channel estimation: payload	−37 dB
Frequency error		
Max. measurement frequency window	DL [29], UL [30]	30 ppm
Uncertainty		1 Hz + R&S®FSL frequency uncertainty (see R&S®FSL reference frequency)
Level uncertainty	test of spectrum mask	like the R&S®FSL (see R&S®FSL total measurement uncertainty)
	output power	like the R&S®FSL (see R&S®FSL total measurement uncertainty)
	ACPR (adjacent channel power ratio)	like the R&S®FSL (see R&S®FSL total measurement uncertainty)

[25] The detected pilot sequence is compared with the standard-conforming pilot sequence. The standard-conforming pilot sequence depends on the IDcell, frame number [UL], PRBS_ID [DL], PermBase [DL] user settings.

[26] In line with [1] IEEE 802.16-2004.

[27] In line with [10] ETSI EN 301 021 V1.6.1 (2003-07).

[28] Valid for R&S®FSL3 with tracking generator serial number ≥ 100704, R&S®FSL6 with tracking generator serial number ≥ 100605, R&S®FSL3 serial number ≥ 100946, R&S®FSL6 serial number ≥ 100760, R&S®FSL18.

[29] This result is based on the following downlink signal: BW = 8.75 MHz, N_{FFT} = 1024, all 30 subchannels assigned to segment 0. The segment contains a downlink PUSC zone with one burst of 30 subchannels and 30 OFDMA symbols using a QPSK modulation format.

[30] This result is based on the following uplink signal: BW = 8.75 MHz, N_{FFT} = 1024, all 35 subchannels being used. The uplink PUSC zone contains one burst of 35 subchannels and 30 OFDMA symbols using a QPSK modulation format.

Measurement uncertainty R&S®ETL[31] (nominal)

Residual EVM	level −30 dBm to +10 dBm, average of 20 bursts	
	f = 2.4 GHz	
	DL[29], UL[30] channel estimation: preamble and payload	−39 dB
Frequency error		
Max. measurement frequency window	DL [29], UL [30]	30 ppm
Uncertainty		1 Hz + R&S®ETL frequency uncertainty (see R&S®ETL reference frequency)
Level uncertainty	test of spectrum mask	like the R&S®ETL (see R&S®ETL total measurement uncertainty)
	output power	like the R&S®ETL (see R&S®ETL total measurement uncertainty)
	ACPR (adjacent channel power ratio)	like the R&S®ETL (see R&S®ETL total measurement uncertainty)

References

[1] IEEE 802.16-2004, IEEE Standard for Local and Metropolitan Area Networks. October 1, 2004.

[2] IEEE 802.16e-2005 and IEEE 802.16-2004/Cor1-2005. February 28, 2006. Amendment 2: Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands and Corrigendum 1.

[3] P802.16-Rev2/D2 (December 2007) (is a revision of IEEE 802.16-2004 and consolidates material from IEEE 802.16e-2005, IEEE 802.16-2004/Cor1-2005, IEEE 802.16f-2005 and IEEE 802.16g-2007).

[4] P802.16-Rev2/D3 (February 2008) (is a revision of IEEE 802.16-2004 and consolidates material from IEEE 802.16e-2005, IEEE 802.16-2004/Cor1-2005, IEEE 802.16f-2005 and IEEE 802.16g-2007).

[10] ETSI EN 301 021 V1.6.1 (2003-07). Fixed radio systems; point-to-multipoint equipment; time division multiple access (TDMA); point-to-multipoint digital radio systems in frequency bands in the range 3 GHz to 11 GHz.

[31] Valid for R&S®ETL fitted with preselector option R&S®ETL-B203. The preselector state is off.

Ordering information

Designation	Type	Order No.
Spectrum Analyzer, 9 kHz to 3 GHz	R&S®FSL3	1300.2502.03
Spectrum Analyzer, 9 kHz to 3 GHz, with tracking generator	R&S®FSL3	1300.2502.13
Spectrum Analyzer, 9 kHz to 6 GHz	R&S®FSL6	1300.2502.06
Spectrum Analyzer, 9 kHz to 6 GHz, with tracking generator	R&S®FSL6	1300.2502.16
Spectrum Analyzer, 9 kHz to 18 GHz	R&S®FSL18	1300.2502.18
Spectrum Analyzer, 9 kHz to 18 GHz, with tracking generator	R&S®FSL18	1300.2502.28
TV Analyzer, 500 kHz to 3 GHz, with tracking generator	R&S®ETL	2112.0004.13
Accessories supplied		
Power cable, quick start guide and CD-ROM (with operating manual and service manual)		
Recommended extras		
Printed manual (includes operating manual and service manual)		1300.3338.32

