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Application Specific Options for the Spectrum and Signal Analyzer Families R&S®FSP/FSU/FSQ

Designation	Type R&S®	FSP	FSU	FSQ	Remarks	Page
General Measurement Applications						
Noise Figure Measurement Software	R&S®FS-K3	•	•	•	Noise measurements, preamplifier recommended (Windows software)	188
Application Firmware for Noise Figure and Gain Measurements	R&S®FS-K30	•	•	•	For R&S®FSP/FSU/FSQ with Windows XP: Outperforming any conventional noise measurement system, preamplifier recommended	189
Phase Noise Measurement Software	R&S®FS-K4	•	•	•	Phase noise measurements (Windows software)	190
AM/FM/PM Measurement Demodulator	R&S®FS-K7	•	•	•	FM Measurement Demodulator for Spectrum Analyzer R&S®FSP for determining analog modulation parameters	191
Mobile radio specific applications						
Option Vector Signal Analyzer	R&S®FSQ-K70			•	Universal demodulation, analysis, documentation of digital radio signals	193
GSM/EDGE Application Firmware	R&S®FS-K5	•	•	•	The solution for easy and fast GSM and EDGE measurements	195
WCDMA 3GPP Application Firmware	R&S®FS-K72	•	•	•	Modulation and code domain power measurements on base station signals (Node B) according to 3GPP TS24.141. Required options for R&S®FSP: R&S®FSP-B15 and R&S®FSP-B70	197
3GPP HSDPA BTS Application Firmware	R&S®FS-K74	•	•	•	Extends the R&S®FS-K72 to include HSDPA	
WCDMA 3GPP Application Firmware	R&S®FS-K73	•	•	•	Modulation and code domain power measurements on modulation signals (UE) according to 3GPP TS25.121. Required options for R&S®FSP: R&S®FSP-B15 for slot-based measurements and R&S®FSP-B70 for frame-based measurements	197
TD-SCDMA Test Application Firmware	R&S®FS-K76	•	•	•	Adds measurement functions in line with 3GPP as well as China Wireless Telecommunication Standard Group (CWTS) and provides the functionality needed for base-station testing	199
TD-SCDMA Test Application Firmware	R&S®FS-K77	•	•	•	Adds measurement functions in line with 3GPP as well as China Wireless Telecommunication Standard Group (CWTS) and provides user equipment functionality	199
cdma2000 Base Station Test Application Firmware	R&S®FS-K82	•	•	•	Modulation and code domain power measurements on cdma2000 base station signals (also applicable for IS-95/cdmaOne signals)	201
1xEV-DO Base Station Test Application Firmware	R&S®FS-K84	•	•	•	Modulation and code domain power measurements on 1xEV-DO base station signals	201
cdma2000/1xEV-DV Mobile Station Test Application Firmware	R&S®FS-K83	•	•	•	Transmitter measurements on cdma2000 and 1xEV-DV reverse link	203
cdma2000 1xEV-DO MS Application Firmware	R&S®FS-K85	•	•	•	Modulation and code domain power measurements on 1xEV-DO mobile station signals	
Other wireless applications						
Bluetooth Application Firmware	R&S®FS-K8	•	•	•	*Bluetooth* transmitter measurements	205
WLAN 802.11a Application Firmware	R&S®FSP-K90	•			OFDM analysis on WLAN 802.11a and WLAN 802.11g signals	207
WLAN 802.11a Application Firmware	R&S®FSQ-K90			•	Transmitter measurements on WLAN 802.11a OFDM signals	208
WLAN 802.11a/b/g/j Application Firmware	R&S®FSQ-K91			•	OFDM analysis and DSSS/CCK analysis	208
TV measurement applications						
TV Trigger/RF Power Trigger	R&S®FSP-B6	•			Makes the Spectrum Analyzers R&S®FSP suitable for analog TV measurement applications	210

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Handheld Spectrum Analyzer R&S®FSH3

100 kHz to 3 GHz

Robust, portable spectrum analyzer

that can be used in the field

Brief description

The R&S®FSH3 is the ideal spectrum analyzer for rapid, high-precision, cost-effective signal investigations. It provides a large number of measurement functions and so can handle anything from the installation or maintenance of a mobile radio base station up to on-site fault location in RF cables to development and service – an extensive range of applications.

Main features

- High measurement accuracy
- Best RF characteristics in this class
- Colour display, 320 × 240 pixels
- High measurement comfort
  - Marker
  - Delta marker
  - Noise marker
  - Frequency counter
- Simple menu-based operation via softkeys
- Four hours operating time on battery power
- Storage of up to 100 traces and setups
- Connection to PC via interference-free, RS-232-C optical interface
- Robust edge protection, stable carrying handle

R&S®FSH View Software

- Runs under Windows 98/ME/NT/2000/XP
- Graphics data stored in standard formats (.bmp, .pcx, .png, .wmf)
- Data export in ASCII or Excel format

Options and applications

The R&S®FSH3 is available with and without an internal tracking generator, thus enhancing its scope of applications by distance-to-fault (DTF) measurements and scalar network analysis. Another model with an adjustable preamplifier is particularly suited for measuring very small signals and includes as standard a tracking generator with selectable output level (0 dBm/–20 dBm). Two power sensors are available as accessories for high-precision power measurements up to 8 GHz and 18 GHz. The table below indicates which configuration is required for each application.

Product/application	TDMA power measurement	Channel-power measurement	Field strength measurement	Power measurement up to 8/18 GHz	Measurement on cables (distance-to-fault)	Scalar transmission measurement Vector transmission measurement[1]	Scalar reflection measurement Vector reflection measurement[1]
R&S®FSH3	•	•					
R&S®FSH3 incl. tracking generator	•	•				•	
R&S®FSH3 incl. tracking generator + SWR Bridge R&S®FSH-Z2 + DTF Function R&S®FSH-B1	•	•			•	•	•
R&S®FSH3 + Power Sensor R&S®FSH-Z1/-Z18	•	•		•			
R&S®FSH3 incl. tracking generator + Power Sensor R&S®FSH-Z1/-Z18 + SWR Bridge R&S®FSH-Z2 + DTF Function R&S®FSH-B1	•	•		•	•	•	•

1) R&S®FSH-Z2 required

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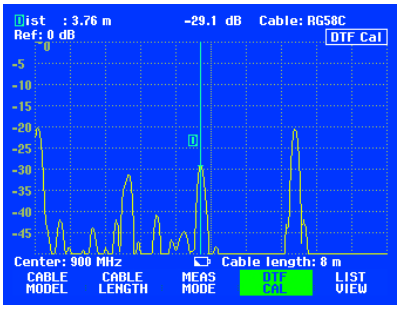
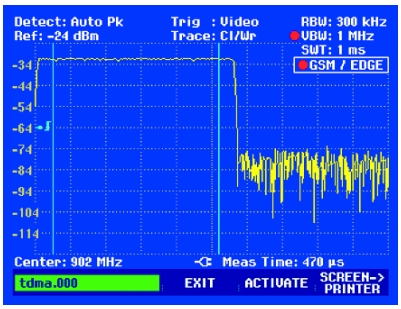
Handheld Spectrum Analyzer R&S®FSH3

- Printout of all relevant data via Windows (screenshot of the R&S®FSH3 display for documentation)
- Permanent and continuous transfer of sweeps to the PC; facilities for subsequent analysis (markers, zoom, etc)
- Editor for the generation of limit lines, transducer factors and correction factors for external attenuators/amplifiers
- Macro function for Word for fast and easy documentation of measurement results



Distance-to fault measurement for rapidly and accurately determining the distance to any defects in an RF cable



TDMA POWER function performs time-domain power measurements in these timeslots; all the settings required for the GSM and EDGE standards are predefined

Specifications in brief

You will find detailed and binding data on the enclosed CD (../DATASHEET/FSH3.pdf), or, for the latest updates, visit www.rohde-schwarz.com, search term: FSH3

