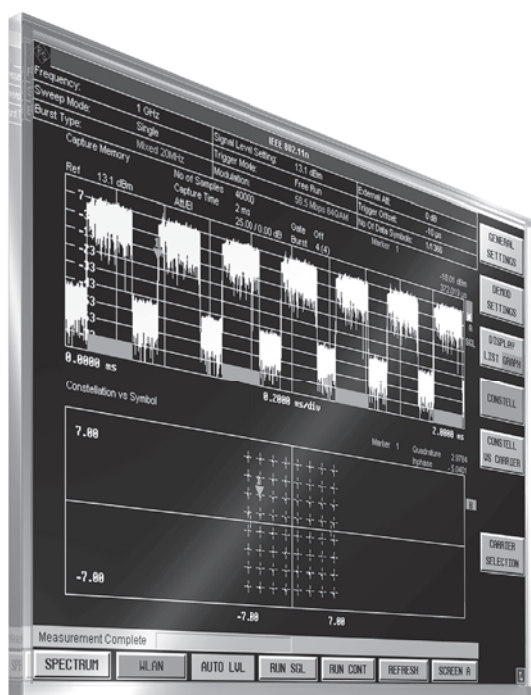


R&S®FSQ-K91/K91n/K91ac WLAN 802.11a/b/g/j/n/ac Application Firmware Specifications



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The specifications of the R&S®FSQ-K91/-K91n/-K91ac application firmware are based on the data sheet specifications of the R&S®FSQ and R&S®FSG signal and spectrum analyzers, which have not been checked separately and are not verified during instrument calibration. Measurement uncertainties are given as 95 % confidence intervals. 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.

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

Support of IEEE 802.11n modulation analysis requires upgrade to R&S®FSQ-K91n (R&S®FSQ-K91 upgrade to IEEE 802.11n).

Support of IEEE 802.11ac modulation analysis requires:

1. Upgrade to R&S®FSQ-K91ac (R&S®FSQ-K91 and R&S®FSQ-K91n upgrade to IEEE 802.11ac)
2. Bandwidth extension R&S®FSQ-B72 order no 1157.0336.12
3. For FMR 6 R&S®FSQ upgrade to FMR7 R&S®FSQ: R&S®FSQ-U3 UPGRADE WIN-XP option.
This upgrade is required in case the following key sequence *SETUP | SYSTEM INFO | STATISTICS* shows *Memory Size* ≤ 512 Mbyte

Frequency

Frequency range	RF input	
	R&S®FSQ3	50 MHz ¹ to 3.6 GHz
	R&S®FSQ8	50 MHz ¹ to 8 GHz
	R&S®FSQ26	50 MHz ¹ to 26.5 GHz
	R&S®FSQ40	50 MHz ¹ to 40 GHz
	I/Q baseband inputs (R&S®FSQ-B71)	DC to 36 MHz
Frequency setting		frequency
		channel number

Level

Level range	RF input	-70 dBm to +30 dBm
	I/Q baseband input (R&S®FSQ-B71)	31.6 mV to 5.62 V
Level setting		autorange
		manual

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

Signal acquisition

Supported standards		IEEE 802.11a, IEEE 802.11g (OFDM), IEEE 802.11j (10 MHz), IEEE 802.11j (20 MHz), IEEE 802.11n, IEEE 802.11ac
Input		RF
	R&S®FSQ-B71 R&S®FSQ-B17	I and Q baseband, unbalanced, balanced digital I/Q, digital input data rate, full scale level
MIMO	IEEE 802.11n, IEEE 802.11ac	
	number of TX antennas that can be analyzed antenna signal capture	1, 2, 3, 4 simultaneous ² , sequential using R&S®OSP open switch and control platform ³ sequential manual
Result length	PVT full burst, PVT rising, falling	capture length, 1 burst to 10922 bursts or gate length
	spectrum flatness, group delay capture memory, EVM versus carrier, EVM versus symbol, constellation, constellation versus carrier, bit stream, signal field	capture length, 1 burst to 10922 bursts capture length, 1 burst to 10922 bursts but maximal capture length
	spectrum FFT, CCDF	capture length, gate length
Sweep time	spectrum mask	100 ms
	ACPR	300 ms
Burst length	automatic detection of number of data symbols, manual	1 to 1366 data symbols
Triggering	RF input	free run, IF power, external
	I/Q baseband input	free run, envelope of I/Q voltage, external

² Requires a Rohde & Schwarz analyzer for each antenna to be measured simultaneous.

³ Requires the R&S®OSP open switch and control platform.

