BLUETOOTH® MEASUREMENT APPLICATION

Specifications

R&S®FSW-K8/-K8E
R&S®FSV3-K8/-K8E
R&S®VSE-K8/-K8E

Specifications
Version 05.00

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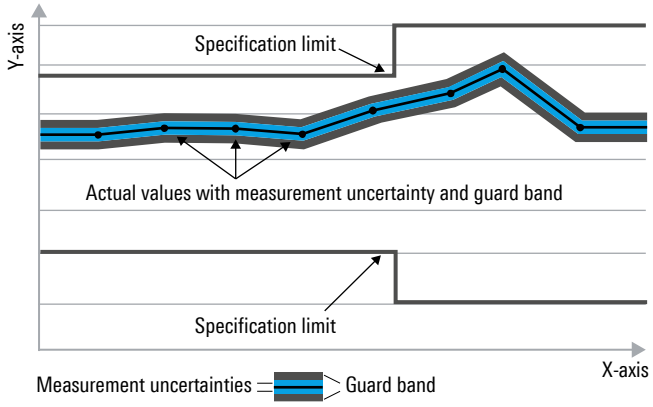
CONTENTS

Definitions

General
Product data applies under the following conditions:

- Three hours of storage at ambient temperature followed by 30 minutes of 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 <, ≤, >, ≥, ±, 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.



Non-traceable specifications with limits (n. trc.)
Represent product performance that is specified and tested as described under “Specifications with limits” above. However, product performance in this case cannot be warranted due to the lack of measuring equipment traceable to national metrology standards. In this case, measurements are referenced to standards used in the Rohde & Schwarz laboratories.

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”.

Non-traceable specifications with limits, typical data as well as nominal and measured values are not warranted by Rohde & Schwarz.

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

Specifications

The specifications of the R&S®FSx-K8, R&S®FSx-K8E, R&S®VSE-K8 and R&S®VSE-K8E Bluetooth® measurement application are based on the specifications of the following products:

- FSW signal and spectrum analyzer (R&S®FSW-K8, R&S®FSW-K8E)
- R&S®FSVA3000 signal and spectrum analyzer (R&S®FSV3-K8, R&S®FSV3-K8E)
- R&S®FSV3000 signal and spectrum analyzer (R&S®FSV3-K8, R&S®FSV3-K8E)

They have not been checked separately and are not verified during instrument calibration. Measurement uncertainties are given as 95 % confidence intervals. The specified errors, accuracies and uncertainties do not take into account systematic errors due to reduced signal-to-noise (S/N) ratio, uncertainties due to imperfect impedance matching, uncertainties of external measurement amplifiers and mixers, uncertainties due to a reduced measurement interval and uncertainties of the noise source. The specified errors, accuracies and uncertainties apply at calibrated measurement frequency points.

General remarks

These specifications cover the R&S®FSW-K8/-K8E, the R&S®FSV3-K8/-K8E and the R&S®VSE-K8/-K8E.

The R&S®FSx-K8 and R&S®FSx-K8E runs on the device itself.

The R&S®VSE-K8 runs on a PC that can be connected to the analyzers and oscilloscopes as specified below.

The R&S®VSE-K8E runs on a PC that can be connected to the analyzers.

If not stated otherwise, the values in these specifications are device-specific, i.e. the same value applies to the R&S®FSW-K8 and the R&S®VSE-K8 with connected FSW. Accordingly, the same value applies to the R&S®FSV3-K8 and the R&S®VSE-K8 with connected R&S®FSVA3000 respectively R&S®FSV3000.

Overview

		FSW	**R&S®FSVA3000/ R&S®FSV3000**	**R&S®FSVA/ R&S®FSV**	**R&S®RTO**	**R&S®RTP**
R&S®FSW-K8 R&S®FSW-K8E	runs on device	•	–	–	–	–
R&S®FSV3-K8 R&S®FSV3-K8E	runs on device	–	•	–	–	–
R&S®VSE-K8	runs on PC that is connected to device	•	•	•	•	•
R&S®VSE-K8E	runs on PC that is connected to device	•	•	•	–	–

Frequency

Frequency range	R&S®FSW-K8 R&S®FSW-K8E[1]	same as FSW
	R&S®FSV3-K8 R&S®FSV3-K8E[1]	same as R&S®FSVA3000/R&S®FSV3000
	R&S®VSE-K8 R&S®VSE-K8E[1]	same as the connected device

Signal acquisition

Input		RF, file
Triggering R&S®FSx-K8/R&S®VSE-K8	RF input	free run, external, IF power, RF power
Triggering R&S®FSx-K8E/ R&S®VSE-K8E	RF input	IF power

[1] Requires R&S®FSx-B80 or higher option.