Frequency	
Frequency range	100 kHz to 3 GHz
Frequency counter, resolution	1 Hz
Span	10 kHz to 3 GHz, 0 Hz
Spectral purity (SSB phase noise, f = 500 MHz, 20°C to 30°C) 1 MHz carrier offset	<120 dBc/(1 Hz)
Sweep time, span ≥10 kHz	100 ms to 1000 s
Sweep time, span = 0 Hz	1 ms to 100 s
Resolution bandwidths (–3 dB)	1 kHz to 1 MHz in 1, 3 steps
Video bandwidths	10 Hz to 1 MHz in 1, 3 steps
Amplitude	
Intermodulation-free range	70 dB (+15 dBm IP3)
Displayed average noise floor	typ. –116 dBm
Spurious response (ref. lev. ≤–10 dBm, f >30 MHz, RBW ≤100 kHz)	<–80 dBm
Image frequ. (carrier offset >1 MHz)	<–70 dBc (nominal)
Level display	
Reference level	–80 to +20 dBm in 1-dB steps
Level display error (ref. level –50 dB)	1.5 dB (+20°C to +30°C)
Trace detector	Auto Peak, Max Peak, Sample, RMS
Markers	1 marker and 1 delta marker
Power sensor R&S®FSH-Z1	
Frequency range	10 MHz to 8 GHz
Measurement range	200 pW to 200 mW
General data	
Display	14 cm (5.7") colour LCD, 320×240 pixels
Serial interface	Optical RS-232-C interface
Power supply	
Ext. power supply (R&S®FSH-Z33)	100 V to 240 V AC, 50 to 60 Hz, 400 mA
External DC voltage	15 V to 20 V
Internal battery (NiMH battery)	6 V to 9 V
Operating temperature range	0°C to +50°C (battery operation)
Dimensions (W × H × D)	170 mm × 120 mm × 270 mm
Weight	2.5 kg

Ordering information

Handheld Spectrum Analyzer		
100 kHz to 3 GHz	R&S®FSH3	1145.5850.03
100 kHz to 3 GHz, with tracking generator	R&S®FSH3	1145.5850.13
100 kHz to 3 GHz, with tracking generator and preamplifier	R&S®FSH3	1145.5850.23
Accessories supplied		
External power supply, battery pack (integral), RS-232-C optical cable, headphones, CD-ROM with control software R&S®FSH View and documentation, quick start manual		
Option		
Distance-to-Fault Measurement, incl. 1 m cable and calibration termination, R&S®FSH-Z2 required	R&S®FSH-B1	1145.5750.02
Remote Control via RS-232-C	R&S®FSH-K1	1157.3458.02
Vector Transmission and Reflection Measurements	R&S®FSH-K2	1157.3387.02
Extras		
Power sensor, 10 MHz to 8 GHz, incl. calibration standards (open, short, 50 Ω load)	R&S®FSH-Z1	1155.4505.02
Power Sensor, 10 MHz to 18 GHz	R&S®FSH-Z18	1165.1909.02
SWR Bridge and Power Divider 10 MHz to 3 GHz	R&S®FSH-Z2	1145.5767.02
Matching Pad 50/75 Ω, 0 to 2.7 GHz	R&S®RAZ	0358.5714.02
12-V Car Adapter	R&S®FSH-Z21	1145.5873.02
Serial/Parallel Converter	R&S®FSH-Z22	1145.5880.02
Additional RF cable, 1 m, N connectors, for R&S®FSH-B1	R&S®FSH-Z20	1145.5867.02
Carrying Bag	R&S®FSH-Z25	1145.5896.02
Spare Short/Open Circuit for calibrating, for R&S®FSH-Z2	R&S®FSH-Z30	1145.5773.02
Spare 50-Ω Load Standard, for R&S®FSH-Z2	R&S®FSH-Z31	1145.5780.02
Spare Battery Pack	R&S®FSH-Z32	1145.5796.02
Spare AC Power Supply	R&S®FSH-Z33	1145.5809.02
RS-232-C Optical Cable	R&S®FSH-Z34	1145.5815.02
Spare CD-ROM with Control Software R&S®FSH View and Documentation	R&S®FSH-Z35	1145.5821.02
Headphones	R&S®FSH-Z36	1145.5838.02

Spectrum Analyzer R&S®FS300

9 kHz to 3 GHz

Professional test equipment for laboratory, service and production

Brief description

The R&S®FS300 is a highly accurate spectrum analyzer with a frequency range of 9 kHz to 3 GHz. Owing to its modern, digital frequency processing technique, it offers high measurement quality at a favourable price.

Applications

- Measurement of RF spectrum (level and frequency)
- Measurement of radiated interference (EMC)
- Applications in mobile radio and wireless communication (GSM, WCDMA, DECT, W-LAN, *Bluetooth*®, etc)
- TDMA power measurements
- Radiomonitoring remote-controlled via USB

The wide frequency range from 9 kHz to 3 GHz, RF characteristics as known from a topend instrument as well as resolution bandwidths from 200 Hz to 1 MHz make this spectrum analyzer suitable for a wide range of applications in training, electronic labs or service centers.

In addition to overview measurements with a selectable span of 1 kHz to 3 GHz, the R&S®FS300 is particularly suitable for fast measurement of electromagnetic spurious emissions and for applications in wireless communication such as radio and wireless LAN.

The instrument is of extremely compact design, with a width that occupies only one half of a 19-inch rack and measuring three units in height.

Operation is menu-guided so that even untrained users will quickly obtain correct results. Clear structures simplify navigation within the menus. The bright TFT colour display with 320 × 240 pixel resolution allows traces to be read even at odd angles or when the incidence of light is unfavourable.

Whether on the lab bench, in service or as a flexible measuring instrument in automatic production systems, the range of applications is almost unlimited.

Main features

- High-quality measurement characteristics
- Resolution bandwidths from 200 Hz to 1 MHz
- Frequency counter with 1 Hz resolution
- Maximum input level 33 dBm
- Ergonomic user interface
- Remote control via USB interface
- High picture refresh rate
- Compact housing with flexible handle

PC software

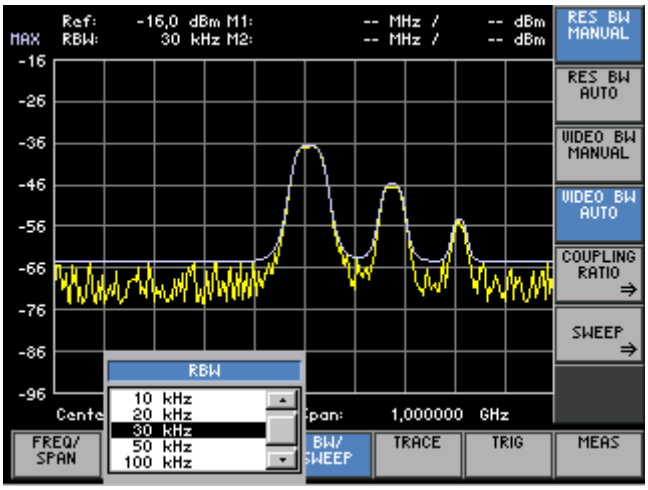
A powerful software option is available for remote control of the R&S®FS300 from a PC. The software enhances the R&S®FS300 functions and supports the generation of test reports on the PC.

Characteristics

- Windows 2000/XP-compatible
- PC linked to R&S®FS300 via convenient USB interface
- Fast and simple transfer of measurements between R&S®FS300 and PC

Spectrum Analyzer R&S®FS300

- Permanent sweep and transmission of ongoing sweeps to the PC with evaluation capabilities (marker, zoom, etc)
- Practically unlimited memory capacity for storing traces and measurement information (comparison of current and previous measurements)
- Extended range of functions (limit lines, log file)
- Export of trace values (900 points) in txt format for import into MS Excel
- Export of displayed data (screenshots) in JPEG format
- Output of results to standard USB printer



The points in the traces are displayed with an accuracy unrivalled in this price class; this is an essential prerequisite for any measurement task

Specifications in brief

You will find detailed and binding data on the enclosed CD (../DATASHEET/FS300.pdf), or, for the latest updates, visit www.rohde-schwarz.com, search term: FS300

