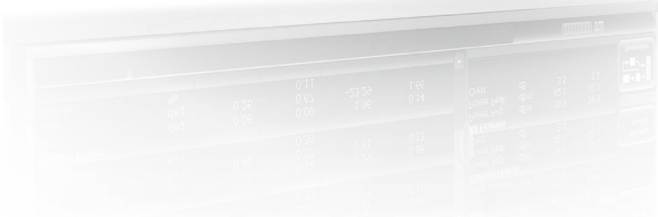


R&S®FSW-K10

GSM Measurements

Specifications



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Definitions

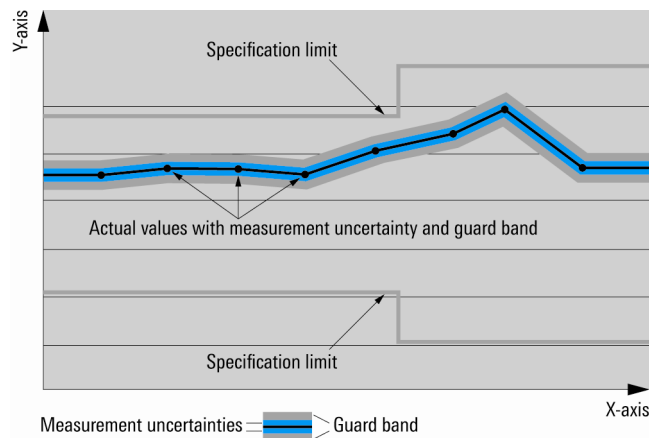
General

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.

Specifications

The specifications of the R&S®FSW-K10 GSM measurements are based on the specifications in the data sheet for the R&S®FSW signal and spectrum analyzer in the default operating mode (signal and spectrum analyzer mode). They have not been checked separately and are not verified during instrument calibration. Measurement uncertainties are given as 95 % confidence intervals at a center frequency of 935 MHz. The specified level measurement errors do not take into account systematic errors due to reduced signal-to-noise ratio (S/N).

GSM measurements

Frequency

Frequency bands	T-GSM380, T-GSM410, GSM450, GSM480, GSM710, GSM750, T-GSM810, GSM850, P-GSM900, E-GSM900, R-GSM900, T-GSM900, DCS1800, PCS1900		
Frequency range	frequency range same as R&S®FSW ¹		
Frequency setting	frequency band	frequency and ARFCN	
	single carrier	up to 16 carriers	
	multicarrier	frequencies	carrier allocation
		contiguous	non-contiguous ²

Level

Level range	RF input	-70 dBm ³ to +30 dBm
Level setting		auto level
		manual

Signal acquisition

Implemented standard versions		3GPP TS 45.002 V12.0.0 (2013-08)
		3GPP TS 45.004 V11.0.0 (2012-09)
		3GPP TS 45.005 V12.0.0 (2013-08)
		3GPP TS 51.010-1 V11.2.0 (2013-09)
		3GPP TS 51.021 V11.4.0 (2013-08)
Device types	base transceiver station (BTS)	normal micro pico
	multicarrier base transceiver station (MC-BTS)	wide area medium range local area
	mobile station (MS)	normal small
Standards		GSM
		EDGE (EGPRS)
		EDGE Evolution level A (EGPRS2-A)
		EDGE Evolution level B (EGPRS2-B) VAMOS ⁴
Burst types and modulation formats	access burst (AB)	GMSK
	normal burst (NB)	GMSK
		AQPSK
		3π/8-8PSK
		π/4-16QAM
	higher symbol rate burst (HSR)	-π/4-32QAM
		3π/4-QPSK
	π/4-16QAM	
	-π/4-32QAM	
Symbol rates	NB and AB	normal (270.833 ksp/s)
	HSR	higher (325 ksp/s)

¹ 5 MHz to 90 MHz with restricted functionality depends on bandwidth (IF power trigger, auto level, IF overload).

² Non-contiguous frequency allocation is defined as an allocation where two sub-blocks are separated by at least 5 MHz (cf. 3GPP TS 51.021, chapter 4.10.10. Multicarrier BTS).

³ Requires R&S®FSW-B24 RF preamplifier option.

⁴ VAMOS = voice services over adaptive multi-user channels on one slot.

