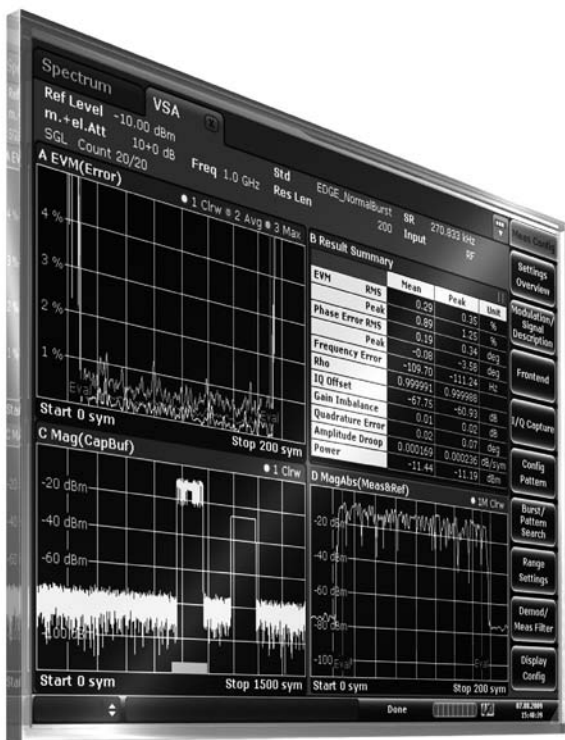


R&S®FSV-K70

Vector Signal Analysis

Specifications



CONTENTS

Specifications	3
Inputs	3
Signal acquisition	3
Modulation formats	4
Predefined standards	5
Filtering	5
Measurement parameters	6
Display formats versus time	7
Additional display formats	7
Display of modulation accuracy results.....	8
Table for FSK.....	8
Detected symbols	8
Measurement uncertainty (nominal)	9
Residual errors for QPSK	9
Residual errors for FSK	10
Residual errors for predefined standards.....	10
Ordering information	11

Specifications

The specifications below apply to the R&S®FSVx (R&S®FSV3/7/13/30/40). They are based on the data sheet specifications of the R&S®FSV signal and spectrum analyzer, have not been checked separately and are not verified during instrument calibration. They apply to the specified symbol rates.

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.

Inputs

RF input	frequency depending on base system		
	R&S®FSV3	DC-coupled	9 kHz to 3.6 GHz
		AC-coupled	1 MHz to 3.6 GHz
	R&S®FSV7	DC-coupled	9 kHz to 7 GHz
		AC-coupled	1 MHz to 7 GHz
	R&S®FSV13	DC-coupled	9 kHz to 13.6 GHz
		AC-coupled	10 MHz to 13.6 GHz
	R&S®FSV30	DC-coupled	9 kHz to 30 GHz
		AC-coupled	10 MHz to 30 GHz
	R&S®FSV40	DC-coupled	9 kHz to 40 GHz
AC-coupled		10 MHz to 40 GHz	
Digital baseband input	only with R&S®FSV-B17 option	0 Hz	

Signal acquisition

Capture length	RF input	100 symbols to 200000/(capture oversampling) symbols
	digital baseband input	up to 50000 symbols
Result length		10 symbols to 10000 symbols, but not larger than capture length
Capture oversampling		4, 8, 16, 32 ¹
Triggering	RF input	free run
		external (positive or negative polarity)
		IF power ²
	digital baseband input	free run
		external (positive or negative polarity)
		baseband power
checks captured data for power bursts and performs analysis only at detected burst	burst search	
checks captured data for patterns and performs analysis only at detected pattern	predefined patterns user-defined patterns	

¹ For large symbol rates, restricted by the limitations of the usable I/Q bandwidth.

² Restricted IF power trigger functionality for carrier frequencies < 50 MHz.

Modulation formats

Type	Order	Mapping
FSK	2FSK	Natural
	4FSK	Natural, Gray, APCO25 C4FM, APCO25 Phase 2
	8FSK	Natural
MSK	MSK, including GMSK	Natural
	DMSK	GSM
PSK	BPSK	Natural
	QPSK	WCDMA, Natural, Gray, CDMA2000® forward, DVB-S2
	Offset QPSK	Gray
	DQPSK	Natural, Inmarsat
	$\pi/4$ -DQPSK	TFTS, TETRA, PHS, PDC, Natural, NADC, APCO25, APCO25 Phase 2
	$3\pi/4$ -QPSK	EDGE
	8PSK	Natural, Gray, DVB-S2
	D8PSK	Natural, Gray
	$3\pi/8$ -8PSK	EDGE
	$\pi/8$ -D8PSK	APCO25 Phase 2, TETRA
	QAM	16QAM
$\pi/4$ -16QAM		EDGE
32QAM		DVB-C
$-\pi/4$ -32QAM		EDGE
64QAM		DVB-C
128QAM		Gray
256QAM		Gray
User QAM	2ASK	OOK
	4ASK	Natural
	16APSK	DVB-S2 (for different code rates)
	32APSK	DVB-S2 (for different code rates)