Frequency	
Frequency range	9 kHz to 3 GHz
Frequency span	1 kHz to 3 GHz, 0 Hz
Spectral purity (9 kHz ≤ f ≤ 3 GHz)	
SSB phase noise	
10 kHz carrier offset	<–90 dBc (1 Hz)
Sweep time	
Span ≥1 kHz	100 ms to 1000 s
Span = 0 Hz	10 µs to 20 s
Bandwidths	
Resolution bandwidths (3 dB)	200 Hz to 1 MHz in 1, 2, 3, 5 sequences
Video band widths	10 Hz to 1 MHz in 1, 2, 3, 5 sequences
Amplitude	
Intermodulation-free range	
Two-tone signal with 2 × –30 dBm,	
0 dB input attenuation	
100 MHz to 3 GHz	≤–70 dBc
Harmonics	
–40 dBm, 0 dB input attenuation	≤–60 dBc
Inherent spurious responses	
Terminated input,	
0 dB input attenuation	≤–85 dBm
Other spurious	
10 MHz to 3 GHz, –30 dBm level at first mixer	≤–60 dBc
Displayed average noise level f > 9 kHz, 300 Hz resolution bandwidth	
10 Hz video bandwidth, 0 dB input attenuation	–110 dBm, typ. –120 dBm
Setting range of reference level	–110 dBm to +36 dBm
Level measurement uncertainty	≤1.5 dB
Marker	1 marker and 1 delta marker
Trigger	free run, video, external, line
Interfaces	
USB host	A plug, protocol 1.1
USB device	B plug, protocol 1.1
Command set	device-specific, remote control via supplied Windows driver (Windows XP, 2000)
General data	
Display	5.4" active TFT colour display
Resolution	320 × 240 pixels
Power supply	
Input voltage range	100 V to 240 V (AC), 50 to 60 Hz, automatic range setting
Power consumption	< 35 VA
Permissible temperature range	+5° C to +45° C
Dimensions (W × H × D)	219 mm × 147 mm × 350 mm
Weight	7.4 kg

Ordering information

Spectrum Analyzer	R&S®FS300	1147.0991.03
PC Software	R&S®FS300-K1	1147.1017.02
Rack Adapter	R&S®ZZA-300	1147.1281.00

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Spectrum Analyzers R&S®FSP

9 kHz to 40 GHz

The new medium-class standard:

Unparalleled range of functions

High measurement speed

Maximum in precision

Spectrum Analyzer R&S®FSP3

Brief description

The R&S®FSP family sets the standard for the medium class regarding the vital criteria of functionality, measurement speed and accuracy. The use of innovative techniques such as an highly integrated front-end and fully digital signal processing in the back end, together with ASICs developed by Rohde&Schwarz, has resulted in a product of top-class specifications and high reliability.

All important functions and interfaces are implemented as standard. R&S®FSP features future-oriented characteristics such as an RMS detector and a CCDF routine for fast statistical measurements on digitally modulated signals not offered by any other medium-class spectrum analyzer. The R&S®FSP Spectrum Analyzers are outstanding for their innovative measurements and a host of standard functions. Instead of a wide choice of options, R&S®FSP offers as standard all the functions and interfaces you may expect from a state-of-the art spectrum analyzer.

Main features

- Largest colour display in its class
- Resolution bandwidths from 1 Hz to 10 MHz
- Highly selective digital and FFT filters
- Quasi-peak detector and EMI bandwidths
- Convenient documentation of results as a hardcopy or PC-compatible file
- GPIB, Centronics, RS-232-C, USB
- Automatic test routines for measuring TOI, OBW, phase noise and ACP(R), multi carrier ACP
- Split screen with separate settings and up to 3 traces per screen
- Editable limit lines including PASS/FAIL indication
- Fast measurements in the time domain: minimum sweep time 1 µs
- Gated sweep for measurements on TDMA signals
- RMS detector for fast and reproducible power measurements on digitally modulated signals in frequency and time domain
- Statistical measurement functions for determining crest factor and CCDF (complementary cumulative distribution function)
- State-of-the-art spectrum analysis at an extremely attractive price-performance ratio

Characteristics

Speed

Time is a finite resource – so high measurement speed is indispensable for competitiveness and cost-effective testing.

Here, too, the new R&S®FSP offers characteristics that make it top of the class:

- Up to 55 measurements/s on GPIB interface including trace transfer of 501 binary data
- 80 measurements/s on GPIB interface in zero span mode including trace transfer of 501 binary data
- Minimum sweep time of 2.5 ms
- 1 µs time domain measurements
- Special list mode for fastest measurement times on GPIB interface
- Unique fast ACP mode for high-speed ACPR measurements in time domain using the standard-stipulated test filters

With up to 100 measurements/s in manual operation and digital filters with sweep time 2.5 times faster than comparable analog filters, R&S®FSP will also help in your day-to-day work to develop your product much faster.

Performance

Modern communication systems are required to achieve optimum spectral efficiency at high data rates. For the 3rd generation of CDMA mobile radio systems currently under development this is achieved, among other things, by high-precision power control.

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Spectrum Analyzers R&S®FSP

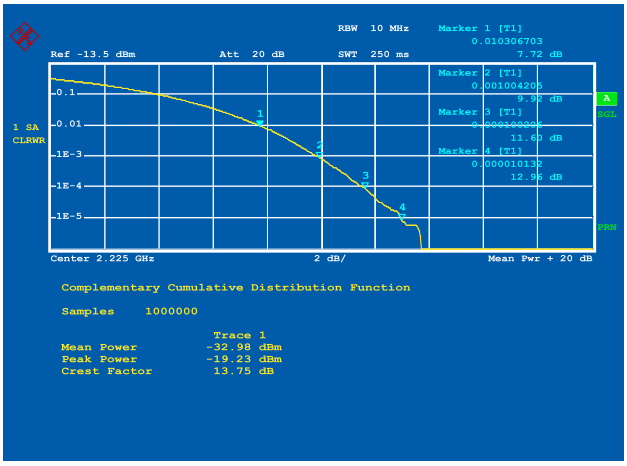
R&S®FSP is the ideal partner in development and production, featuring the smallest level measurement uncertainty of all spectrum analyzers on the market, as well as excellent RF characteristics:

- 0.5 dB total measurement uncertainty allows higher tolerances for the DUT, thus increasing production yield
- 0.07 dB linearity uncertainty (1 σ) is ideal for precise measurements, for example of gain control and ACPR
- RMS detector with 100 dB dynamic range measures power fast and accurately irrespective of the signal shape – almost like a thermal power sensor
- The displayed average noise level of typ. –155 dBm (1 Hz) is attained without the use of preamplifiers and thus without any reduction in dynamic range
- Typ. –145 dBc (1 Hz) phase noise at 10 MHz offset offers optimum conditions for ACPR measurements on W-CDMA systems

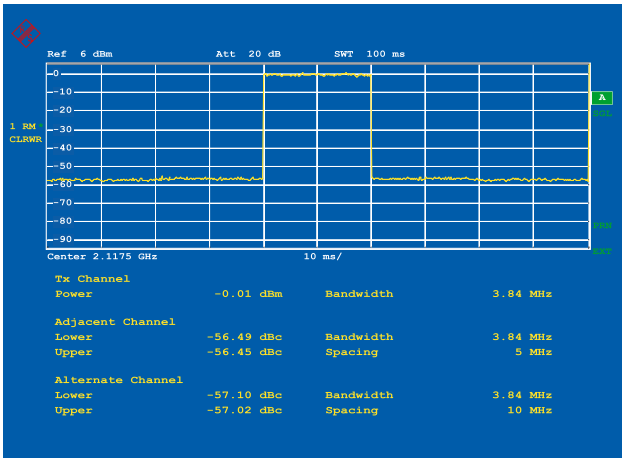
Resolution bandwidths of up to 100 kHz are fully digital and provide – in addition to high selectivity – an ideal basis for accurate (adjacent-) channel measurements thanks to a maximum bandwidth deviation of 3%.

Open for the PC world …

- PC-compatible screenshots, no conversion software needed
- Windows™ printer support
- LabWindows driver
- LabView driver
- SCPI-compatible
- R&S®FSE/R&S®FSIQ-compatible GPIB command set



R&S®FSP is the first spectrum analyzer to offer statistical analysis of signals by means of the complementary cumulative distribution function (CCDF) as standard and at an impressively high speed. FSP furnishes in only 250 ms the exact CCDF characteristic, average and peak power as well as the crest factor over 1 million measured values



Adjacent-channel power ratio (ACPR) measurements, which many mobile radio standards stipulate for components and units, are implemented in R&S®FSP by means of automatic test routines; all settings, measurements and filters required for a selected standard are activated at a keystroke

859x/8566-compatible IEC/IEEE bus command set

The R&S®FSP comes standard with an IEC/IEEE bus command set that is compatible not only with the R&S®FSEx/FSIQ family but also with the spectrum analyzers of the 859x/8566 series.

- Approx. 175 commands in IEEE 488-2 format (incl. CF, AT, ST)
- The most important commands in IEEE 488-1 format (8566A, for exclusive use only)
- Selectable presets
- Selectable trace format

8560E to 8565E, 8566A/B, 8568A/B and 8594E are supported. The IEC/IEEE bus commands in IEEE 488-2 format can be used together with the R&S®FSP command set.