Result display

Result list	min/mean/max IEEE 802.11n, IEEE 802.11ac result dimensions ⁴	
		center frequency error
		symbol clock error
		EVM all carriers
		EVM pilots
		EVM payload
	number of streams	EVM all carriers
		EVM pilots
		EVM payload
	number of TX antennas	I/Q offset
	gain imbalance	
	quadrature error	
number of RX antennas	mean burst power	
	crest factor	
Power versus time	IEEE 802.11n, IEEE 802.11ac result dimensions ⁴	
	number of RX antennas	capture memory
		full burst
		rising/falling edge
EVM	IEEE 802.11n, IEEE 802.11ac result dimensions ⁴	
	number of streams	EVM versus symbol
		EVM versus carrier
Spectrum	IEEE 802.11n, IEEE 802.11ac result dimensions ⁴	
		spectrum mask (IEEE and ETSI)
		ACP (IEEE 802.11j: absolute/relative)
	number of RX antennas	spectrum FFT
	#RX antennas x #streams ^{5 6}	spectrum flatness
		group delay
	#TX antennas x # RX antennas ^{5 7}	spectrum flatness
		group delay
Constellation	IEEE 802.11n, IEEE 802.11ac result dimensions ⁴	
	number of streams	constellation diagram
		constellation versus carrier
Statistics	IEEE 802.11n, IEEE 802.11ac result dimensions ⁴	
		signal field
	number of streams	bit stream
	number of RX antennas	CCDF
Limit check	values according to standard	result list
		EVM, center frequency error, symbol clock error, I/Q offset
		spectrum flatness
		spectrum mask
		ACP

⁴ For the other WLAN standards and if not stated otherwise, the result dimension is one.

⁵ Read as number of RX antennas times number of streams.

⁶ SPECTRUM | NEXT | CHAN SEL := EFFective.

⁷ SPECTRUM | NEXT | CHAN SEL := PHYsical.

Measurement parameters

Data capture settings	capture time IEEE 802.11a, j, g (OFDM)	24 μ s to 50 ms
	capture time IEEE 802.11n	CBW 20MHz: 24 μ s to 25 ms CBW 40MHz: 24 μ s to 12.5 ms
	capture time IEEE 802.11ac	24 μ s to 50 ms ⁸
	overall burst count	ON/OFF
	number of bursts to analyze	1 to 10922
Channel bandwidth (CBW)	sampling rate (F_s) and N_{FFT} are set depending on the channel bandwidth	
	IEEE 802.11n	CBW20, CBW40 ⁹
	IEEE 802.11ac	CBW20, CBW40 ⁹ , CBW80 ⁹
PPDU format	IEEE 802.11n	auto, HT-MF, HT-GF
	IEEE 802.11ac	auto, VHT
Guard interval	IEEE 802.11n, IEEE 802.11ac	auto, short, long
Modulation format	IEEE 802.11a/g (OFDM)/j/n/ac	BPSK, QPSK, 16QAM, 64QAM
	IEEE 802.11ac	256QAM
Demodulator setting		auto
		manual with/without using the signal field
MIMO	IEEE 802.11n, IEEE 802.11ac	
	spatial mapping mode	direct, spatial expansion user defined
Source of payload length	IEEE 802.11n, IEEE 802.11ac	
		estimate from signal take from signal field
Pilot tracking		phase ON/OFF timing ON/OFF level ON/OFF
Channel estimation		preamble and data preamble

Measurement uncertainty (nominal)

Residual EVM ¹⁰	level -23 dBm to +30 dBm average of 20 bursts input = RF (f = 2.4 GHz or 5 GHz)	IEEE 802.11a/g/j signal	IEEE 802.11n signal		IEEE 802.11ac signal		
			20 MHz	40 MHz	20 MHz	40 MHz	80 MHz
channel estimation = preamble and data	-46	-46 ¹¹	-43 ¹¹	-46 ¹²	-43 ¹²	-42 ¹²	
channel estimation = preamble	-44	-44 ¹¹	-42 ¹¹	-44 ¹²	-42 ¹²	-40 ¹²	
input = I and Q baseband (voltage 1 V)							
channel estimation = preamble and data	-47	-47	-44	-47	-44	na	
channel estimation = preamble	-45	-45	-43	-45	-43	na	
Frequency error							
Lock range							40 ppm
Uncertainty							1 Hz + reference frequency uncertainty
Level uncertainty	test of spectrum mask						0.1 dB
	output power						
	f < 3.6 GHz						0.5 dB
	3.6 GHz \leq f \leq 8 GHz						1.5 dB
Spectrum flatness	ACPR						0.5 dB
	f < 3.6 GHz						0.3 dB
	f > 3.6 GHz						0.5 dB

⁸ Depending on the nominal channel bandwidth (CBW) to be analyzed and the number of TX antennas to be analyzed. For example CBW 80MHz, 4 TX antennas: maximal capture time = 25 ms or CBW 80 MHz, 1 TX antenna: maximal capture time = 50 ms.

⁹ Requires R&S®FSQ-B72 bandwidth extension option. Order no. 1157.0336.12.

¹⁰ Unit is dB.

¹¹ Valid for R&S®FSQ-B72 order no. 1157.0336.xx.

