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R&S®FSQ-K70 Vector Signal Analyzer for R&S®FSQ, R&S®FSG, R&S®FSUP Vector Signal Analysis for R&S®FMU, R&S®FSU-B73, R&S®FSMR-B73

Data sheet

ROHDE&SCHWARZ

CONTENTS

Specifications **3**

Signal acquisition **3**

Modulation formats **3**

Predefined standards 4

Filtering **4**

Symbol rate 5

Measurement results **5**

PSK, MSK, QAM, USER-QAM, VSB formats 5

FSK measurement results 6

Display formats **6**

Error summary **6**

PSK, MSK, QAM, USER-QAM or VSB formats 6

FSK format 6

VSB format 6

Detected symbols **7**

Symbol table 7

Adaptive Filter Display 7

Measurement uncertainty **7**

Residual errors 7

Residual errors for standard measurements 8

Frequency dependency of residual errors 8

Measurement rate for standard measurements 8

Ordering information **9**

The R&S®FSQ-K70, R&S®FSMR-B73, R&S®FSU-B73, R&S®FMU, R&S®FSG and R&S®FSUP vector signal analyzer specifications are based on the specifications of the R&S®FSQ Signal Analyzer, the R&S®FSMR Measurement Receiver, the R&S®FMU Baseband Analyzer, the R&S®FSU Spectrum Analyzer, the R&S®FSG Spectrum Analyzer and the R&S®FSUP Signal Source Analyzer, respectively. If not noted otherwise, the vector signal analyzer specifications apply for R&S®FSQ, R&S®FSMR, R&S®FMU, R&S®FSU, R&S®FSG and R&S®FSUP.

Specifications apply under the following conditions:
30 minutes warmup time at ambient temperature, specified environmental conditions met, calibration cycle adhered to and all internal calibrations performed. Data with tolerances are measurement uncertainties with a confidence level of 95 %. Data without tolerances are typical values.

Specifications

Signal acquisition

Record length		up to 4 Msymbol
Record length	R&S®FSQ, R&S®FMU, with R&S®FSQ-B100 option	up to 117 Msymbol
Record length	R&S®FSQ, R&S®FMU, with R&S®FSQ-B100/-B102 options	up to 352 Msymbol
Result length	adjustable	up to 8 ksymbol
Samples per symbol		1, 2, 4, 8, 16
Symbol clock		internally generated
Carrier lock		internally locked
Triggering		single
		continuous
		external
	searches data block for beginning of TDMA burst and performs analysis over detected burst length	burst search
Data synchronization	synchronization patterns are required to resolve carrier phase ambiguity in non-differential modulation formats	predefined patterns
		user-defined patterns

Modulation formats

FSK	including GFSK	2 FSK
		4 FSK
MSK	including GMSK	yes
PSK	static	BPSK, QPSK, OQPSK, DQPSK, π/4 DQPSK, 8PSK, D8PSK
	differential	3π/8 8PSK (EDGE)
QAM	static	16QAM, 32QAM, 64QAM, 128QAM, 256QAM
	differential	D16QAM, D32QAM, D64QAM, D128QAM, D256QAM
VSB		8VSB
USER-QAM (with external MAPWIZ tool)	static	user-definable constellation 2-ary, 4-ary, 8-ary, 16-ary, 32-ary, 64-ary, 128-ary, 256-ary
	differential	user-definable constellation 2-ary, 4-ary, 8-ary, 16-ary, 32-ary, 64-ary, 128-ary, 256-ary

Predefined standards

Cellular networks		
3GPP WCDMA (QPSK)		forward link
		reverse link
CDMA2000® 1x (QPSK, OQPSK)		forward link
		reverse link
EDGE		normal burst
GSM		access burst
		frequency correction burst
		normal burst
		synchronization burst
NADC		forward link
		reverse link
PDC		downlink
		uplink
PHS		communications burst
		control burst
Wireless networks		
Bluetooth®		DH1 packets
		DH3 packets
		DH5 packets
Other		
DECT		fixed part burst
TETRA		control burst downlink
		data burst downlink