Electronic attenuator for high production throughput

The optional Electronic Attenuator R&S®FSP-B25 (only for R&S®FSP3 and R&S®FSP7) supplements the standard mechanical attenuator and provides a setting range of 30 dB in 5 dB steps. The integrated switchable 20-dB preamplifier allows high-sensitivity measurements in the useful frequency range from 10 MHz to 7 GHz.

LAN interface

With the aid of the optional LAN Interface R&S®FSP-B16, R&S®FSP can be connected to common networks such as 100Base-T. In addition, R&S®FSP can be remote-controlled via LAN.

Spectrum Analyzers R&S®FSP

Specifications in brief

You will find detailed and binding data on the enclosed CD (../DATASHEET/FSP.pdf), or, for the latest updates, visit www.rohde-schwarz.com, search term: FSP

Frequency

	R&S®	FSP3	FSP7	FSP13	FSP30	FSP40
Frequency range	9 kHz to	3 GHz	7 GHz	13.6 GHz	30 GHz	40 GHz
Frequency resolution	0.01 Hz					
Frequency display	with marker or frequency counter					
Marker resolution	span/500					
Frequency counter resolution	0.1 Hz to 10 kHz (selectable)					
Frequency span 0 Hz, 10 Hz to		3 GHz	7 GHz	13.6 GHz	30 GHz	40 GHz
Max. span deviation	0.1%					
Spectral purity						
SSB phase noise, f = 500 MHz						
Carrier offset 10 kHz	typ. –113 (dBc (1 Hz))					
Carrier offset 10 MHz	typ. –145 (dBc (1 Hz))					
Residual FM, f = 500 MHz, RBW 1 kHz,						
Sweep time 100 ms	typ. 3 Hz					

Sweep time	
Span ≥10 Hz	2.5 ms to 16000 s in steps of 10%
Span 0 Hz	1 µs to 16000 s in steps of 5%

Typical values for SSB phase noise (referred to 1 Hz bandwidth)

Offset	f_{in}= 3 GHz	f_{in}= 7 GHz	f_{in}= 13 GHz	f_{in}= 22 GHz	f_{in}=26 GHz	f_{in}= 40 GHz
10 kHz	–108 dBc	–104 dBc	–98 dBc	–94 dBc	–92 dBc	–91 dBc
1 MHz	–118 dBc	–118 dBc	–112 dBc	–108 dBc	–106 dBc	–102 dBc

Resolution bandwidths	
Bandwidths (–3 dB)	10 Hz to 10 MHz, in 1, 3 sequences
EMI bandwidths (–6 dB)	200 Hz, 9 kHz, 120 kHz
Video bandwidths	1 Hz to 10 MHz in 1, 3 sequences
FFT filter bandwidths (–3 dB)	1 Hz to 30 kHz in 1, 3 sequences
Channel filters (bandwidths)	100/200/300/500 Hz, 1/1.5/2/2.4/2.7/3/3.4/4/4.5/5/6/8.5/9/10/12.5/14/15/16/18 (RRC)/20/21/24.3 (RRC)/25/30/50/100/150/192/200/300/500 kHz, 1/1.228/1.5/2/3/5 MHz

Level

1 dB compression of input mixer	
RF attenuation 0 dB, f>200 MHz	0 dBm nominal

Intermodulation					
3rd-order intermodulation					
Intermodulation-free dynamic range, level 2 × –30 dBm, Δf > 5 × RBW or 10 kHz, whichever the greater value					
R&S®	FSP3	FSP7	FSP13	FSP30	FSP40
200 MHz to 3 GHz	>74 dBc, TOI typ. >10 dBm				
3 GHz to 7 GHz	–	>80 dBc, TOI typ. >15 dBm			
7 GHz to 20 GHz	–	–	>80 dBc, TOI >10 dBm		
with optional Electronic Attenuator R&S®FSP-B25 switched on					

R&S®	FSP3	FSP7	FSP13	FSP30	FSP40
Second harmonic intercept point (SHI)					
100 MHz to 3 GHz	>35 dBm				
3 GHz to 7 GHz	–	>45 dBm			
7 GHz to 13.6 GHz	–	–	typ. 45 dBm		
13.6 GHz to 30 GHz	–	–	–	typ. 45 dBm	
30 GHz to 40 GHz	–	–	–	–	typ. 45 dBm
Displayed average noise level (dBm)					
(0 dB RF attenuation, RBW 10 Hz, VBW 1 Hz, 20 averages, trace average, span 0 Hz, termination 50 Ω)					
10 MHz to 1 GHz	typ. <–145	typ. –145			
1 GHz to 3 GHz	typ. <–145	typ. –143			
3 GHz to 7 GHz	–	typ. <–143	typ. <–145		<–135
7 GHz to 13.6 GHz	–	–	typ. <–138		<–132
13.6 GHz to 20 GHz	–	–	–	–	<–120
13.6 GHz to 22 GHz	–	–	–	typ. –130	–
20 GHz to 30 GHz	–	–	–	–	<–120
22 GHz to 30 GHz	–	–	–	typ. –123	–
30 GHz to 40 GHz	–	–	–	–	<–112
Displayed average noise level with preamplifier on (option R&S®FSP-B25)					
10 MHz to 2 GHz	<–152 dBm	–			
2 GHz to 7 GHz	<–150 dBm	–			

Immunity to interference	
Image frequency	>70 dB
Intermediate frequency (f <3 GHz)	>70 dB
Spurious response (f >1 MHz, without input signal, 0 dB attenuation)	<–103 dBm
Level display	
Screen	501 × 400 pixels (one diagram), max. 2 diagrams with independent settings
Log level scale	10 dB to 200 dB, in steps of 10 dB
Linear level scale	10% of reference level per level division, 10 divisions
Traces	max. 3, with two diagrams on screen max. 3 per diagram
Trace detector	Max peak, Min Peak, Auto Peak, Sample, Quasi-Peak, Average, RMS
Trace functions	Clear/Write, Max/Min Hold, Average
Number of measurement points	501, settable in steps of factor 2, from 125 to 8001
Setting range of reference level	
Logarithmic level display	–130 dBm to 30 dBm, in steps of 0.1 dB
Linear level display	70.71 nV to 7.07 V in steps of 1%
Max. uncertainty of level measurement	
At 128 MHz, –30 dBm (RF attenuation 10 dB, RBW 10 kHz, ref. level –20 dBm)	<0.2 dB

R&S®	FSP3	FSP7	FSP13	FSP30	FSP40
Frequency response					
<50 kHz	<+0.5/–1.0 dB				
50 kHz to 3 GHz	<0.5 dB				
3 GHz to 7 GHz	–	<2 dB	–	–	–
7 GHz to 13.6 GHz	–	–	<2.5 dB		
13.6 GHz to 30 GHz	–	–	–	<3 dB	
30 GHz to 40 GHz	–	–	–	–	<4 dB
Attenuator	<0.2 dB				
Reference level switching	<0.2 dB				

Display nonlinearity LOG/LIN (S/N >16 dB)	
RBW ≤100 kHz, 0 dB to –70 dB	<0.2 dB
RBW ≥300 kHz, 0 dB to –50 dB	<0.2 dB

Spectrum Analyzers R&S®FSP

Bandwidth switching uncertainty (ref. to RBW = 10 kHz)	
10 Hz to 100 kHz	<0.1 dB
300 kHz to 10 MHz	<0.2 dB
1 Hz to 3 kHz, FFT	<0.2 dB
Total measurement uncertainty	
0 GHz to 3 GHz	0.5 dB

Data of options

Tracking Generator R&S®FSP-B9	
Frequency range	9 kHz to 3 GHz
Frequency offset setting range	±150 MHz
Spectral purity	
SSB phase noise, f = 500 MHz, carrier offset 100 kHz, normal mode	–90 dBc (1 Hz) typ.
Level range	–30 dBm to 0 dBm in 0.1 dB steps
Frequency response, output level 0 dBm, 100 kHz to 2 GHz	<1 dB
Dynamic range, attenuation measurement range, RBW=1 kHz, f >10 MHz	120 dB
Electronic Attenuator R&S®FSP-B25 (only for R&S®FSP3/FSP7)	
Frequency range	10 MHz to 7 GHz
Input attenuator range (mechanical)	0 dB to 75 dB in 5 dB steps
Electronic attenuation range	0 dB to 30 dB in 5 dB steps
Preamplifier	20 dB, switchable
Max. deviation of level measurement	
Preamplifier on	<0.2 dB
Electronic attenuator	<0.2 dB
Frequency response with preamplifier, electronic attenuator	
10 MHz to 3 GHz	<1 dB
3 GHz to 7 GHz	<2 dB