Predefined standards

Predefined standards can be loaded in order to preset the measurement parameters, the filters and the display format.
Predefined standards can be changed and resaved.

3GPP CDMA	QPSK	CPICH (without descrambling and despreading)	
GSM, EDGE, EDGE Evolution	GMSK	normal burst	
		access burst	
		frequency correction burst	
		synchronization burst	
	3 π /8-8PSK	normal burst	
π /4-16QAM	3 π /4-QPSK	higher symbol rate burst with narrow and wide pulse filter	
		normal burst	
	π /4-16QAM	higher symbol rate burst with narrow and wide pulse filter	
TETRA	π /4-DQPSK	normal burst	
		higher symbol rate burst with wide pulse filter	
		discontinuous downlink	
APCO25	QPSK	continuous downlink	
		CQPSK	
Bluetooth®	4FSK	C4FM	
		2FSK	DH1
			DH3
DECT	2FSK	DH5	
		P32, fixed part	
DVB-S2	QPSK	P32, portable part	
	8PSK		
	16APSK	only XFECFRAME	
	32APSK	only XFECFRAME	
CDMA2000®	QPSK	1x forward link (without descrambling and despreading)	
	Offset QPSK	1x reverse link (without descrambling and despreading)	
ZigBee® (IEEE 802.15.4)	Offset QPSK	PHY for 2450 MHz band (without descrambling and despreading)	
	BPSK	PHY for 915 MHz band (without descrambling and despreading) PHY for 868 MHz band (without descrambling and despreading)	
User-definable standards			

Filtering

Filter types	transmit filter	RC (raised cosine)
		RRC (root raised cosine)
		Gauss
		GMSK
		linearized GMSK
		EDGE narrow pulse shape
		EDGE wide pulse shape
		CDMA2000® 1x forward
		CDMA2000® 1x reverse
		APCO25 C4FM
		APCO25 H-CPM
		APCO25 H-DQPSK
		APCO25 H-D8PSK narrow
		APCO25 H-D8PSK wide
		half sine
		rectangular
		none
		user-definable filters designed with FILTWIZ ³

³ FILTWIZ is a free tool from Rohde & Schwarz that can be downloaded from the website www.rohde-schwarz.com. It requires MATLAB®.

Filter types	measurement filter	RRC EDGE NSR EDGE HSR (narrow pulse) EDGE HSR (wide pulse) rectangular low ISI measurement filter none user-definable filters designed with FILTWIZ ³
	receive filter	R&S [®] FSV-K70 automatically selects appropriate receive filters
User-selectable filter parameters		
Alpha (roll-off factor)	for RC and RRC filters	0.1 to 1
B × T	for Gaussian and GMSK filters	0.1 to 1

Measurement parameters

Symbol rate	RF input	
	with R&S [®] FSV-B70 option	25 Hz to 32 MHz
	without R&S [®] FSV-B70 option	25 Hz to 11 MHz
	R&S [®] FSV40, model 39	25 Hz to 3.125 MHz
	digital baseband input	
	with R&S [®] FSV-B70 option	25 Hz to 0.25 × digital input sampling rate
	without R&S [®] FSV-B70 option	25 Hz to 11 MHz, but not larger than 0.25 × digital input sampling rate
Usable I/Q bandwidth	depending on set symbol rate	about 0.8 × capture oversampling × symbol rate
	maximum	
	RF input	
	with R&S [®] FSV-B70 option	40 MHz
	without R&S [®] FSV-B70 option	28 MHz
	R&S [®] FSV40, model 39	10 MHz
	digital baseband input	
	with R&S [®] FSV-B70 option	capture oversampling × symbol rate, but not larger than 0.76 × digital input sampling rate
	without R&S [®] FSV-B70 option	capture oversampling × symbol rate, but not larger than 28 MHz
EVM normalization	only for PSK, QAM and User QAM	mean reference power
		max. reference power
		mean constellation power
		max. constellation power
Offset EVM	only for Offset QPSK	ON/OFF
Error compensation (optional)	PSK, QAM, User QAM and MSK, measured signal	estimated I/Q offset
		estimated I/Q imbalance
	FSK, measured signal	estimated amplitude droop
		FSK, reference signal
Estimation points per symbol	samples per symbol used for fine synchronization	estimated FSK deviation error
		1, 2 or capture oversampling
Swap I/Q	captured signal	ON/OFF

Display formats versus time

The following display formats versus time are available.