Filtering

Filter types		raised cosine (RC)
		root raised cosine (RRC)
		CDMA2000® compliant
		Gaussian
		EDGE
		unfiltered
		user-definable filters designed with FILTWIZ
		adaptive filter
User-selectable		
alpha	for RC and RRC filters	0.1 to 1
B×T	for Gaussian filters	0.1 to 1

Symbol rate

Maximum symbol rate [1] [2]	R&S®FSQ, R&S®FSMR, R&S®FSG	25 MHz
	R&S®FSQ with R&S®FSQ-B71 option, R&S®FMU	25 MHz
	R&S®FSQ with R&S®FSQ-B72 option (1157.0336.02, discontinued)	60 MHz below 3.6 GHz
		81.6 MHz above 3.6 GHz
	R&S®FSQ with R&S®FSQ-B72 option (1157.0336.12)	81.6 MHz below 3.6 GHz
		81.6 MHz above 3.6 GHz
	R&S®FSU-B73, R&S®FSUP	6.4 MHz
Maximum bandwidth	R&S®FSQ, R&S®FSMR, R&S®FSG	28 MHz
	R&S®FSQ with R&S®FSQ-B71 option, R&S®FMU	36 MHz (aliasing filter OFF)
		30 MHz (aliasing filter ON)
	R&S®FSQ with R&S®FSQ-B72 option (1157.0336.02, discontinued)	60 MHz below 3.6 GHz
		120 MHz above 3.6 GHz
	R&S®FSQ with R&S®FSQ-B72 option (1157.0336.12)	120 MHz below 3.6 GHz
		120 MHz above 3.6 GHz
	R&S®FSU-B73, R&S®FSUP	7 MHz

Measurement results

PSK, MSK, QAM, USER-QAM, VSB formats

Measured signal	filtered, carrier locked, symbol locked	I/Q versus time
		magnitude versus time
		phase versus time
		frequency versus time (MSK only)
		PDF/CDF
		spectrum
Reference signal	ideal, computed from detected symbols	I/Q versus time
		magnitude versus time
		phase versus time
		frequency versus time (MSK only)
		PDF/CDF
		spectrum
Error vector signal	vector difference between measured and reference signal	I/Q versus time
		magnitude versus time
		phase versus time
		PDF/CDF
		spectrum
Error signal	difference between measured magnitude/phase and reference magnitude/phase	magnitude versus time
		phase versus time
		PDF/CDF
		spectrum
Detected symbols		symbols versus time
Modulation accuracy		single sweep based numerical results
		statistical results over multiple sweeps
AM/AM conversion		gain error versus reference signal level
AM/φM conversion		phase error versus reference signal level

[1] Symbol rate limitations (RF input) for R&S®FSQ, R&S®FSMR, R&S®FSU-B73, R&S®FSG, and R&S®FSUP:
The maximum symbol rate is additionally limited by the bandwidth and the filter roll-off (alpha).
Example for R&S®FSQ with raised cosine filtering, bandwidth set to 28 MHz: [symbol rate × (1+alpha) ≤ 28 MHz]

[2] Symbol rate limitations (base-band input) for R&S®FSQ with R&S®FSQ-B71 option, and R&S®FMU:
If a low-IF signal is applied to the base-band input, the maximum symbol rate is also limited by the maximum bandwidth, the filter roll-off (alpha) and the frequency offset (IF).
Example with raised cosine filtering: [0.5 × symbol rate × (1+alpha) + IF ≤ max. BW]

FSK measurement results

Measured signal		magnitude versus time
		instantaneous frequency versus time
		PDF/CDF
Reference signal		magnitude versus time
		instantaneous frequency versus time
		PDF/CDF
Deviation signal	difference between instantaneous frequency of measured signal and reference signal	deviation error versus time
Magnitude error signal	difference between measured magnitude and reference magnitude	magnitude error versus time

Display formats

The following trace formats are available for measured data and computed ideal reference data, with complete marker and scaling capabilities and automatic grid line adjustment to ideal symbol or constellation points.