General data

Display	21 cm TFT colour display (8.4", VGA)
Operating temperature range	+5°C to +40°C
Power supply	100 V AC to 240 V AC, 50 Hz to 400 Hz, 3.1 A to 1.3 A
Power consumption	70 VA to 150 VA (dep. on model)
Dimensions (W × H × D)	412 mm × 197 mm × 417 mm
Weight	12 kg to 13.5 kg (dep. on model)

Ordering information

Spectrum Analyzer		
9 kHz to 3 GHz	R&S®FSP3	1164.4391.03
9 kHz to 7 GHz	R&S®FSP7	1164.4391.07
9 kHz to 13.6 GHz	R&S®FSP13	1164.4391.13
9 kHz to 30 GHz	R&S®FSP30	1164.4391.30
9 kHz to 40 GHz	R&S®FSP40	1164.4391.40
Accessories supplied		
Power cable, operating manual, service manual		
Options		
Rugged Case, carrying handle (factory-fitted)	R&S®FSP-B1	1129.7998.02
AM/FM Audio Demodulator	R&S®FSP-B3	1129.6491.02
OCXO Reference Frequency	R&S®FSP-B4	1129.6740.02
TV Trigger/RF Power Trigger	R&S®FSP-B6	1129.859.4.02
Internal Tracking Generator 9 kHz to 3 GHz, I/Q modulator	R&S®FSP-B9	1129.6991.02
External Generator Control	R&S®FSP-B10	1129.7246.02
Pulse Calibrator (not with R&S®FSP-B3)	R&S®FSP-B15	1155.1006.02
LAN Interface 100BT for all R&S®FSP models with Windows XP (1164.4391.xx) with Windows NT (1043.4495.xx)	 R&S®FSP-B16 R&S®FSP-B16	 1129.8042.03 1129.8042.02
Extended Environmental Specification (only factory fitted)	R&S®FSP-B20	1155.1606.06
LO/IF Ports for External Mixers (only retrofittable in R&S®FSP40, 1164.4391.40)	R&S®FSU-B21	1157.1090.02
Electronic Attenuator, 0 dB to 30 dB, integrated preamplifier, for R&S®FSP3 and R&S®FSP7	R&S®FSP-B25	1129.7746.02
Trigger Port for indication of trigger conditions	R&S®FSP-B28	1162.9915.02
DC Power Supply	R&S®FSP-B30	1155.1158.02
Battery Pack (R&S®FSP-B1 and -B30 required)	R&S®FSP-B31	1155.1258.02
Spare Battery Pack (R&S®FSP-B31 required)	R&S®FSP-B32	1155.1506.02
Demodulation Hardware and Memory Extension (R&S®FSP-B15 required)	R&S®FSP-B70	1157.0559.02
Software/Firmware		
Noise Measurement Software	R&S®FS-K3	1057.3028.02
Application Firmware for Noise Figure and Gain Measurements	R&S®FS-K30	1300.6508.02
Phase Noise Measurement Software	R&S®FS-K4	1108.0088.02
GSM/EDGE Application Firmware, mobile	R&S®FS-K5	1141.1496.02
AM/FM Measurement Demodulator	R&S®FS-K7	1141.1796.02
3GPP BTS/Node B FDD Application Firmware	R&S®FS-K72	1154.7000.02
3GPP-FDD UE Transmitter Test	R&S®FS-K73	1154.7252.02
3GPP HSDPA BTS Application Firmware	R&S®FS-K74	1300.7156.02
3GPP TD-SCDMA BTS Application Firmware	R&S®FS-K76	1300.7291.02
3GPP TD-SCDMA UE Application Firmware	R&S®FS-K77	1300.8100.02
Bluetooth® Application Firmware	R&S®FS-K8	1141.2568.02
cdma2000 Base Station Test Application Firmware	R&S®FS-K82	1154.7252.02
cdma2000 1xEV-DO BTS Application Firmware	R&S®FS-K84	1157.2851.02
cdma2000-1xEV-DO MS Application Firmware	R&S®FS-K85	1300.6689.02
Power Sensor Measurements (supports R&S®NRP-Z11/-Z21 with R&S®NRP-Z4 USB connector)	R&S®FS-K9	1157.3006.02
WLAN 802.11a TX Measurements Application Firmware	R&S®FSP-K90	1300.6650.02
Recommended extras		
Headphones	–	0708.9010.00
US Keyboard with trackball	R&S®PSP-Z2	1091.4100.02
DC Block,10 kHz to 18 GHz (type N)	R&S®FSE-Z4	1084.7443.02
IEC/IEEE-Bus Cable, xx 10/20/40 = 1/2/4 m	R&S®PCK	0292.2013.xx
19" Rack Adapter (not for R&S®FSP-B1)	R&S®ZZA-478	1096.3248.00
Transit bag	R&S®ZZT-473	1109.5048.00
Matching Pads, 75 Ω		
L Section	R&S®RAM	0358.5414.02
Series Resistor, 25 Ω	R&S®RAZ	0358.5714.02
SWR Bridge, 5 MHz to 3000 MHz	R&S®ZRB2	0373.9017.52
SWR Bridge, 40 kHz to 4 GHz	R&S®ZRC	1039.9492.52
High-Power Attenuators, 100 W 3/6/10/20/30 dB (xx = 03/06/10/20/ 30)	R&S®RBU100	1073.8820.xx
High-Power Attenuators, 50 W 3/6/10/20/30 dB (xx = 03/06/10/20/ 30)	R&S®RBU50	1073.8695.xx
For R&S®FSP30		
Test Port Adapter, 3.5 mm male	–	1021.0529.00
Test Port Adapter, N male	–	1021.0541.00
Microwave Meas. Cable and Adapter Set	R&S®FS-Z15	1046.2002.02
For R&S®FSP40		
Test Port Adapter K male	–	1036.4802.00
Test Port Adapter N male	–	1036.4783.00
Test Port Adapter 2.4 mm female	R&S®FSE-Z5	1088.1627.02

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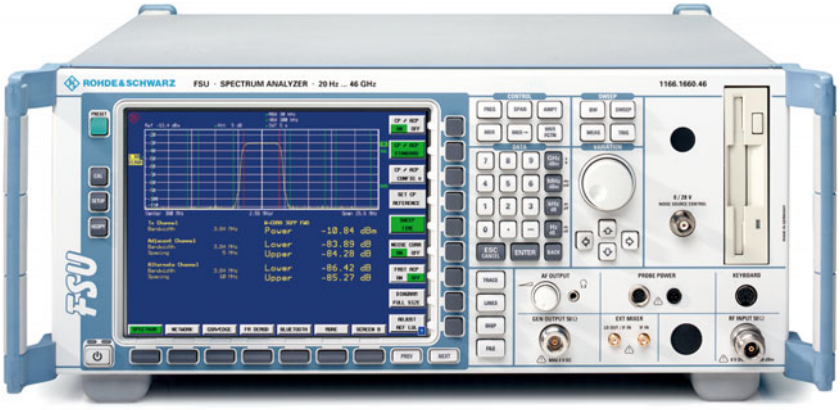
Spectrum Analyzer R&S®FSU

20 Hz to 50 GHz

High-end spectrum analyzer with unmatched performance



Spectrum Analyzer R&S®FSU46

Brief description

Measurements calling for an extremely wide dynamic range become even simpler, faster and more reliable – in design, quality management and production. R&S®FSU can rightly be called the new reference in spectrum analysis, with an unprecedented dynamic range:

- TOI >20 dBm, typ. 25 dBm
- 1 dB compression point (0 dB RF attenuation): +13 dBm
- Displayed average noise level: –158 dBm (1 Hz bandwidth)
- Typ. 77 dB ACLR for 3GPP
- HSOI typ. 55 dBm
- Typ. phase noise: –160 dBc (1 Hz) at 10-MHz carrier offset

These characteristics make it easy to find small spurious signals even in the presence of strong carriers (e.g. at a base station). For 3GPP adjacent-channel power measurements, a figure of 84 dB ACLR allows good adjacent-channel power ratios to be verified and demonstrated very simply and with high accuracy. The high harmonic second-order intercept point means optimum dynamic range for multichannel cable TV measurements.