Measurement

Supported standards	standard	Bluetooth® 6.0 – Basic Rate
		Bluetooth® 6.0 – Enhanced Data Rate
		Bluetooth® 6.0 – Low Energy
		Bluetooth® 6.0 – Low Energy Channel Sounding (not supported by R&S®VSE)
	test standard	Bluetooth® RF test specification RF.TS.p34, Bluetooth® Low Energy RF PHY test specification RFPHY.TS.p22
Supported power classes		classes 1 to 3
Packet type detection	Basic Rate	DHx, DMx, HVx, AUX, POLL, FHS
	Enhanced Data Rate	2-DHx, 3-DHx, 2-EVx, 3-EVx
	Low Energy	test packet for Low Energy 1M and Low Energy 2M with CTE support, test packet for Low Energy coded
		test packet types for Low Energy Channel Sounding (CS-SYNC, CS-Tone)
Display types	Basic Rate	RF spectrum, RF envelope, result summary, demodulation waveform, symbols (DHx only), header info
	Enhanced Data Rate	RF spectrum, RF envelope, result summary, constellation, symbols, header info
	Low Energy	RF spectrum, RF envelope, result summary, demodulation waveform, symbols, header info
	Low Energy Channel Sounding	RF spectrum, power versus time, stable phase, frequency deviation, result summary
In-band spurious measurement (IBSE)/adjacent channel power (ACP)	Basic Rate/Low Energy	20000 trace points for IBSE, 500 trace points for ACP
	Enhanced Data Rate	trace points depending on gate length

Bluetooth® Basic Rate/Low Energy measurements

Level		
Level range	RF input, average and peak power in line with Bluetooth® RF test specification; packet type: DH1, DH3, DH5	–70 dBm [2] to +30 dBm
Level uncertainty	R&S®FSW-K8	same as FSW
	R&S®FSV3-K8	same as R&S®FSVA3000/R&S®FSV3000
	R&S®VSE-K8	same as the connected device
Frequency deviation		
Deviation range	average and peak power in line with Bluetooth® RF test specification; packet type: DH1, DH3, DH5; payload type: 00001111 or 01010101	±250 kHz
Uncertainty	average value per packet, level > –30 dBm	< 3 kHz (nom.)
Initial carrier frequency tolerance (ICFT)		
Deviation range	in line with Bluetooth® RF test specification; packet type: DH1	±250 kHz
Uncertainty	R&S®FSW-K8, level > –30 dBm	< 2 kHz + FSW frequency uncertainty (nom.)
	R&S®FSV3-K8, level > –30 dBm	< 2 kHz + R&S®FSVA3000/R&S®FSV3000 frequency uncertainty (nom.)
	R&S®VSE-K8, level > –30 dBm	same as the connected device
Carrier frequency drift		
Deviation range	in line with Bluetooth® RF test specification; packet type: DH1, DH3, DH5; payload: f1 or f2	±250 kHz
Uncertainty	signal level > –30 dBm	< 2 kHz (nom.)
Adjacent channel power (ACP)		
Measurement		adjacent channel power in line with Bluetooth® RF test specification
Level uncertainty	R&S®FSW-K8	same as FSW
	R&S®FSV3-K8	same as R&S®FSVA3000/R&S®FSV3000
	R&S®VSE-K8	same as the connected device

[2] FSW with R&S®FSW-B24, R&S®FSVA3000 with R&S®FSV3-B24 or R&S®FSV3000 with R&S®FSV3-B24 RF preamplifier option.

Bluetooth® Enhanced Data Rate measurements

Relative TX power		
Level range	GFSK and DPSK power in line with Bluetooth® RF test specification; packet type: 2-DHx, 3-DHx, 2-EVx, 3-EVx	–70 dBm [3] to +30 dBm
Level uncertainty	R&S®FSW-K8	same as FSW
	R&S®FSV3-K8	same as R&S®FSVA3000/R&S®FSV3000
	R&S®VSE-K8	same as the connected device
Frequency stability		
Measurement range	initial frequency error (ω_i), block frequency error (ω_0) and total frequency error ($\omega_i + \omega_0$) in line with Bluetooth® RF test specification; packet type: 2-DHx, 3-DHx, 2-EVx, 3-EVx	±250 kHz
Uncertainty	R&S®FSW-K8, initial frequency error, level > –25 dBm	< 2 kHz + FSW frequency uncertainty (nom.)
	R&S®FSV3-K8, initial frequency error, level > –25 dBm	< 2 kHz + R&S®FSVA3000/R&S®FSV3000 frequency uncertainty (nom.)
	R&S®VSE-K8, initial frequency error, level > –25 dBm	same as the connected device
	block frequency error, level > –25 dBm	< 2 kHz (nom.)
Modulation accuracy		
Measurement range	RMS, peak and 99 % DEVM RF in line with Bluetooth® RF test specification; packet type: 2-DHx, 3-DHx, 2-EVx, 3-EVx	0 % to 100 %
Uncertainty	DEVM (RMS), level > –25 dBm	< 2 % (nom.)
	DEVM (peak), level > –25 dBm	< 5 % (nom.)
Inband spurious emissions		
Measurement	adjacent channel power and power between 1 MHz and 1.5 MHz from carrier	in line with Bluetooth® RF test specification
Level uncertainty	R&S®FSW-K8	same as FSW
	R&S®FSV3-K8	same as R&S®FSVA3000/R&S®FSV3000
	R&S®VSE-K8	same as the connected device