VAMOS ⁴ SCPIR ⁵			
Training sequence codes (TSC)	NB-8PSK, 16QAM and 32QAM	TSC 0 to TSC 7 user-definable TSC	
	NB-GMSK	TSC 0 (set 1) to TSC 7 (set 1) TSC 0 (set 2) to TSC 7 (set 2) user-definable TSC	
	NB-AQPSK	subchannel 1: TSC 0 (set 1) to TSC 7 (set 1) user-definable TSC	
		subchannel 2: TSC 0 (set 1) to TSC 7 (set 1) TSC 0 (set 2) to TSC 7 (set 2) user-definable TSC	
		HSR	TSC 0 to TSC 7 user-definable TSC
		AB	TS 0 to TS 2 user-definable TS
	Filter	NB-AQPSK, 8PSK, 16QAM and 32QAM	linearized GMSK pulse
NB-GMSK and AB		GMSK pulse	
HSR		narrow pulse wide pulse	
Multicarrier filter		optional channel filter for suppressing neighboring channels prior to synchronization and demodulation	
Timeslot	lengths	157 symbol, 156 symbol	
		156.25 symbol (NB)	
188.4 symbol, 187.2 symbol			
187.5 symbol (HSR)			
	power versus time, limit line, time alignment	alignment with respect to reference slot (slot to measure) measured TSC position per slot	
Number of slots to measure	1 slot	modulation accuracy table EVM versus time graph phase error versus time graph magnitude error versus time graph modulation spectrum table modulation spectrum graph	
	1 slot to 8 slots	power versus slot table power versus time graph transient spectrum table transient spectrum graph	
Input		RF	
		analog baseband ⁶	
		digital I/Q ⁷	
		MSRA I/Q data capture iq-tar file import	
Triggering	RF input	free run	
		IF power	
		I/Q power	
		RF power external	
Capture time		10 ms to 1 s (up to 200 GSM frames)	

⁵ SCPIR = subchannel power imbalance ratio.

⁶ Requires R&S®FSW-B71 analog baseband inputs option.

⁷ Requires R&S®FSW-B17 digital baseband interface option.

Result display

I/Q Measurements		
Power versus slot	numerical results: table	average and peak power versus slot crest factor versus slot delta to sync (slot timing) versus slot per slot limit check of power versus time mask
Power versus time	graphical results: minimum; average; maximum; current	1 slot to 8 slots full burst view limit check
Modulation accuracy	numerical results: table	EVM: RMS, peak and 95:th percentile phase error: RMS, peak and 95:th percentile magnitude error: RMS, peak and 95:th percentile origin offset suppression I/Q imbalance frequency error slot power amplitude droop
EVM	graphical results: minimum; average; maximum; current	error vector magnitude versus time
Phase error	graphical results: minimum; average; maximum; current	phase error versus time
Magnitude error	graphical results: minimum; average; maximum; current	magnitude error versus time
Modulation spectrum graph	graphical results: current; average	power versus frequency limit check
Modulation spectrum table	numerical results: table	power versus offset frequency offset frequencies up to 6 MHz limit check
Transient spectrum graph	graphical results: current; maximum	power versus frequency limit check
Transient spectrum table	numerical results: table	power versus offset frequency limit check
Multicarrier wideband noise measurements (MCWN) ⁸		
MCWN spectrum graph	graphical results: average trace 100 kHz and 300 kHz RBW combined	power versus frequency wideband noise intermodulation products limit check
MCWN carrier power table	numerical results: table	power level per carrier 30/100/300 kHz ref. powers per carrier reference carrier indication
MCWN outer intermodulation product table MCWN inner intermodulation product table ⁹	numerical results: table	power at intermodulation product frequency relative to closest outermost carrier intermodulation product order (up to 5 th) limit check

⁸ Measurement according to 3GPP TS 51.021, chapter 6.12 Wideband noise and intra BSS intermodulation attenuation in multicarrier operation.

⁹ Only available for non-contiguous carrier allocation of a multicarrier BTS.

Measurement uncertainty (nominal)