Main features

Even in its basic version, R&S®FSU offers the functionality and characteristics needed to design, verify and produce 3G mobile radio systems:

- Time-domain power in conjunction with channel or RRC filters makes R&S®FSU a fully-fledged channel power meter
- Versatile channel/adjacent-channel power measurement functions with wide selection of standards, user-configurable
- CCDF measurement function
- 2.5 ms sweep time in frequency domain
- 1 µs sweep time in time domain
- Measurement points/trace selectable from 155 to 10001
- Time-selective spectrum analysis with gating function
- Fast ACP measurement in time domain
- Statistical signal analysis with CCDF function
- Transducer factor
- Fast ACP test routine in time domain
- User-configurable list for fast measurements at frequencies of interest
- Up to 60 measurements/s in time domain via IEC/IEEE bus (including trace data transfer)
- Fast time domain power measurement using channel or RRC filters
- Full choice of detectors for adaptation to a wide range of signal types
  - RMS (dynamic range 100 dB)
  - AUTO, MIN/MAX, QUASI PEAK
  - SAMPLE, AVERAGE

The most versatile resolution filter characteristics and largest bandwidth found in a spectrum analyzer:

- Standard resolution filters from 10 Hz to 50 MHz in steps of 1, 2, 3, 5
- 32 channel filters with bandwidth from 100 Hz to 5 MHz (DAB)
- RRC filters for NADC and TETRA
- EMI filters: 200 Hz, 9 kHz, 120 kHz
- Fast FFT filters from 1 Hz to 30 kHz

Full range of analysis functions

- TOI marker
- Noise/phase-noise marker
- Split-screen mode with selectable settings
- CCDF measurement function
- Peak list marker for fast search of all peaks within selected frequency range

Flexible data interchangeability

- Standard LAN interface (Ethernet 10/100 BaseT)
- Network capable workstation by Embedded Windows XP
- All elements of the R&S®FSU screen are represented by a soft front panel function; the complete R&S®FSU screen shows on the remote PC
- Special RSIB interface (Windows and UNIX) links the user´s application to the TCP/IP protocol and acts like an IEC/IEEE-bus driver
- USB interface
- Integrated standard disk drive

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Spectrum Analyzer R&S®FSU

Specifications in brief

You will find detailed and binding data on the enclosed CD (../DATASHEET/FSU.pdf), or, for the latest updates, visit www.rohde-schwarz.com, search term: FSU

Frequency

	R&S®FSU3/8	R&S®FSU26/46/50
Frequency range		
DC coupled	20 Hz to 3.6/8 GHz	20 Hz to 26.5/46/50 GHz
AC coupled	1 MHz to 3.6/8 GHz	10 MHz to 26.5/46/50 GHz
Frequency resolution	0.01 Hz	
Frequency display	with marker or frequency counter	
Frequency span	0 Hz, 10 Hz to 3.6/8 GHz	0 Hz, 10 Hz to 26.5/46/50 GHz
Spectral purity (dBc (1 Hz)), SSB phase noise, f = 640 MHz		
Carrier offset		
10 Hz	typ. –73 dBc (1 Hz), with option R&S®FS-B4 typ. –86 dBc	
10 kHz	typ. –123 dBc (1 Hz)	
10 MHz	typ. –160 dBc (1 Hz)	
Sweep		
Span 0 Hz	1 µs to 16000 s in steps of 5%	
Span ≥10 Hz	2.5 ms to 16000 s in steps ≤10%	
Resolution bandwidth		
Analog filters		
3 dB bandwidths	10 Hz to 20 MHz in 1/2/3/5 sequence, 50 MHz	
Video bandwidths	1 Hz to 10 MHz in 1/2/3/5 sequence	
FFT filters (–3 dB)	1 Hz to 30 kHz in 1/2/3/5 sequence	
EMI filters (–6 dB)	200 Hz, 9 kHz, 120 kHz	
Channel filters (bandwidths)	100/200/300/500 Hz, 1/1.5/2/2.4/2.7/3/3.4/4/4.5/5/6/8.5/9/10/12.5/14/15/16/18 (RRC)/20/21/24.3 (RRC)/25/30/50/100/150/192/200/300/500 kHz, 1/1.228/1.5/2/3/5 MHz	

Level

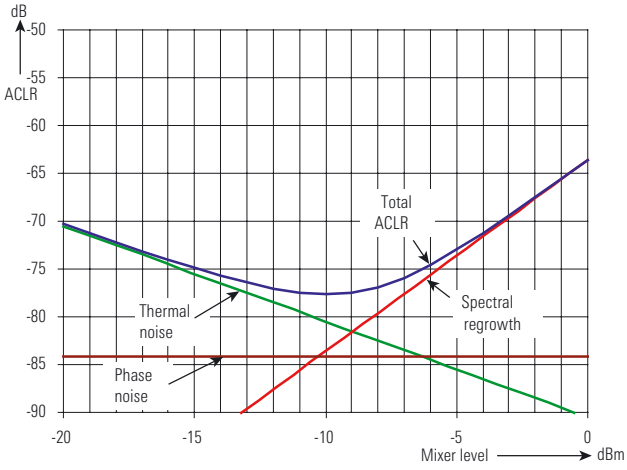
1 dB compression of input mixer (0 dB RF attenuation)		
≤3.6 GHz	13 dBm	13 dBm
>3.6 GHz	–/10 dBm	7 dBm
Intermodulation		
Third-order intermodulation (third-order intercept (TOI), level 2 × –10 dBm, Δf >5 × RBW or 10 kHz, whichever is the greater value, typical values)		
300 MHz to 3.6 GHz	25 dBm	27 dBm
3.6 GHz to 26.5 GHz	–	15 dBm
Second harmonic intercept point (SHI)		
400 MHz< f_{in} ≤500 Hz	typ. 60 dBm	
Maximum dynamic range		
1 dB compression to DANL (1 Hz)	170 dB	
Immunity to interference		
Image frequency, f ≤3.6 GHz	>90 dB, typ. >110 dB	
Intermediate frequency, ≤3.6 GHz	>90 dB, typ. >110 dB	
Spurious responses (f > 1 MHz, without input signal, 0 dB attenuation)	<–103 dBm	
Level display (spectrum mode)		
Screen	625 × 500 pixels (one diagram), max. 2 diagrams with independent settings	
Logarithmic level axis	1 dB, 10 dB to 200 dB in steps of 10 dB	
Linear level axis	10% of reference level per level division, 10 divisions or logarithmic scaling	

	R&S®FSU3/8	R&S®FSU26/46/50
Traces	max. 6, with two diagrams on screen, max. 3 per diagram	
Trace detector	Max Peak, Min Peak, Auto Peak (normal), Sample, RMS, Average, Quasi Peak	
Number measurement points	625 (default value), range 155 to 10001 in steps of about a factor of 2	
Trace functions	Clear/Write, Max Hold, Min Hold, Average	
Setting range of reference level		
Logarithmic level display	–130 dBm to (+5 dBm + RF attenuation), max. 30 dBm, in steps of 0.1 dB	
Linear level display	7.0 nV to 7.07 V in steps of 1%	

Displayed average noise level

(0 dB RF attenuation, RBW 10 Hz, VBW 30 Hz, 20 averages, trace average, span 0 Hz, termination 50 Ω, typical values)

R&S®	FSU3	FSU8	FSU26	FSU46	FSU50
10 MHz ≤ f < 2 GHz	–148 dBm	–148 dBm	–146 dBm	–146 dBm	–146 dBm
2 GHz ≤ f < 3 GHz	–147 dBm	–145 dBm	–	–	–
2 GHz ≤ f < 3.6 GHz	–143 dBm	–	–	–	–
2 GHz ≤ f < 13 GHz	–	–	–	–143 dBm	–143 dBm
3 GHz ≤ f < 3.6 GHz	–146 dBm	–	–	–	–
3 GHz ≤ f < 7 GHz	–	–144 dBm	–	–	–
3.6 GHz ≤ f < 8 GHz	–	–	–146 dBm	–	–
7 GHz ≤ f < 8 GHz	–	–142 dBm	–	–	–
8 GHz ≤ f < 13 GHz	–	–	–143 dBm	–	–
13 GHz ≤ f < 18 GHz	–	–	–141 dBm	–141 dBm	–141 dBm
18 GHz ≤ f < 22 GHz	–	–	–140 dBm	–140 dBm	–140 dBm
22 GHz ≤ f < 26.5 GHz	–	–	–138 dBm	–138 dBm	–138 dBm
26.5 GHz ≤ f < 32 GHz	–	–	–	–	–131 dBm
26.5 GHz ≤ f < 40 GHz	–	–	–	–131 dBm	–
32 GHz ≤ f < 46 GHz	–	–	–	–	–126 dBm
40 GHz ≤ f < 46 GHz	–	–	–	–128 dBm	–
46 GHz ≤ f < 50 GHz	–	–	–	–	–121 dBm



