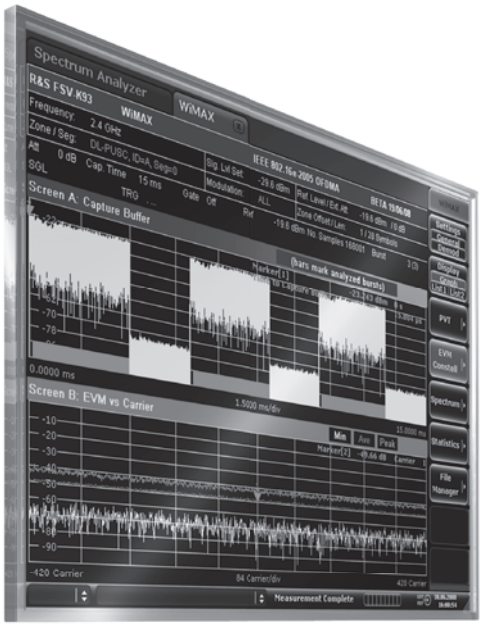
R&S®FSV-K93
WiMAX IEEE 802.16
SISO Analysis
Specifications



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Test & Measurement

Data Sheet | 01.00

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The specifications of the R&S®FSV-K93 application firmware for WiMAX IEEE 802.16 SISO analysis are based on the data sheet of the R&S®FSV signal 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.

WiMAX IEEE 802.16 OFDM analysis (IEEE 802.16-2004/802.16-2005)

Frequency

Frequency range	RF input	
	R&S®FSV3	50 MHz [1] to 3.6 GHz
	R&S®FSV7	50 MHz [1] to 7 GHz
Frequency setting		frequency, channel number
Nominal channel bandwidth		1.25 MHz to 28 MHz

Level

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

Signal acquisition

Supported standards		IEEE 802.16-2004 OFDM, IEEE 802.16e-2005 OFDM P802.16-Rev2/D3 OFDM
Capture length	sampling rate (F_s) 1.44 MHz to sampling rate (F_s) 32 MHz	24 µs to 694.44 ms upper limit decreases linearly 24 µs to 31.25 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 [2]
	FFT spectrum, CCDF	capture length or gate length
	result summary	capture length [2] or 1 to 10922 bursts
Burst length	number of data symbols automatically detected, manually adjustable	1 to 2425 data symbols
Sweep time	spectrum mask	2.13 ms to 16000 s, auto
	adjacent channel power ratio (ACPR)	114 µs to 16000 s
Sweep count		1 to 32767
Trigger modes	RF input	free run, external, power

[1] 5 MHz to 50 MHz with restricted functionality depending on bandwidth (power trigger, auto level, IF overload).

[2] Max. 200 bursts per capture buffer.

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
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 [3], ETSI [4], 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

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

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

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 [5], ETSI [6], user-definable

Measurement uncertainty (nominal)

Residual EVM	level –30 dBm to +15 dBm, average of 20 bursts	
	f = 2.4 GHz or 5 GHz	
	DL[7] channel estimation: preamble and payload	–45 dB
	UL[8] channel estimation: preamble and payload	–45 dB
Frequency error		
Max. measurement frequency window	DL [7], UL [8]	50 ppm
Uncertainty		1 Hz + R&S®FSV frequency uncertainty (see R&S®FSV reference frequency)
Level uncertainty	test of spectrum mask	like R&S®FSV (see R&S®FSV total measurement uncertainty)
	output power	like R&S®FSV (see R&S®FSV total measurement uncertainty)
	adjacent channel power ratio (ACPR)	like R&S®FSV (see R&S®FSV total measurement uncertainty)

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

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

[7] 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.

[8] 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.

WiMAX/WiBro IEEE 802.16 OFDMA SISO analysis (IEEE 802.16-2004, 802.16-2004/Cor1-2005, 802.16e-2005, P802.16-Rev2/D3 WiMAX and WiBro)

Frequency

Frequency range	RF input	
	R&S®FSV3	50 MHz [9] to 3.6 GHz
	R&S®FSV7	50 MHz [9] to 7 GHz
Nominal channel bandwidth		1.25 MHz to 28 MHz

Level

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

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	sampling rate (F_s) 1.44 MHz to sampling rate (F_s) 32 MHz	24 µs to 714.29 ms upper limit decreases linearly 24 µs to 31.25 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 [10]
	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 [10] or 1 to 10922 subframes
Frame length		2 ms to 20 ms
Sweep time	spectrum mask,	2.13 ms to 16000 s, auto
	adjacent channel power ratio (ACPR)	114 µs to 16000 s
Sweep count		1 to 32767
Trigger modes	RF input	free run, power, external

[9] 5 MHz to 50 MHz with restricted functionality depending on bandwidth (power trigger, auto level, IF overload).

[10] Max. 100 subframes per capture buffer.

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
ID_{cell}		0 to 31
Segments	DL-PUSC	0, 1, 2
Preamble	preamble mode, auto	derived from ID_{cell} 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 [11]
		use detected pilots [12]
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

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

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

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 [13], ETSI [14], TTA, user-definable spectrum mask
	clear write, max. hold	ACP (absolute/relative)
	clear write	FFT spectrum
Constellation		constellation diagram versus symbol
Statistics		CCDF
		bit stream
	downlink, uplink	erroneous pilots are highlighted [15]
		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 [16], ETSI [17], TTA, user-definable

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

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

[15] The detected pilot sequence is compared with the pilot sequence in line with the standard. The pilot sequence in line with the standard depends on the ID_{cell}, frame number [UL], PRBS_ID [DL], PermBase [DL] user settings.

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

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

Measurement uncertainty (nominal)

Residual EVM	level –30 dBm to +15 dBm, average of 20 bursts	
	f = 2.4 GHz or 5 GHz	
	DL[18] channel estimation: preamble and payload	–45 dB
	UL[19] channel estimation: payload	–45 dB
Frequency error		
Max. measurement frequency window	DL [18], UL [19]	30 ppm
Uncertainty		1 Hz + R&S®FSV frequency uncertainty (see R&S®FSV reference frequency)
Level uncertainty	test of spectrum mask	like R&S®FSV (see R&S®FSV total measurement uncertainty)
	output power	like R&S®FSV (see R&S®FSV total measurement uncertainty)
	ACPR (adjacent channel power ratio)	like R&S®FSV (see R&S®FSV total measurement uncertainty)

Ordering information

Designation	Type	Order No.
WiMAX IEEE 802.16 SISO Analysis	R&S®FSV-K93	1310.88955.02
Signal Analyzer, 9 kHz to 3.6 GHz	R&S®FSV3	1307.9002.03
Signal Analyzer, 9 kHz to 7 GHz	R&S®FSV7	1307.9002.07
Recommended options and extras	**see also the specifications for the R&S®FSV signal analyzer (PD 5214.0499.22)**	

Recommended options and extras

Designation	Type	Order No.	Retrofittable	Remarks
OCXO Reference Frequency	R&S®FSV-B4	1310.9522.02	yes	user-retrofittable
RF Preamplifier (9 kHz to 7 GHz)	R&S®FSV-B22	1310.9600.02	yes	user-retrofittable
Electronic Attenuator, 1 dB steps	R&S®FSV-B25	1310.9622.02	yes	user-retrofittable
40 MHz Analysis Bandwidth	R&S®FSV-B70	1310.9645.02	yes	user-retrofittable
See also the specifications for the R&S®FSV signal analyzer (PD 5214.0499.22).				

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.

[18] 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.

[19] 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.

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