Polar diagrams	samples displayed only at symbol times	constellation
	display of trajectory between symbol times with 1, 2, 4, 8, 16 points/symbol	vector
I or Q versus time		
Eye diagrams	formats other than FSK	I/Q
	FSK	frequency
Error vector magnitude (EVM) versus time	formats other than FSK	
Deviation error	FSK	
AM/AM conversion AM/φM conversion		for modulation formats with amplitude variations
Statistical diagrams		PDF
		CDF
Spectrum		for all traces versus time

Error summary

PSK, MSK, QAM, USER-QAM or VSB formats

Measured rms and peak values	EVM can be calculated with or without removing I/Q offset	EVM
		magnitude error
		phase error
		carrier frequency offset
	I/Q offset	origin offset
		amplitude drop
		I/Q imbalance
		statistics

FSK format

Measured rms and peak values	FSK errors can be calculated with measured deviation or ideal deviation	deviation error
		magnitude error
		carrier frequency offset

VSB format

Measured rms and peak values	EVM can be calculated with or without removing I/Q offset. The specified pilot will always be removed. The EVM value is calculated over the real part of the error signal	EVM
		magnitude error
		phase error
		carrier frequency offset
	I/Q offset	origin offset
		amplitude drop
		I/Q imbalance
		statistics

Detected symbols

Symbol table

Symbol formats		binary
		octal
		hexadecimal
		decimal
Symbol marker	symbol mapping user-definable with additional utility program (MAPWIZ)	synchronization patterns shown as inverse video

Adaptive Filter Display

Display result	results are available only if adaptive filter is switched on. Otherwise the adaptive filter results are referred to a feed-through connection.	FIR filter taps in time domain (magnitude, phase)
		FIR filter taps in frequency domain
		group delay, frequency response, inverse frequency response

Measurement uncertainty

R&S®FSQ, R&S®FSU, R&S®FSMR, R&S®FSG, and R&S®FSUP:
Formats other than FSK, OQPSK, and VSB, result length = 150 symbols, averages = 10, frequency = 1 GHz, RF input.
Conditions: Modulation formats with the exception of FSK, OQPSK, and VSB. Specifications apply from +20 °C to +30 °C, for a full-scale signal, fully contained in the selected measurement span, random data sequence; instrument receiver mode; RF > 20 MHz; level ≥–25 dBm; start frequency ≥15 % of BW; alpha/BT ≥ 0.3 (0.3 ≤ alpha ≤ 0.7 offset QPSK) and symbol rate ≥ 1 kHz;
for symbol rates <1 kHz or RF frequency >5 GHz, accuracy may be limited by phase noise.

R&S®FSQ with R&S®FSQ-B71 option , R&S®FMU:
Formats other than FSK, OQPSK, and VSB, result length = 150 symbols, averages = 10, I/Q baseband signal.
Conditions: Modulation formats with the exception of FSK, OQPSK, and VSB. Specifications apply from +20 °C to +30 °C, for a full-scale signal, fully contained in the selected measurement span, random data sequence; level ≥ 5 dBm;
alpha/BT ≥ 0.3 (0.3 ≤ alpha ≤ 0.7 offset QPSK) and symbol rate ≥1 kHz;
for symbol rates <1 kHz accuracy may be limited by phase noise,
for symbol rates >10 MHz accuracy may be limited by I/Q imbalance.

Residual errors

Residual EVM	symbol rate ≤100 kHz	0.5 % rms
	symbol rate ≤1 MHz	0.5 % rms
	symbol rate ≤10 MHz	1.0 % rms
	symbol rate >10 MHz <15 MHz	2.0 % rms
Residual magnitude error	symbol rate ≤100 kHz	0.3 % rms
	symbol rate ≤1 MHz	0.5 % rms
	symbol rate ≤10 MHz	1.0 % rms
	symbol rate >10 MHz	1.5 % rms
Residual phase error	(for modulation formats with equal symbol amplitudes)	
	symbol rate ≤100 kHz	0.3° rms
	symbol rate ≤1 MHz	0.4° rms
	symbol rate ≤10 MHz	0.6° rms
	symbol rate >10 MHz	1.2° rms
Frequency error	added to frequency accuracy, if applicable	symbol rate/500000
I/Q origin offset	RF input	–60 dB or better
	baseband input	–54 dB or better