R&S®FSU dynamic range for adjacent-channel power measurement on WCDMA signal without using noise correction; noise correction enhances the dynamic range to 84 dB

Spectrum Analyzer R&S®FSU

Level measurement error		
Reference error at 128 MHz, RBW ≤100 kHz, reference level –30 dBm		
RF attenuation 10 dB	<0.2 dB	
Frequency response (DC coupling, RF attenuation ≥ 10 dB)		
10 MHz to 3.6 GHz	<0.3 dB	
22 GHz to 26.5 GHz	–	<2.5 dB
Attenuator (≥5 dB)	<0.2 dB	
Reference level switching	<0.15 dB	
Display nonlinearity (+20 °C to +30 °C, mixer level = –10 dBm)		
Logarithmic level display, RBW = 100 kHz or channel filters,		
S/N >20 dB, 0 dB to –70 dB	<0.1 dB (s = 0.03 dB)	
200 kHz = RBW =10 MHz, S/N >16 dB		
0 dB to –50 dB	<0.2 dB (s = 0.07 dB)	
RBW >10 MHz, S/N >16 dB		
0 dB to –50 dB	<0.5 dB (s = 0.17 dB)	
Linear level display	5% of reference level	
Bandwidth switching error referenced to RBW = 10 kHz		
1 Hz to 100 kHz 200 kHz to 3 MHz 5 MHz to 50 MHz FFT filter 1 Hz to 3 kHz	<0.1 dB (s = 0.03 dB) <0.2 dB (s = 0.07 dB) <0.5 dB (s = 0.15 dB) <0.2 dB (s = 0.07 dB)	
Total measurement uncertainty (0 dB to –70 dB, S/N >20 dB, span/RBW <100, 95 % confidence level) (20 °C to 30 °C, mixer level ≤–10 dBm)		
f < 3.6 GHz	0.3 dB (RBW ≤100 kHz) 0.5 dB (RBW >100 kHz)	
3.6 GHz ≤ f < 8 GHz	2.0 dB	
8 GHz ≤ f < 18 GHz	2.5 dB	
18 GHz ≤ f < 26.5 GHz	3.0 dB	
26.5 GHz ≤ f < 40 GHz	3.0 dB	
40 GHz ≤ f < 50 GHz	3.5 dB	

Trigger

Span ≥10 Hz, Span = 0 Hz	
Trigger source	free run, video, ext., IF level (mixer level >–20 dBm)
Trigger offset	125 ns to 100 s
Gated sweep	
Trigger source	external, IF level, video
Gate delay	1 µs to 100 s
Gate length	125 ns to 100 s

General data

Display	21 cm TFT LCD colour display (8.4", SVGA)
Mass memory	1.44 Mbyte 3½" disk drive, hard disk
Data storage	>500 instrument settings and traces
Remote control	interface to IEC625-2 (IEEE488.2)
Serial interface	RS-232-C (COM), 9-pin Sub-D female
Printer interface	parallel (Centronics-compatible)
Rated temperature range	+5 °C to +40 °C
AC power supply	100 V AC to 240 V AC, 3.1 A to 1.3 A, 50 to 400 Hz
Power consumption	typ. 140 VA
Dimensions (W x H x D)	435 mm × 192 mm × 460 mm
Weight	15 kg

Tracking Generator R&S®FSU-B9, Attenuator R&S®FSU-B12 for Tracking Generator

Frequency range	100 kHz to 3.6 GHz
Frequency offset (setting range)	200 MHz
Level setting range With option R&S®FSU-B12	–30 dBm to +5 dBm in steps of 0.1 dB –100 dBm to +5 dBm in steps of 0.1 dB
Max. deviation of output level (absolute, f = 128 MHz, –20 dBm to 0 dBm)	<1 dB
Frequency response (referenced to level at 128 MHz, sweep time >100 ms, –20 dBm to 0 dBm, 100 kHz to 3.6 GHz	<3 dB, typ. 1.9 dB
Dynamic range (attenuation measurement range, RBW = 1 kHz, f >10 MHz)	100 dB
Modulation format (external)	I/Q, AM, FM
AM (modulation depth)	0% to 99%
FM (frequency deviation)	0 Hz to 10 MHz
Modulation frequency range	0 Hz to 100 kHz (deviation <1 MHz)
I/Q modulation (modulation frequency response, 0 Hz to 5 MHz)	1 dB

Optional Electronic Attenuator R&S®FSU-B25

Electronic attenuator	0 dB to 30 dB, 5 dB steps
Preamplifier	20 dB, switchable
Maximum level measurement error (frequency response, with preamplifier or electronic attenuator)	
10 MHz to 50 MHz 50 MHz to 3.6 GHz 3.6 GHz to 8 GHz	<1 dB <0.6 dB <2.0 dB
Reference error at 128 MHz, RBW ≤100 kHz, reference level –30 dBm, RF attenuation 10 dB	
Electronic attenuator	<0.3 dB
Preamplifier	<0.3 dB
Displayed average noise level (RBW =1 kHz, VBW =3 kHz, zero span, sweep time 50 ms, 20 averages, mean marker, normalized to 10 Hz RBW, preamplifier on)	
10 MHz to 2.0 GHz 2.0 GHz to 3.6 GHz 3.6 GHz to 8.0 GHz	<–152 dBm <–150 dBm <–147 dBm
Intermodulation (third-order intermodulation, third-order intercept (TOI), electronic attenuator on, Δf > 5 × RBW or 10 kHz)	
10 MHz to 300 MHz 300 MHz to 3.6 GHz 3.6 GHz to 8 GHz	>17 dBm >20 dBm >18 dBm

RF Preamplifier R&S®FSU-B23

Displayed average noise level (RBW = 1 kHz, VBW = 3 kHz, zero span, sweep time 50 ms, trace average, sweep count = 20, mean marker, normalized to 10 Hz RBW, preamplifier = on)	
3.6 GHz to 8 GHz	typ. –155 dBm
22 GHz to 26.5 GHz	typ. –145 dBm

LO/IF Ports for External Mixers R&S®FSU-B21

LO signal (Frequency range)	7.0 GHz to 15.5 GHz
Level (+20 °C to +30 °C)	+15.0 dBm ±1 dB
IF input	404.4 MHz
Full scale level	–20 dBm
Level uncertainty, IF input level –30 dBm, RBW 30 kHz, +20 to +30 °C	<1 dB

Spectrum Analyzer R&S®FSU

Ordering information

Spectrum Analyzer		
20 Hz to 3.6 GHz	R&S®FSU3	1166.1660.03
20 Hz to 8 GHz	R&S®FSU8	1166.1660.08
20 Hz to 26.5 GHz	R&S®FSU26	1166.1660.26
20 Hz to 46.5 GHz	R&S®FSU46	1166.1660.46
20 Hz to 50 GHz	R&S®FSU50	1166.1660.50

Accessories supplied

Power cable, operating manual, service manual,
R&S®FSU26: test port adapter with 3.5 mm female (1021.0512.00) and N female (1021.0535.00) connector
R&S®FSU46: test port adapter with K female (10366.4790.00) and N female (1036.4777.00) connector
R&S®FSU50: test port adapter with 2.4 mm female (1088.1627.02) and N female (1036.4777.00) connector

