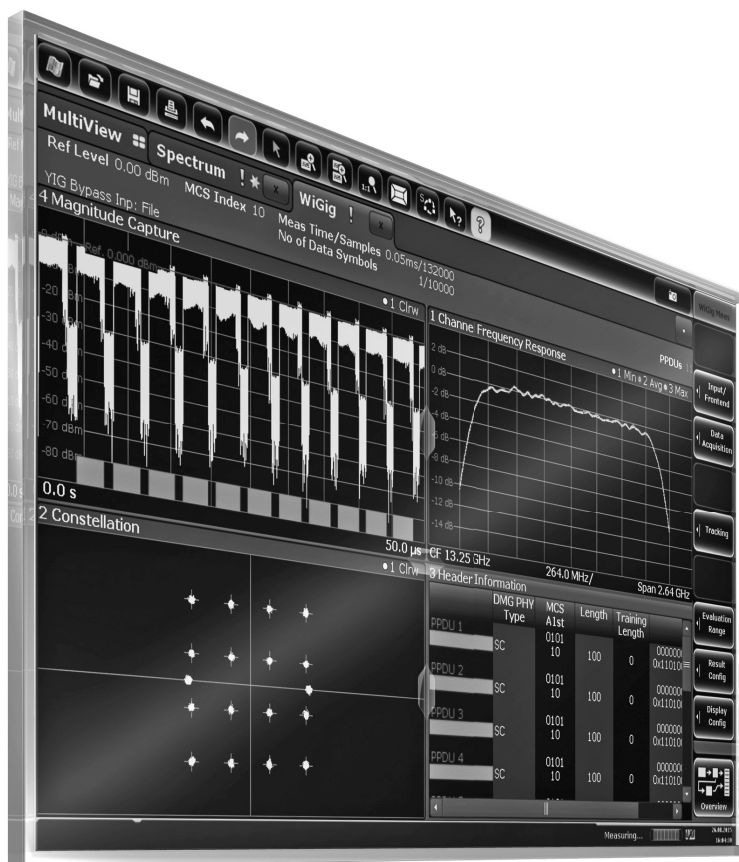


R&S®FSW-K95/-K97

WLAN IEEE 802.11ad/ay

Measurement Application Specifications



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Definitions

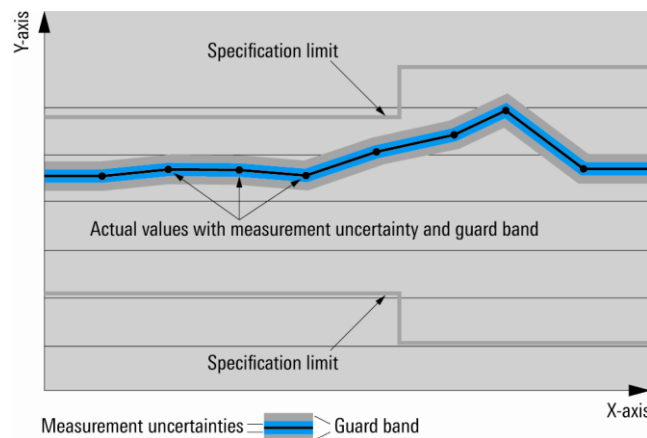
General

Product data applies under the following conditions:

- Three hours storage at ambient temperature followed by 30 minutes warm-up operation
- Specified environmental conditions met
- Recommended calibration interval adhered to
- All internal automatic adjustments performed, if applicable

Specifications with limits

Represent warranted product performance by means of a range of values for the specified parameter. These specifications are marked with limiting symbols such as $<$, \leq , $>$, \geq , \pm , or descriptions such as maximum, limit of, minimum. Compliance is ensured by testing or is derived from the design. Test limits are narrowed by guard bands to take into account measurement uncertainties, drift and aging, if applicable.



Specifications without limits

Represent warranted product performance for the specified parameter. These specifications are not specially marked and represent values with no or negligible deviations from the given value (e.g. dimensions or resolution of a setting parameter). Compliance is ensured by design.

Typical data (typ.)

Characterizes product performance by means of representative information for the given parameter. When marked with $<$, $>$ or as a range, it represents the performance met by approximately 80 % of the instruments at production time. Otherwise, it represents the mean value.