Residual errors for standard measurements

Predefined standard settings and average = 10, frequency = 1 GHz

Residual EVM	3GPP WCDMA (QPSK)	0.6 % rms
	CDMA2000®	0.4 % rms
	EDGE	0.25 % rms
	TETRA	0.5 % rms
	NADC	0.4 % rms
	PDC	0.55 % rms
Residual phase error	GSM	0.15° rms
Residual deviation error	DECT	2.5 kHz rms

Frequency dependency of residual errors

Residual EVM	3GPP WCDMA (QPSK)	
	frequency	
	5 GHz	0.9 %
	10 GHz	1.4 %
	15 GHz	2.1 %
	20 GHz	2.6 %
	25 GHz	4.0 %
Residual EVM	QPSK, symbol rate 15 MHz, alpha = 0.22	
	frequency	
	5 GHz	1.2 %
	10 GHz	1.9 %
	15 GHz	2.3 %
	20 GHz	2.8 %
	25 GHz	3.8 %

Measurement rate for standard measurements

Predefined standard settings, external trigger, continuous sweep

Measurements	3GPP WCDMA (QPSK)	10/s
	GSM (normal burst)	15/s
	EDGE (normal burst)	15/s
	DECT	15/s
	NADC	10/s
	CDMA2000®	10/s

Ordering information

Designation	Type	Order No.
Vector Signal Analyzer for R&S®FSQ	R&S®FSQ-K70	1161.8038.02
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 extras and options	**see specifications R&S®FSQ Signal Analyzer, PD 0758.0945.12**	
I/Q Baseband Inputs for Signal Analyzer R&S®FSQ	R&S®FSQ-B71	1157.0113.02
I/Q Bandwidth Extension to 120 MHz	R&S®FSQ-B72	1157.0336.12
I/Q Memory Extension to 235 Msample	R&S®FSQ-B100	1169.5244.02
I/Q Memory Extension to 705 Msample	R&S®FSQ-B102	1169.5444.04

Designation	Type	Order No.
Vector Signal Analyzer for R&S®FSMR	R&S®FSMR-B73	1169.5696.02
Measurement Receiver, 20 Hz to 3.6 GHz	R&S®FSMR3	1166.3311.03
Measurement Receiver, 20 Hz to 26.5 GHz	R&S®FSMR26	1166.3311.26
Measurement Receiver, 20 Hz to 50 GHz	R&S®FSMR50	1166.3311.50

Designation	Type	Order No.
Vector Signal Analyzer for R&S®FSU	R&S®FSU-B73	1169.5696.03
Spectrum Analyzer, 20 Hz to 3.6 GHz	R&S®FSU3	1166.1660.03
Spectrum Analyzer, 20 Hz to 8 GHz	R&S®FSU8	1166.1660.08
Spectrum Analyzer, 20 Hz to 26.5 GHz	R&S®FSU26	1166.1660.26
Spectrum Analyzer, 20 Hz to 46 GHz	R&S®FSU46	1166.1660.46
Spectrum Analyzer, 20 Hz to 50 GHz	R&S®FSU50	1166.1660.50

Designation	Type	Order No.
Baseband Analyzer	R&S®FMU	1303.3500.02
Recommended extras and options	**see specifications R&S®FMU Baseband Analyzer, PD 5213.7025.12**	
I/Q Memory Extension to 235 Msample	R&S®FSQ-B100	1169.5244.02
I/Q Memory Extension to 705 Msample	R&S®FSQ-B102	1169.5444.04

Designation	Type	Order No.
Spectrum Analyzer, 9 kHz to 8 GHz	R&S®FSG8	1309.0002.08
Spectrum Analyzer, 9 kHz to 13.6 GHz	R&S®FSG13	1309.0002.13

Designation	Type	Order No.
Signal Source Analyzer, 20 Hz to 8 GHz	R&S® FSUP8	1166.3505.08
Signal Source Analyzer, 20 Hz to 26.5 GHz	R&S® FSUP26	1166.3505.26
Signal Source Analyzer, 20 Hz to 50 GHz	R&S®FSUP50	1166.3505.26

Certified Quality System
ISO 9001
DQS REG. NO 1954 QM

Certified Environmental System
ISO 14001
DQS REG. NO 1954 UM

For product brochure, see PD 0758.0945.12
and www.rohde-schwarz.com
(search term: FSQ/FSMR/FSU/FMU/FSG/
FSUP)

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