For this display format, the number of displayed samples per symbols is fixed to the selected capture oversampling.

Captured signal		magnitude versus time
		I/Q versus time
		absolute frequency versus time

For these display formats, the parameter “display points per symbol” (1, 2, 4, 8 or 16) sets the number of displayed samples per symbol.

Measured signal	filtered, carrier locked, symbol locked	absolute/relative magnitude versus time
		I/Q versus time
		wrapped/unwrapped phase versus time
Reference signal	ideal, calculated from detected symbols	absolute/relative frequency versus time
		absolute/relative magnitude versus time
		I/Q versus time
Error vector signal	vector difference between measured signal and reference signal	wrapped/unwrapped phase versus time
		absolute/relative frequency versus time
		EVM versus time (EVM normalization selectable)
Error signal	difference between the measured signal's magnitude/phase/frequency and the reference signal's magnitude/phase/frequency	I/Q versus time
		magnitude error versus time
		phase error versus time
		absolute and relative frequency error versus time

For all the listed results, spectrum and statistics (probability density function (PDF), cumulative probability density function (CDF), 95th percentile) are also available.

Additional display formats

For this display format, the number of displayed samples per symbols is fixed to the selected capture oversampling.

I/Q vector	captured signal	polar diagram
------------	-----------------	---------------

For these display formats, only symbol times are displayed.

I/Q constellation	measured signal, reference signal	polar diagram; I/Q samples
Frequency constellation	measured signal, reference signal	absolute frequency

For these display formats, the parameter “display points per symbol” (1, 2, 4, 8 or 16) sets the number of displayed samples per symbol.

I/Q vector	measured signal, reference signal, error vector signal	polar diagram; display of trajectory between symbol times
Frequency vector	measured signal, reference signal	absolute frequency
Eye diagram	measured signal, reference signal	eye diagram I
		eye diagram Q
Eye diagram frequency	measured signal, reference signal	eye diagram of the absolute frequency

Display of modulation accuracy results

The tables show the scalar result values calculated for each measurement. Additionally, the following statistical measures (calculated over multiple measurements) are shown for each result value: mean, peak (worst value), standard deviation, 95th percentile.

Numerical limits can be set for the current, mean and peak value. Limits can only be set for the parameters EVM, magnitude error, phase error, carrier frequency error, waveform quality factor and I/Q offset.

The tables are modulation specific.

Table for MSK, PSK, QAM and User QAM

For the following results, the parameter “estimation points per symbol” can be set by the user. It can be set to 1 (only symbol times contribute to the result), 2 (two samples per symbol contribute to the result) or “capture oversampling” (all samples contribute to the result).

I/Q offset		R&S®FSV-K70 automatically selects calculation range
I/Q imbalance	not for BPSK, ASK	
Gain imbalance	not for BPSK, ASK	
Quadrature error	not for BPSK, ASK	
Amplitude droop		
Carrier frequency error		

For the following results, the parameter “display points per symbol” can be set by the user. It can be set to 1 (only symbol times contribute to the result), 2 (two samples per symbol contribute to the result) or “capture oversampling” (all samples contribute to the result). The estimated I/Q offset, amplitude droop, I/Q imbalance may be optionally compensated before calculating these values.

Error vector magnitude (EVM)	RMS and peak value of corresponding trace	user-settable calculation range (evaluation range)
Modulation error ratio (MER)	RMS and peak value of corresponding trace	
Magnitude error	RMS and peak value of corresponding trace	
Phase error	RMS and peak value of corresponding trace	
Mean power		
Waveform quality factor ρ (rho)		

Remark: for Offset QPSK, the measurement results “error vector magnitude” (EVM) and “modulation error ratio” (MER) can be influenced by the parameter “Offset EVM”.

Table for FSK

For the following results, the parameter “estimation points per symbol” can be set by the user (1, 2 or “capture oversampling”).