Nominal values (nom.)

Characterize product performance by means of a representative value for the given parameter (e.g. nominal impedance). In contrast to typical data, a statistical evaluation does not take place and the parameter is not tested during production.

Measured values (meas.)

Characterize expected product performance by means of measurement results gained from individual samples.

Uncertainties

Represent limits of measurement uncertainty for a given measurand. Uncertainty is defined with a coverage factor of 2 and has been calculated in line with the rules of the Guide to the Expression of Uncertainty in Measurement (GUM), taking into account environmental conditions, aging, wear and tear.

Device settings and GUI parameters are designated with the format "parameter: value".

Typical data as well as nominal and measured values are not warranted by Rohde & Schwarz.

In line with the 3GPP/3GPP2 standard, chip rates are specified in Mcps (million chips per second), whereas bit rates and symbol rates are specified in Mbps (million bits per second), kbps (thousand bits per second) or ksp/s (thousand symbols per second), and sample rates are specified in Msample/s (million samples per second). Mcps, kbps, ksp/s and Msample/s are not SI units.

Specifications

The specifications of the R&S®FSW-K95/-K97 WLAN IEEE 802.11ad/ay measurement application are based on the specifications in the data sheet for the R&S®FSW signal and spectrum analyzer. They have not been checked separately and are not verified during instrument calibration. Measurement uncertainties are given as 95 % confidence intervals. They apply to the specified symbol rates. The specified level measurement errors do not take into account systematic errors due to reduced signal-to-noise ratio (SNR).

The measurement application requires:

- R&S®FSW-B2000, R&S®FSW-B2001 analysis bandwidth option to cover measurement bandwidth up to 2 GHz
- R&S®FSW-B5000 analysis bandwidth option to cover measurement bandwidth up to 5 GHz
- R&S®FSW-B24 RF preamplifier option is recommended for over-the-air measurements

Frequency

Center frequency range	frequency range same as R&S®FSW with R&S®FSW-B2000 or R&S®FSW-B2001 or R&S®FSW-B5000
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Level

Reference level range	RF input	–70 dBm ¹ to +30 dBm
Reference level setting		manual

Signal acquisition

Supported standards	R&S®FSW-K95/-K97 ²	WLAN IEEE 802.11ad
	R&S®FSW-K97	WLAN IEEE 802.11ay
Input		RF
Evaluation range	EVM data symbols, EVM pilot symbols, I/Q offset, gain imbalance, quadrature error, center frequency error, symbol clock error, rise time, fall time, time skew, time domain power, crest factor, header BER, payload BER	all PPDU's completely contained within capture; given at least 2 µs additional capture time before first and after last PPDU is available
	bitstream header raw, bitstream header decoded, bitstream data raw, bitstream data decoded, channel frequency response, constellation, EVM versus symbol, frequency error versus symbol, header information, marker table, phase error versus symbol, phase tracking versus symbol, PVT full PPDU, PVT rising, PVT falling	all PPDU's completely contained within capture; given at least 2 µs additional capture time before first and after last PPDU is available
	magnitude capture, power spectrum	measurement time (= complete capture)
	spectrum emission mask	9 ms (configurable up to 16 000 s)
Sweep time		
Triggering	RF input	free run, IF power, external

¹ Requires R&S®FSW-B24 RF preamplifier option.

² Requires R&S®FSW-K95 option.

Result display

Numeric results	min./mean/max.	EVM data symbols (in dB)
		EVM pilot symbols (in dB)
		I/Q offset (in dB)
		gain imbalance (in dB)
		quadrature error (in °)
		center frequency error (in Hz)
		symbol clock error (in ppm)
		rise time (in s)
		fall time (in s)
		time skew (in s)
		time domain power (in dBm)
		crest factor (in dB)
		SNR (in dB)
		header BER
		payload BER
Power versus time	clear/write	magnitude capture
	min./average/max.	PVT full PPDU
	min./average/max.	PVT rising
	min./average/max.	PVT falling
EVM	clear/write	EVM versus symbol
Spectral results	clear/write	spectrum emission mask
	min./average/max.	channel frequency response
	clear/write	power spectrum
Constellation	clear/write	constellation
Signal content and statistics	result table	bitstream header raw
		bitstream header decoded
		bitstream data raw
		bitstream data decoded
		header information
Versus symbol	clear/write	EVM versus symbol
		freq error versus symbol
		phase error versus symbol
		phase tracking versus symbol