[3] FSW with R&S®FSW-B24, R&S®FSVA3000 with R&S®FSV3-B24 or R&S®FSV3000 with R&S®FSV3-B24 RF preamplifier option.

Bluetooth® Low Energy Channel Sounding measurements [4]

Level		
Level range	average and peak power in line with Bluetooth® RF test specification	–70 dBm [3] to +30 dBm
Level uncertainty	R&S®FSW-K8E	same as FSW
	R&S®FSV3-K8E	same as R&S®FSVA3000/R&S®FSV3000
	R&S®VSE-K8E	same as connected device
Packet type		CS-SYNC, CS-Tone
Synchronization		access address
Trigger		IF power
Stable phase measurement		
Measurement range		±180º
Uncertainty	level > –25 dBm	0.6º
Packet type		CS-SYNC, CS-Tone
Synchronization		access address
Trigger		IF power
Modulation spectrum		
Packet type		CS-SYNC
Synchronization		access address
Trigger		IF power
TX antenna switching integrity		
Level range	average and peak power in line with Bluetooth® RF test specification	–70 dBm [3] to +30 dBm
Level uncertainty	R&S®FSW-K8E	same as FSW
	R&S®FSV3-K8E	same as R&S®FSVA3000/R&S®FSV3000
	R&S®VSE-K8E	same as connected device
Packet type		CS-Sync, CS-Tone
Synchronization		access address
Trigger		IF power
Modulation characteristics		
Deviation range	LE1M	±300 kHz
	LE2M and LE2M BT2.0	±600 kHz
Uncertainty	signal level > –30 dBm	< 3 kHz
Packet type		CS-Sync
Payload		00001111, 01010101
Synchronization		access address
Trigger		IF power
Frequency verification		
Measurement		in line with Bluetooth® RF CS test specification
Packet type		CS-Sync, CS-Tone
Synchronization		access address
Trigger		IF power

[4] Requires R&S®FSx-B80 or higher option.

Ordering information

Bluetooth® measurement application

Designation	Type	Order No.
Bluetooth® Basic Rate/Enhanced Data Rate/Low Energy measurement application	R&S®FSW-K8	1313.1351.02
Bluetooth® Basic Rate/Enhanced Data Rate/Low Energy measurement application	R&S®FSV3-K8	1346.5679.02
Bluetooth® Basic Rate/Enhanced Data Rate/Low Energy measurement application	R&S®VSE-K8	1345.1970.06
Bluetooth® 6.0 Low Energy Channel Sounding measurement application	R&S®FSW-K8E [5]	1353.3284.02
Bluetooth® 6.0 Low Energy Channel Sounding measurement application	R&S®FSV3-K8E [6]	1346.4389.02
Bluetooth® 6.0 Low Energy Channel Sounding measurement application	R&S®VSE-K8E [7]	1345.2982.06

FSW signal and spectrum analyzer

Designation	Type	Order No.
FSW		
Signal and spectrum analyzer, 2 Hz to 8 GHz	R&S®FSW8	1331.5003.08
Signal and spectrum analyzer, 2 Hz to 13.6 GHz	R&S®FSW13	1331.5003.13
Signal and spectrum analyzer, 2 Hz to 26.5 GHz	R&S®FSW26	1331.5003.26
Signal and spectrum analyzer, 2 Hz to 43.5 GHz	R&S®FSW43	1331.5003.43
Signal and spectrum analyzer, 2 Hz to 50 GHz	R&S®FSW50	1331.5003.50
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