FSK deviation error		R&S®FSV-K70 automatically selects calculation range
FSK measurement deviation		
Carrier frequency drift		
Carrier frequency error		

For the following results, the parameter “display points per symbol” can be set by the user (1, 2 or “capture oversampling”). The estimated FSK deviation error and the estimated carrier frequency drift may be optionally compensated before calculating these values.

Frequency Error	RMS and peak value of corresponding trace	user-settable calculation range (evaluation range)
Magnitude error	RMS and peak value of corresponding trace	
Mean power		

Detected symbols

Symbol formats		binary
		octal
		decimal
		hexadecimal
Symbol marker		detected synchronization patterns are marked in green

Measurement uncertainty (nominal)

Specifications apply from +20 °C to +30 °C, signal level ≥ -25 dBm, well adjusted reference level, offset between analyzer's center frequency and the signal's center frequency is smaller than 5 % of symbol rate, no additional I/Q impairments, random data sequence. "Capture oversampling" is set to 4. For symbol rates < 1 kHz or frequencies > 5 GHz, accuracy may be limited by phase noise.

Residual errors for QPSK

The modulation is QPSK, the TX filter is RRC with roll-off factor 0.22, the measurement filter is RRC with roll-off factor 0.22 and EVM is normalized to mean reference power. The parameter "estimation points per symbol" is set to 1, as well as the parameter "display points per symbol" for the result summary. The result length is 150 symbols and the number of averages is 10.

Residual EVM RMS (averaged value)	symbol rate = 100 kHz	
	CF = 1 GHz	< 0.5 %
	CF = 2 GHz	< 0.5 %
	CF = 3 GHz	< 0.5 %
	symbol rate = 1 MHz	
	CF = 1 GHz	< 0.5 %
	CF = 2 GHz	< 0.5 %
	CF = 3 GHz	< 0.5 %
	symbol rate = 10 MHz	
	CF = 1 GHz	< 1.0 %
	CF = 2 GHz	< 1.0 %
	CF = 3 GHz	< 1.0 %
	symbol rate = 20 MHz	
	CF = 1 GHz	< 2.0 %
	CF = 2 GHz	< 2.0 %
CF = 3 GHz	< 2.0 %	
Carrier frequency error uncertainty (2σ value)	symbol rate = 100 kHz	R&S [®] FSV frequency uncertainty ⁴ +
	CF = 1 GHz	3 Hz
	CF = 2 GHz	3 Hz
	CF = 3 GHz	3 Hz
	symbol rate = 1 MHz	R&S [®] FSV frequency uncertainty ⁴ +
	CF = 1 GHz	15 Hz
	CF = 2 GHz	15 Hz
	CF = 3 GHz	15 Hz
	symbol rate = 10 MHz	R&S [®] FSV frequency uncertainty ⁴ +
	CF = 1 GHz	400 Hz
	CF = 2 GHz	400 Hz
	CF = 3 GHz	400 Hz
	symbol rate = 20 MHz	R&S [®] FSV frequency uncertainty ⁴ +
	CF = 1 GHz	600 Hz
	CF = 2 GHz	600 Hz
CF = 3 GHz	600 Hz	

⁴ For R&S[®]FSV frequency uncertainty, refer to the reference frequency stated in the R&S[®]FSV specifications.

Residual errors for FSK

The modulation is 2FSK, the TX filter is RRC with roll-off factor 0.2, the measurement filter is RRC with roll-off factor 0.2 and the FSK reference deviation is half the symbol rate. The parameter "estimation points per symbol" is set to 4 (capture oversampling), as well as the parameter "display points per symbol" for the result summary. The result length is 150 symbols and the number of averages is 10.

Residual frequency error RMS (averaged value)	symbol rate = 100 kHz	
	CF = 1 GHz	< 0.5 %
	CF = 2 GHz	< 0.5 %
	CF = 3 GHz	< 0.5 %
	symbol rate = 1 MHz	
	CF = 1 GHz	< 0.5 %
	CF = 2 GHz	< 0.5 %
	CF = 3 GHz	< 0.5 %
	symbol rate = 10 MHz	
	CF = 1 GHz	< 1.0 %
	CF = 2 GHz	< 1.0 %
	CF = 3 GHz	< 1.0 %
	symbol rate = 20 MHz	
	CF = 1 GHz	< 2.0 %
	CF = 2 GHz	< 2.0 %
CF = 3 GHz	< 2.0 %	

Residual errors for predefined standards

Measurements are based on the corresponding predefined standards. The number of averages is 10.