Options

Designation	Type	Order No.	Retrofittable	Remarks
Options				
OCXO Reference Frequency	R&S®FSL-B4	1300.6008.02	yes	standard with the R&S®FSL18
Additional Interfaces	R&S®FSL-B5	1300.6108.02	yes	video out, IF out, noise source control, AUX port, R&S®NRP-Zxx power sensor
TV Trigger	R&S®FSL-B6	1300.5901.02	yes	
Narrow Resolution Filters	R&S®FSL-B7	1300.5601.02	yes	
Gated Sweep	R&S®FSL-B8	1300.5701.02	yes	
GPIB Interface	R&S®FSL-B10	1300.6208.02	yes	
RF Preamplifier (3/6 GHz)	R&S®FSL-B22	1300.5953.02	yes	
DC Power Supply	R&S®FSL-B30	1300.6308.02	yes	
NiMH Battery Pack 4.5 Ah	R&S®FSL-B31	1300.6408.02	yes	requires R&S®FSL-B30
Li-Ion Battery Pack 10 Ah with Battery Charger	R&S®ETL-B235	2112.0262.02	yes	requires R&S®FSL-B30
Firmware/Software				
AM/FM/φM Measurement Demodulator	R&S®FSL-K7	1301.9246.02		
Bluetooth® TX Measurements (1.1 and 2.0 + EDR)	R&S®FSL-K8	1301.9398.02		
Power Sensor Support	R&S®FSL-K9	1301.9530.02		requires R&S®FSL-B5 or R&S®NRP-Z3/4
Spectrogram Measurements	R&S®FSL-K14	1302.0913.02		
Cable TV and TV Measurements	R&S®FSL-K20	1301.9675.02		
Application Firmware for Noise Figure and Gain Measurements	R&S®FSL-K30	1301.9817.02		requires R&S®FSL-B5 and preamplifier
3GPP FDD BTS Application Firmware	R&S®FSL-K72	1302.0620.02		
CDMA2000® Base Station Analysis	R&S FSL-K82	1308.7803.02		
1xEV-DO Base Station Measurement	R&S FSL-K84	1302.0159.02		
WLAN IEEE 802.11a/b/g/j Application Firmware	R&S®FSL-K91	1302.0094.02		
Upgrade of R&S®FSL-K91 to IEEE 802.11n	R&S®FSL-K91n	1308.7903.02		
WiMAX™ IEEE 802.16 OFDM Application Firmware	R&S®FSL-K92	1302.0236.02		
WiMAX™ IEEE 802.16 OFDM/OFDMA Application Firmware	R&S®FSL-K93	1302.0736.02		
Upgrade from R&S®FSL-K92 to R&S®FSL-K93	R&S®FSL-K92U	1302.0307.02		

Recommended extras

Designation	Type	Order No.
19'' Rackmount Adapter	R&S®ZZA-S334	1109.4487.00
Soft Carrying Bag	R&S®FSL-Z3	1300.5401.00
Protective Hard Cover	R&S®EVS-Z6	5201.7760.00
Additional Charger Unit	R&S®FSL-Z4	1300.5430.02
Matching Pad 75 Ω, L section	R&S®RAM	0358.5414.02
Matching Pad 75 Ω, series resistor 25 Ω	R&S®RAZ	0358.5714.02
Matching Pad 75 Ω, L section, N to BNC	R&S®FSH-Z38	1300.7740.02
SWR Bridge, 5 MHz to 3 GHz	R&S®ZRB2	0373.9017.52
SWR Bridge, 40 kHz to 4 GHz	R&S®ZRC	1039.9492.52
SWR Bridge, 10 MHz to 3 GHz (incl. Open, Short, Load calibration standards)	R&S®FSH-Z2	1145.5767.02

Power sensors supported by R&S®FSL-K9

Designation	Type	Order No.
Average Power Sensor 10 MHz to 8 GHz, 200 mW	R&S®NRP-Z11	1138.3004.02
Average Power Sensor 10 MHz to 18 GHz, 200 mW	R&S®NRP-Z21	1137.6000.02
Average Power Sensor 10 MHz to 18 GHz, 2 W	R&S®NRP-Z22	1137.7506.02
Average Power Sensor 10 MHz to 18 GHz, 15 W	R&S®NRP-Z23	1137.8002.02
Average Power Sensor 10 MHz to 18 GHz, 30 W	R&S®NRP-Z24	1137.8502.02
Power Sensor Module with Power Splitter DC to 18 GHz, 500 mW	R&S®NRP-Z27	1169.4102.02
Power Sensor Module with Power Splitter DC to 26.5 GHz, 500 mW	R&S®NRP-Z37	1169.3206.02
Average Power Sensor 9 kHz to 6 GHz, 200 mW	R&S®NRP-Z91	1168.8004.02
Thermal Power Sensor 0 Hz to 18 GHz, 100 mW	R&S®NRP-Z51	1138.0005.02
Thermal Power Sensor 0 Hz to 40 GHz, 100 mW	R&S®NRP-Z55	1138.2008.02
Wideband Power Sensor 50 MHz to 18 GHz, 100 mW	R&S®NRP-Z81	1137.9009.02

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- ISO 14001-certified environmental management system

Certified Quality System
ISO 9001

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