Demodulation – GSM, EGPRS (EDGE) and VAMOS ⁴	Note	NB GMSK	NB 3 π /8-8PSK	NB π /2-AQPSK	AUME ¹⁰
EVM ¹¹	(S/N > 40 dB)				
RMS value, error floor		–	< 0.25 %	< 0.25 %	
RMS value, uncertainty		–	< 0.2 %	< 0.2 %	
Peak value, error floor		–	< 0.75 %	< 1 %	
Peak value, uncertainty		–	< 0.75 %	< 0.75 %	
95:th percentile value, error floor		–	< 0.4 %	< 0.4 %	
Phase error ¹¹	(S/N > 40 dB)				
RMS value, error floor		< 0.2°	–	–	1.5°
RMS value, uncertainty		< 0.15°	–	–	
Peak value, error floor		< 0.7°	–	–	5°
Peak value, uncertainty		< 0.6°	–	–	
Frequency error ¹¹					
Frequency lock range (referenced to RF carrier frequency)		±30 kHz	±30 kHz	±30 kHz	–
Uncertainty	excluding Δf_{REF}	< 1.5 Hz	< 1.5 Hz	< 1.5 Hz	GMSK: 10 Hz ¹² 8PSK: 16 Hz AQPSK: 6 Hz
I/Q origin offset suppression (OOS)					
Measurement range		–	15 dB to 50 dB	20 dB to 50 dB	35 dB
Uncertainty	(S/N > 60 dB) (OOS < 45 dB)	–	±1.5 dB	±1.5 dB	±1.5 dB

Demodulation – EGPRS2-A	Note	NB π /4-16QAM	NB $-\pi$ /4-32QAM	AUME ¹⁰
EVM ¹¹	(S/N > 40 dB)			
RMS value, error floor		< 0.25 %	< 0.25 %	
RMS value, uncertainty		< 0.2 %	< 0.2 %	
Peak value, error floor		< 0.75 %	< 0.75 %	
Peak value, uncertainty		< 0.75 %	< 0.75 %	
95:th percentile value, error floor		< 0.4 %	< 0.4 %	
Frequency error ¹¹				
Frequency lock range (referenced to RF carrier frequency)		±30 kHz	±30 kHz	–
Uncertainty	excluding Δf_{REF}	< 1.5 Hz	< 1.5 Hz	6 Hz
I/Q origin offset suppression (OOS)				
Measurement range		25 dB to 50 dB	25 dB to 50 dB	35 dB
Uncertainty	(S/N > 60 dB) (OOS < 45 dB)	±1.5 dB	±1.5 dB	±1.5 dB

¹⁰ AUME = acceptable uncertainty of measurement equipment (in line with 3GPP TS 51.021, chapter 4.7, base station requirements); if there is more than one limit, the strictest limit applies.

¹¹ Frequency in GSM frequency band, level –50 dBm to +30 dBm, average of 200 bursts, measurement synchronized using training sequence.

¹² GSM400: 5 Hz.

Demodulation – EGPRS2-B	Note	HSR 3 π /4-QPSK narrow pulse	HSR π /4-16QAM narrow pulse	HSR – π /4-32QAM narrow pulse	AUME ¹⁰
EVM ¹¹	(S/N > 40 dB)				
RMS value, error floor		< 0.4 %	< 0.4 %	< 0.4 %	
RMS value, uncertainty		< 0.2 %	< 0.2 %	< 0.2 %	
Peak value, error floor		< 0.75 %	< 0.75 %	< 1 %	
Peak value, uncertainty		< 0.5 %	< 0.5 %	< 0.5 %	
95:th percentile value, error floor		< 0.4 %	< 0.4 %	< 0.4 %	
Frequency error ¹¹					
Frequency lock range (referenced to RF carrier frequency)		±30 kHz	±30 kHz	±30 kHz	–
Uncertainty	excluding Δf_{REF}	< 1.5 Hz	< 1.5 Hz	< 1.5 Hz	6 Hz
I/Q origin offset suppression (OOS)					
Measurement range		25 dB to 50 dB	30 dB to 50 dB	30 dB to 50 dB	35 dB
Uncertainty	(S/N > 60 dB) (OOS < 45 dB)	±1.5 dB	±1.5 dB	±1.5 dB	±1.5 dB

Demodulation – EGPRS2-B	Note	HSR 3 π /4-QPSK wide pulse	HSR π /4-16QAM wide pulse	HSR – π /4-32QAM wide pulse	AUME ¹⁰
EVM ¹¹	(S/N > 40 dB)				
RMS value, error floor		< 0.2 %	< 0.2 %	< 0.2 %	
RMS value, uncertainty		< 0.2 %	< 0.2 %	< 0.2 %	
Peak value, error floor		< 0.4 %	< 0.5 %	< 0.5 %	
Peak value, uncertainty		< 0.5 %	< 0.5 %	< 0.5 %	
95:th percentile value, error floor		< 0.4 %	< 0.4 %	< 0.4 %	
Frequency error ¹¹					
Frequency lock range (referenced to RF carrier frequency)		±30 kHz	±30 kHz	±30 kHz	–
Uncertainty	excluding Δf_{REF}	< 1.5 Hz	< 1.5 Hz	< 1.5 Hz	6 Hz
I/Q origin offset suppression (OOS)					
Measurement range		20 dB to 50 dB	25 dB to 50 dB	25 dB to 50 dB	35 dB
Uncertainty	(S/N > 60 dB) (OOS < 45 dB)	±1.5 dB	±1.5 dB	±1.5 dB	±1.5 dB