R&S®FSVA3000 and R&S®FSV3000 signal and spectrum analyzers

Designation	Type	Order No.
R&S®FSVA3000		
Signal and spectrum analyzer, 10 Hz to 4 GHz	R&S®FSVA3004	1330.5000.05
Signal and spectrum analyzer, 10 Hz to 7.5 GHz	R&S®FSVA3007	1330.5000.08
Signal and spectrum analyzer, 10 Hz to 13.6 GHz	R&S®FSVA3013	1330.5000.14
Signal and spectrum analyzer, 10 Hz to 30 GHz	R&S®FSVA3030	1330.5000.31
Signal and spectrum analyzer, 10 Hz to 44 GHz	R&S®FSVA3044	1330.5000.44
Signal and spectrum analyzer, 10 Hz to 50/54 GHz	R&S®FSVA3050	1330.5000.51
R&S®FSV3000		
Signal and spectrum analyzer, 10 Hz to 4 GHz	R&S®FSV3004	1330.5000.04
Signal and spectrum analyzer, 10 Hz to 7.5 GHz	R&S®FSV3007	1330.5000.07
Signal and spectrum analyzer, 10 Hz to 13.6 GHz	R&S®FSV3013	1330.5000.13
Signal and spectrum analyzer, 10 Hz to 30 GHz	R&S®FSV3030	1330.5000.30
Signal and spectrum analyzer, 10 Hz to 44 GHz	R&S®FSV3044	1330.5000.43
Signal and spectrum analyzer, 10 Hz to 50/54 GHz	R&S®FSV3050	1330.5000.50

[5] Requires R&S®FSW-B80 or higher option.

[6] Requires R&S®FSV3-B80 or higher option.

[7] Requires R&S®FSx-B80 or higher option.

R&S®RTO1000 and R&S®RTO2000 oscilloscopes

Designation	Type	Order No.
R&S®RTO1000		
Oscilloscope, 600 MHz, 10 Gsample/s, 20/40 Msample, 2 channels	R&S®RTO1002	1316.1000.02
Oscilloscope, 600 MHz, 10 Gsample/s, 20/80 Msample, 4 channels	R&S®RTO1004	1316.1000.04
Oscilloscope, 1 GHz, 10 Gsample/s, 20/40 Msample, 2 channels	R&S®RTO1012	1316.1000.12
Oscilloscope, 1 GHz, 10 Gsample/s, 20/80 Msample, 4 channels	R&S®RTO1014	1316.1000.14
Oscilloscope, 2 GHz, 10 Gsample/s, 20/40 Msample, 2 channels	R&S®RTO1022	1316.1000.22
Oscilloscope, 2 GHz, 10 Gsample/s, 20/80 Msample, 4 channels	R&S®RTO1024	1316.1000.24
Oscilloscope, 4 GHz, 20 Gsample/s, 20/80 Msample, 4 channels	R&S®RTO1044	1316.1000.44
R&S®RTO2000		
Oscilloscope, 600 MHz, 10 Gsample/s, 50/100 Msample, 2 channels	R&S®RTO2002	1329.7002.02
Oscilloscope, 600 MHz, 10 Gsample/s, 50/200 Msample, 4 channels	R&S®RTO2004	1329.7002.04
Oscilloscope, 1 GHz, 10 Gsample/s, 50/100 Msample, 2 channels	R&S®RTO2012	1329.7002.12
Oscilloscope, 1 GHz, 10 Gsample/s, 50/200 Msample, 4 channels	R&S®RTO2014	1329.7002.14
Oscilloscope, 2 GHz, 10 Gsample/s, 50/100 Msample, 2 channels	R&S®RTO2022	1329.7002.22
Oscilloscope, 2 GHz, 10 Gsample/s, 50/200 Msample, 4 channels	R&S®RTO2024	1329.7002.24
Oscilloscope, 3 GHz, 10 Gsample/s, 50/100 Msample, 2 channels	R&S®RTO2032	1329.7002.32
Oscilloscope, 3 GHz, 10 Gsample/s, 50/200 Msample, 4 channels	R&S®RTO2034	1329.7002.34
Oscilloscope, 4 GHz, 20 Gsample/s, 50/200 Msample, 4 channels	R&S®RTO2044	1329.7002.44
Oscilloscope, 6 GHz, 20 Gsample/s, 50/200 Msample, 4 channels	R&S®RTO2064	1329.7002.64

R&S®RTP oscilloscope

Designation	Type	Order No.
R&S®RTP		
Oscilloscope, 4 GHz, 4 channels	R&S®RTP044	1320.5007.04
Oscilloscope, 6 GHz, 4 channels	R&S®RTP064	1320.5007.06
Oscilloscope, 8 GHz, 4 channels	R&S®RTP084	1320.5007.08
Oscilloscope, 13 GHz, 4 channels	R&S®RTP134	1320.5007.13
Oscilloscope, 16 GHz, 4 channels	R&S®RTP164	1320.5007.16

R&S®VSE vector signal explorer software

Designation	Type	Order No.
R&S®VSE basic edition	R&S®VSE	1345.1011.06
R&S®VSE enterprise edition	R&S®VSE	1345.1105.06
R&S®VSE software maintenance	R&S®VSE-SWM	1320.7622.81

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Sustainable product design

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Certified Environmental Management
ISO 14001

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Bluetooth® Measurement Application