Residual EVM RMS (averaged value)	3GPP WCDMA (CPICH)	
	CF = 1 GHz	< 1.0 %
	CF = 2 GHz	< 1.0 %
	CF = 3 GHz	< 1.0 %
	GSM EDGE (3π/8-8PSK, normal burst)	
	CF = 1 GHz	< 0.6 %
	CF = 2 GHz	< 0.6 %
	CF = 3 GHz	< 0.6 %
	GSM (normal burst)	
	CF = 1 GHz	< 0.8 %
	CF = 2 GHz	< 0.8 %
	CF = 3 GHz	< 0.8 %
Residual frequency error RMS (averaged value)	Bluetooth® (DH1)	
	CF = 1 GHz	< 0.8 %
	CF = 2 GHz	< 0.8 %
	CF = 3 GHz	< 0.8 %

Ordering information

Designation	Type	Order No.	Remarks
Vector Signal Analysis	R&S®FSV-K70	1310.8455.02	
Spectrum and Signal Analyzer	R&S®FSV3	1307.9002.03	
Spectrum and Signal Analyzer	R&S®FSV7	1307.9002.07	
Spectrum and Signal Analyzer	R&S®FSV13	1307.9002.13	
Spectrum and Signal Analyzer	R&S®FSV30	1307.9002.30	
Spectrum and Signal Analyzer	R&S®FSV40 ⁵	1307.9002.39	model 39
Spectrum and Signal Analyzer	R&S®FSV40	1307.9002.40	
Recommended options and extras			
Digital Baseband Interface	R&S®FSV-B17	1310.9568.02	not available for R&S®FSV40, model 39
RF Preamplifier, 9 kHz to 7 GHz	R&S®FSV-B22	1310.9600.02	
RF Preamplifier, 9 kHz to 13.6 GHz	R&S®FSV-B24	1310.9616.13	
RF Preamplifier, 9 kHz to 30 GHz	R&S®FSV-B24	1310.9616.30	
RF Preamplifier, 9 kHz to 40 GHz	R&S®FSV-B24	1310.9616.40	
Electronic Attenuator, 1 dB steps	R&S®FSV-B25	1310.9622.02	
40 MHz Analysis Bandwidth	R&S®FSV-B70	1310.9645.02	not available for R&S®FSV40, model 39
OCXO Reference Frequency	R&S®FSV-B4	1310.9522.02	
OCXO Extended Frequency Stability	R&S®FSV-B4	1310.9522.03	
Additional Interfaces (IF out, video out, AUX port, trigger out, 2 × USB)	R&S®FSV-B5	1310.9539.02	
Analog Modulation Analysis (AM/FM/φM)	R&S®FSV-K7	1310.8103.02	
Related products			
OFDM Vector Signal Analysis Software PC + Analyzer required	R&S®FS-K96	1310.0202.06	
OFDM Vector Signal Analysis Software Usable with and without Analyzer	R&S®FS-K96PC	1310.0219.06	
Upgrade from R&S®FS-K96 to R&S®FS-K96PC	R&S®FS-K96U	1310.0225.06	

The product brochure containing further information is available under PD 5214.0499.12 and at www.rohde-schwarz.com.

CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA -USA).

The Bluetooth® word mark and logos are registered trademarks owned by Bluetooth SIG, Inc. and any use of such marks by Rohde & Schwarz is under license.

⁵ Max. IF bandwidth 10 MHz

Service you can rely on

- | Worldwide
- | Local and personalized
- | Customized and flexible
- | Uncompromising quality
- | Long-term dependability

About Rohde & Schwarz

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.

Environmental commitment

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

Certified Quality System
ISO 9001

Rohde & Schwarz GmbH & Co. KG

www.rohde-schwarz.com

Regional contact

- | Europe, Africa, Middle East
+49 89 4129 123 45
customersupport@rohde-schwarz.com
- | North America
1 888 TEST RSA (1 888 837 87 72)
customer.support@rsa.rohde-schwarz.com
- | Latin America
+1 410 910 79 88
customersupport.la@rohde-schwarz.com
- | Asia/Pacific
+65 65 13 04 88
customersupport.asia@rohde-schwarz.com

R&S® is a registered trademark of Rohde & Schwarz GmbH & Co. KG
Trade names are trademarks of the owners | Printed in Germany (as)
PD 5214.0599.22 | Version 04.00 | November 2010 | R&S®FSV-K70
Subject to change

© 2009 - 2010 Rohde & Schwarz GmbH & Co. KG | 81671 München, Germany



5214059922