Power versus slot		All modulations	AUME ¹⁰
Absolute level uncertainty		see R&S [®] FSW data sheet: “Total measurement uncertainty, YIG preselector off”	1 dB ¹³
Relative level uncertainty		see R&S [®] FSW data sheet: “Display nonlinearity”	0.7 dB ¹⁴

Power versus time		All modulations	AUME ¹⁰
Absolute level uncertainty		see R&S [®] FSW data sheet: “Total measurement uncertainty, YIG preselector off”	1.0 dB
Dynamic range (PvT filter = 1 MHz) (for all modulations)	average detector	> 76 dB	
	peak hold detector	> 71 dB	

¹³ For static power step = 0.¹⁴ For power steps other than 0.

Spectrum due to modulation and noise		all modulations	
Level measurement uncertainty			
Absolute		see R&S®FSW data sheet: "Total measurement uncertainty, YIG preselector off"	1.0 dB
Relative			
$\Delta f \leq 0.1$ MHz		see R&S®FSW data sheet: "Display nonlinearity" and "Bandwidth switching uncertainty"	0.5 dB
0.1 MHz $\leq \Delta f \leq 1.8$ MHz			0.7 dB ¹⁵
$\Delta f > 1.8$ MHz			2.0 dB
Dynamic range at offset frequency		carrier power = -10 dBm	NB GMSK NB $\pi/8$-8PSK
100 kHz ¹⁶	RBW = 30 kHz	> 42.0 dB	
200 kHz ¹⁶	RBW = 30 kHz	> 70.0 dB	
250 kHz ¹⁶	RBW = 30 kHz	> 78.2 dB	
400 kHz ¹⁶	RBW = 30 kHz	> 82.5 dB	
600 kHz	RBW = 30 kHz	> 79.5 dB	
1.2 MHz	RBW = 30 kHz	> 86.0 dB	
1.8 MHz	RBW = 30 kHz	> 87.0 dB	
1.8 MHz	RBW = 100 kHz	> 81.8 dB	
3.0 MHz	RBW = 100 kHz	> 83.0 dB	
6.0 MHz	RBW = 100 kHz	> 83.0 dB	
Dynamic range at offset frequency		carrier power = -10 dBm	NB $\pi/2$-AQPSK HSR $3\pi/4$-QPSK narrow pulse
100 kHz ¹⁶	RBW = 30 kHz	> 42.0 dB	
200 kHz ¹⁶	RBW = 30 kHz	> 70.0 dB	
250 kHz ¹⁶	RBW = 30 kHz	> 78.2 dB	
400 kHz ¹⁶	RBW = 30 kHz	> 82.5 dB	
600 kHz	RBW = 30 kHz	> 78.5 dB	
1.2 MHz	RBW = 30 kHz	> 85.5 dB	
1.8 MHz	RBW = 30 kHz	> 86.0 dB	
1.8 MHz	RBW = 100 kHz	> 80.8 dB	
3.0 MHz	RBW = 100 kHz	> 82.5 dB	
6.0 MHz	RBW = 100 kHz	> 82.5 dB	
Dynamic range at offset frequency		carrier power = -10 dBm	NB $\pi/4$-16QAM NB $-\pi/4$-32QAM HSR $\pi/4$-16QAM narrow pulse HSR $-\pi/4$-32QAM narrow pulse
100 kHz ¹⁶	RBW = 30 kHz	> 42.0 dB	
200 kHz ¹⁶	RBW = 30 kHz	> 70.0 dB	
250 kHz ¹⁶	RBW = 30 kHz	> 78.2 dB	
400 kHz ¹⁶	RBW = 30 kHz	> 82.5 dB	
600 kHz	RBW = 30 kHz	> 78.5 dB	
1.2 MHz	RBW = 30 kHz	> 82.5 dB	
1.8 MHz	RBW = 30 kHz	> 84.0 dB	
1.8 MHz	RBW = 100 kHz	> 78.8 dB	
3.0 MHz	RBW = 100 kHz	> 79.5 dB	
6.0 MHz	RBW = 100 kHz	> 79.5 dB	
Dynamic range at offset frequency		carrier power = -10 dBm	HSR $3\pi/4$-QPSK wide pulse HSR $\pi/4$-16QAM wide pulse HSR $-\pi/4$-32QAM wide pulse
100 kHz ¹⁶	RBW = 30 kHz	> 42.0 dB	
200 kHz ¹⁶	RBW = 30 kHz	> 70.0 dB	
250 kHz ¹⁶	RBW = 30 kHz	> 78.2 dB	
400 kHz ¹⁶	RBW = 30 kHz	> 82.5 dB	
600 kHz	RBW = 30 kHz	> 74.0 dB	
1.2 MHz	RBW = 30 kHz	> 79.5 dB	
1.8 MHz	RBW = 30 kHz	> 82.5 dB	
1.8 MHz	RBW = 100 kHz	> 77.3 dB	
3.0 MHz	RBW = 100 kHz	> 78.5 dB	
6.0 MHz	RBW = 100 kHz	> 78.5 dB	