Measurement parameters

R&S®FSW-K95

Signal	MCS	0 to 12, extended SC MCS
	guard interval	normal
Signal capture settings	measurement time (R&S®FSW-B2000)	24 µs to 5 ms
	evaluation range	
	PPDU to analyze	all PPDU to be analyzed in one capture (all PPDU or one specific PPDU)
	index of specific PPDU	1 PPDU to number of PPDU in current capture
Tracking		phase on/off
		level on/off
Compensation		I/Q mismatch compensation on/off

R&S®FSW-K97

Signal	channel bonding N_{CB} ³	1, 2, 3, 4
	MCS	1 to 21
	guard interval	short, normal, long
	codeword	short, long
Signal capture settings	measurement time (R&S®FSW-B2001, R&S®FSW-B5000)	24 μ s to 15/ N_{CB} ms
	evaluation range	
	PPDU to analyze	all PPDU's to be analyzed in one capture (all PPDU's or one specific PPDU)
Tracking	index of specific PPDU	1 PPDU to number of PPDU's in current capture
		phase on/off
		level on/off
Compensation		I/Q mismatch compensation on/off

Measurement uncertainty (nominal)

Frequency error uncertainty		1 Hz + reference frequency uncertainty
Level uncertainty – spectrum emission mask	RF attenuation = 10/20/30/40 dB, RF preamplifier off, electronic attenuator off, YIG filter on, 50 GHz < f_{center} \leq 67 GHz, +20 °C to +30 °C, signal level = 0 dB to –70 dB below reference level, S/N > 20 dB, identical reference level and attenuation settings for all SEM ranges as predefined in R&S®FSW-K95 option, 95 % confidence level	± 2.9 dB
Level uncertainty – I/Q power	RF attenuation = 10/20/30/40 dB, RF preamplifier off, electronic attenuator off, YIG filter off, 26.5 GHz < f_{center} \leq 67 GHz, +20 °C to +30 °C, signal level = 0 dB to –70 dB below reference level, S/N > 20 dB, span/RBW < 100, 95 % confidence level	± 2.7 dB

³ Corresponding nominal channel bandwidth restricted by fitted analysis bandwidth. Analysis from file possible.

Ordering information

Designation	Type	Order No.	Retrofittable	Remarks
WLAN IEEE 802.11ad measurements	R&S®FSW-K95	1313.1639.02	yes	
WLAN IEEE 802.11ay measurements	R&S®FSW-K97	1338.4902.02	yes	
Signal and spectrum analyzer, 2 Hz to 67 GHz	R&S®FSW67	1331.5003.67		
Signal and spectrum analyzer, 2 Hz to 85 GHz	R&S®FSW85	1331.5003.85		
Recommended options and extras				
RF preamplifier, 100 kHz to 67 GHz	R&S®FSW-B24	1313.0832.67	yes	for R&S®FSW67; export license required; contact service center
Electronic attenuator, 1 dB steps	R&S®FSW-B25	1313.0990.02	yes	
2 GHz analysis bandwidth	R&S®FSW-B2000	1325.4750.02		contact service center
2 GHz analysis bandwidth	R&S®FSW-B2001	1331.6916.14		contact service center
5 GHz analysis bandwidth	R&S®FSW-B5000	1331.6997.85		contact service center

For R&S®FSW product brochure, see PD 5214.5984.12,
for R&S®FSW data sheet, see PD 5214.5984.22,
and www.rohde-schwarz.com

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The Rohde & Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, monitoring and network testing. Founded more than 80 years ago, the independent company which is headquartered in Munich, Germany, has an extensive sales and service network with locations in more than 70 countries.

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ISO 14001

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R&S®FSW-K95/-K97 WLAN IEEE 802.11ad/ay Measurement Application

Data without tolerance limits is not binding | Subject to change

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