¹² Valid for R&S®FSQ-B72 order no. 1157.0336.12. *Hardware Info | Order #1155.6150 Model 12. f = 5 GHz only.*

DSSS/CCK analysis (IEEE 802.11b)

Frequency

Frequency range	RF input	R&S®FSQ3	20 MHz to 3.6 GHz
		R&S®FSQ8	20 MHz to 8 GHz
		R&S®FSQ26	20 MHz to 26.5 GHz
	I/Q baseband input (R&S®FSQ-B71)		DC to 36 MHz
Frequency setting			frequency
			channel number

Level

Level range	RF input	-65 dBm to +30 dBm
	I/Q baseband input (R&S®FSQ-B71)	31.6 mV to 5.62 V
Level setting		autorange
		manual

Signal acquisition

Supported standards		IEEE 802.11b
Modulation format		DBPSK, DQPSK, CCK, short PLCP, long PLCP
Demodulator setting		auto
		manual with/without test of signal field
Capture length	continuous	24 µs to 66 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	capture length, 1 to 10922 bursts
	bit stream	
	PLCP header	
Sweep time	spectrum mask	200 ms
	ACPR	200 ms
Burst length	automatic detection of number of data symbols	1 byte to 4095 bytes
	manual	
Triggering	RF input	free run, IF power, external
	I/Q baseband input	free run, envelope of I/Q voltage, external

Result display

Result list	min/mean/max	peak vector error
	min/mean/max	burst EVM
		I/Q offset
		gain imbalance
		quadrature error
		center freq error
		chip clock error
		rise time
		fall time
		mean burst power
		peak burst power
		crest factor
	Power versus time	
EVM		EVM versus symbol
Spectrum		spectrum mask, ACPR, spectrum FFT
Constellation		constellation diagram
Statistics		bit stream
		PLCP header
		CCDF
Limit check	values according to standard	result list, power versus time, EVM, spectrum mask, ACP

Adjustable parameters

Input		RF
	R&S®FSQ-B71	I and Q baseband, unbalanced, balanced
	R&S®FSQ-B17	digital IQ, digital input data rate, full scale level
Tracking		phase ON/OFF
		timing ON/OFF
		level ON/OFF

Measurement uncertainty (nominal)

Residual EVM	level -23 dBm to +30 dBm average of 20 bursts, 11 Mbps CCK with short PLCP, burst EVM	
	input = RF (f = 2.442 GHz)	0.7 %
	input = I and Q baseband	0.4 %
Frequency error		
Lock range		1.3 MHz
Uncertainty		1 Hz + reference frequency uncertainty
Level uncertainty	test of spectrum mask	0.1 dB
	output power	
	f < 3.6 GHz	0.5 dB
	3.6 GHz ≤ f ≤ 8 GHz	1.5 dB
	ACPR	0.5 dB

Ordering information

Designation	Type	Order No.
WLAN IEEE 802.11a/b/g/j Application Firmware	R&S®FSQ-K91	1157.3129.02
Upgrade from R&S®FSQ-K90 to R&S®FSQ-K91	R&S®FSQ-K90U	1300.8000.02
Upgrade from R&S®FSQ-K91 to R&S®FSQ-K91n	R&S®FSQ-K91N	1308.9387.02
Upgrade from R&S®FSQ-K91 and R&S®FSQ-K91n to R&S®FSQ-K91ac	R&S®FSQ-K91AC	1308.9170.02
Signal Analyzer, 20 Hz to 3.6 GHz	R&S®FSQ3	1155.5001.03
Signal Analyzer, 20 Hz to 8 GHz	R&S®FSQ8	1155.5001.08
Signal Analyzer, 20 Hz to 26.5 GHz	R&S®FSQ26	1155.5001.26
Signal Analyzer, 20 Hz to 40 GHz	R&S®FSQ40	1155.5001.40
Recommended options and extras		
I/Q Baseband Inputs	R&S®FSQ-B71	1157.0113.03
Digital Baseband Interface	R&S®FSQ-B17	1163.0063.02
I/Q-Bandwidth Extension	R&S®FSQ-B72	1157.0336.12
Upgrade to FMR7 FSQ ¹³	R&S®FSQ-U3 UPGRADE WIN-XP	1155.5999.02
R&S®OSP Open Switch and Control Platform	R&S®OSP120	1505.3009K02
	R&S®OSP130	1505.3009K03
RF Switch Module for R&S®OSP open switch and control platform	R&S®OSP-B101	1505.5101.02
	R&S®OSP-B111	1505.4605.02
	R&S®OSP-B107	1505.5901.02

See also specifications for the R&S®FSQ signal analyzer (PD 0758.0945.22).

For product brochure, see PD 5214.1989.12 and www.rohde-schwarz.com

¹³ This upgrade is required in case the following key sequence *SETUP | SYSTEM INFO | STATISTICS* shows *Memory Size* ≤ 512 Mbyte.

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Rohde & Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established more than 75 years ago, Rohde & Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

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