¹⁵ < 50 dBc: 0.7 dB; otherwise: 1.5 dB.

¹⁶ Due to the nominal GSM signal bandwidth, the dynamic range cannot be measured directly but is computed from phase noise measurements with CW carriers.

Spectrum due to switching transients		all modulations	
Level measurement uncertainty			
Absolute		see R&S®FSW data sheet: "Total measurement uncertainty, YIG preselector off"	1.5 dB
Relative			
0 dBc to 50 dBc		see R&S®FSW data sheet: "Display nonlinearity" and "Bandwidth switching uncertainty"	0.7 dB
> 50 dBc			1.5 dB
Dynamic range at offset frequency	carrier power = -10 dBm RBW = 30 kHz VBW = 100 kHz	NB GMSK NB $\pi/8$-8PSK	
400 kHz ¹⁶		> 69.5 dB	
600 kHz		> 74.5 dB	
1.2 MHz		> 81.5 dB	
1.8 MHz		> 82.0 dB	
Dynamic range at offset frequency	carrier power = -10 dBm RBW = 30 kHz VBW = 100 kHz	NB $\pi/4$-16QAM NB $-\pi/4$-32QAM HSR $\pi/4$-16QAM narrow pulse HSR $-\pi/4$-32QAM narrow pulse	
400 kHz ¹⁶		> 69.5 dB	
600 kHz		> 71.0 dB	
1.2 MHz		> 80.0 dB	
1.8 MHz		> 81.0 dB	
Dynamic range at offset frequency	carrier power = -10 dBm RBW = 30 kHz VBW = 100 kHz	NB $\pi/2$-AQPSK HSR $3\pi/4$-QPSK narrow pulse HSR $3\pi/4$-QPSK wide pulse HSR $\pi/4$-16QAM wide pulse HSR $-\pi/4$-32QAM wide pulse	
400 kHz ¹⁶		> 69.5 dB	
600 kHz		> 71.0 dB	
1.2 MHz		> 77.5 dB	
1.8 MHz		> 76.5 dB	

Ordering information

Designation	Type	Order No.	Remarks
GSM Measurements	R&S®FSW-K10	1313.1368.02	
Spectrum and Signal Analyzer	R&S®FSW8	1312.8000.08	
Spectrum and Signal Analyzer	R&S®FSW13	1312.8000.13	
Spectrum and Signal Analyzer	R&S®FSW26	1312.8000.26	
Recommended options and extras			
RF Preamplifier, 100 kHz to 13.6 GHz	R&S®FSW-B24	1313.0832.13	Please contact your local Rohde & Schwarz sales office.
RF Preamplifier, 100 kHz to 26.5 GHz	R&S®FSW-B24	1313.0832.26	
Electronic Attenuator, 1 dB steps	R&S®FSW-B25	1313.0990.02	
Digital Baseband Interface	R&S®FSW-B17	1313.0784.02	
Analog Baseband Inputs, 40 MHz Analysis Bandwidth	R&S®FSW-B71	1313.1651.13	for R&S®FSW8/13. Contact service center
Analog Baseband Inputs, 40 MHz Analysis Bandwidth	R&S®FSW-B71	1313.1651.26	for R&S®FSW26/43. Contact service center
80 MHz Analysis Bandwidth for Analog Baseband Inputs	R&S®FSW-B71E	1313.6547.02	R&S®FSW-B71 required.

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

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Environmental commitment

- | Energy-efficient products
- | Continuous improvement in environmental sustainability
- | ISO 14001-certified environmental management system

Certified Quality System
ISO 9001

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R&S®FSW-K10 GSM Measurements

Data without tolerance limits is not binding | Subject to change

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