Options		
OCXO, low aging/improved phase noise at 10 Hz carrier offset	R&S®FSU-B4	1144.9000.02
Tracking Generator, 9 kHz to 3.6 GHz	R&S®FSU-B9	1142.8994.02
External Generator Control	R&S®FSP-B10	1129.7246.02
Output Attenuator, 0 dB to 70 dB, for R&S®FSU-B9 (requires R&S®FSU-B9)	R&S®FSU-B12	1142.9349.02
Removable Hard Disk (excludes R&S®FSU-B20, factory fitted only)	R&S®FSU-B18	1145.0242.0x
Second Hard Disk for R&S®FSU-B18 (requires R&S®FSU-B18)	R&S®FSU-B19	1145.0394.0x
Extended Environmental Specification (factory fitted only)	R&S®FSU-B20	1155.1606.08
LO/IF ports for external mixers (only for R&S®FSU26 and R&S®FSU46)	R&S®FSU-B21	1157.1090.02
20 dB Preamplifier, 3.6 GHz to 26.5 GHz (only for R&S®FSU26, requires R&S®FSU-B25, factory fitted only	R&S®FSU-B23	1157.0907.02
Electronic Attenuator, 0 dB to 30 dB, integrated 20 dB preamplifier (3.6 GHz)	R&S®FSU-B25	1044.9298.02

Firmware/Software		
Noise Measurement Software (preamplifier, e.g. R&S®FSU-B25, recommended)	R&S®FS-K3	1057.3028.02
Application Firmware for Noise Figure and Gain Measurements	R&S®FS-K30	1300.6508.02
Phase Noise Measurement Software	R&S®FS-K4	1108.0088.02
GSM/EDGE Application Firmware	R&S®FS-K5	1141.1496.02
FM Measurement Demodulator	R&S®FS-K7	1141.1796.02
Bluetooth Application Firmware	R&S®FS-K8	1141.2568.02
Power Sensor Measurements	R&S®FS-K9	1157.3006.02
3GPP BTS/Node B FDD Application Firmware	R&S®FS-K72	1154.7000.02
3GPP-FDD UE Transmitter Test	R&S®FS-K73	1154.7252.02
3GPP HSDPA BTS Application Firmware	R&S®FS-K74	1300.7156.02
3GPP TD-SCDMA Application Firmware	R&S®FS-K76	1300.7291.02
cdma2000 Base Station Test Application Firmware	R&S®FS-K82	1157.2316.02
CDMA2000 MS Application Firmware	R&S®FS-K83	1157.2416.02
CDMA2000 1xEV-DO BTS Application Firmware	R&S®FS-K84	1157.2851.02
CDMA2000 1xEV-DO Mobile Station Test Application Firmware	R&S®FS-K85	1300.6689.02

Recommended extras		
Headphones		0708.9010.00
US Keyboard with trackball	R&S®PSP-Z2	1091.4100.02
IEC/IEEE-Bus Cable, 1 m	R&S®PCK	0292.2013.10
IEC/IEEE-Bus Cable, 2 m	R&S®PCK	0292.2013.20
19" Rack Adapter	R&S®ZZA-411	1096.3283.00
Adapter for mounting on telescopic rails (only with 19" Adapter R&S®ZZA-411)	R&S®ZZA-T45	1109.3774.00
Matching pads, 50/75 Ω		
L Section, matching at both ends	R&S®RAM	0358.5414.02
Series Resistor, 25 Ω, matching at one end (taken into account in instrument function RF INPUT 75 Ω)	R&S®RAZ	0358.5714.02
SWR Bridge, 5 MHz to 3 GHz, 50 Ω	R&S®ZRB2	0373.9017.5x
SWR Bridge, 40 kHz to 4 GHz, 50 Ω	R&S®ZRC	1039.9492.5x
High power attenuators		
100 W, 3/6/10/20/30 dB, 1 GHz (xx = 03/06/10/20/30)	R&S®RBU100	1073.8495.xx
50 W, 3/6/10/20/30 dB, 2 GHz (xx = 03/06/10/20/30)	R&S®RBU50	1073.8695.xx
50 W, 20 dB, 6 GHz	R&S®RDL50	1035.1700.52
Probe power connector, 3 pin		1065.9480.00
DC Block, 5 MHz to 7 GHz (Type N)	R&S®FSE-Z3	4010.3895.00
DC Block, 10 kHz to 18 GHz (Type N)	R&S®FSE-Z4	1084.7443.02
External harmonic mixers (for R&S®FSU26, R&S®FSU46 with option R&S®FSU-B21)		
Harmonic Mixer 40 GHz to 60 GHz	R&S®FS-Z60	1089.0799.02
Harmonic Mixer 50 GHz to 75 GHz	R&S®FS-Z75	1089.0847.02
Harmonic Mixer 60 GHz to 90 GHz	R&S®FS-Z90	1089.0899.02
Harmonic Mixer 90 GHz to 110 GHz	R&S®FS-Z110	1089.0976.02
For R&S®FSU26 only:		
Test port adapter N male		1021.0541.00
Test port adapter 3.5 mm male		1021.0529.00
Microwave Measurement Cable with test port adapter set N male and 3.5 mm male	R&S®FSE-Z15	1046.2002.02
For R&S®FSU46 only:		
Test port adapter N male		1036.4783.00
Test port adapter K male		1036.4802.00
Test port adapter 2.4 mm male	R&S®FSE-Z5	1088.1627.02

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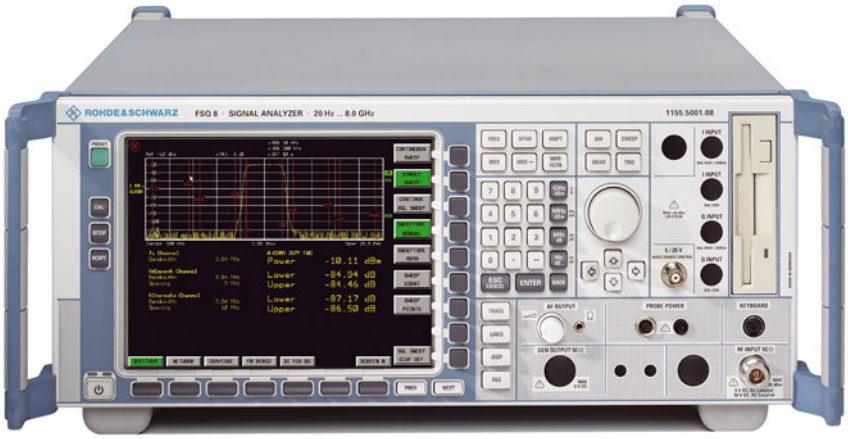
Signal Analyzers R&S®FSQ

R&S®FSQ3: 20 Hz to 3.6 GHz

R&S®FSQ8: 20 Hz to 8 GHz

R&S®FSQ26: 20 Hz to 26 GHz

Signal analysis with the dynamic range of a high-end spectrum analyzer and a demodulation bandwidth up to 120 MHz



Signal Analyzer R&S®FSQ8

Brief description

Future transmission methods in mobile radio and related fields call for wider transmission bandwidths to handle increasing data throughput. Even today, multiple carriers of a GSM or 3GPP base station are often boosted in common power output stages. This reduces the technical effort and costs on the one hand, but increases the bandwidth to be transmitted on the other. In both cases, analysis bandwidths exceeding those provided by present-day spectrum analyzers are required in development and production, while at the same time the dynamic range must satisfy stringent requirements.

The R&S®FSQ combines the outstanding spectrum analyzer features and functions of the R&S®FSU with a demodulation and analysis bandwidth that has been enhanced to 28 MHz. The R&S®FSQ is thus ideal for applications in the development and production of the following:

- Wireless LAN (WLAN)
- 3GPP and GSM-MCPA

The R&S®FSQ additionally supports measurements on 2G, 2.5G and 3G mobile radio systems when using application firmware such as:

- R&S®FS-K5, GSM/EDGE
- R&S®FS-K72/K74, 3GPP FDD BTS
- R&S®FS-K73, 3GPP FDD UE
- R&S®FS-K82/K84, FS-K83/K85, cdma2000

The option Vector Analysis R&S®FSQ-K70 extends the R&S®FSQ to an universal signal analyzer for digital modulated signals.

In addition to the broadband demodulation capabilities, the R&S®FSQ provides the dynamic range that is required for multicarrier measurements or the measurement of spurious emissions at base transceiver stations (BTS).

Main features

- Dynamic range of a high-end spectrum analyzer
  - TOI typ. +25 dBm
  - 1 dB compression +13 dBm
  - 84 dB ACLR/3GPP with noise correction
- Displayed average noise level –158 dBm (1 Hz bandwidth)
- Phase noise –160 dBc (1 Hz) at 10 MHz carrier offset
- 28 MHz I/Q demodulation bandwidth
- 16 Msample I and Q memory
- Statistical signal analysis with CCDF function
- Software for measurements on 802.11a wireless LAN
- I/Q data extraction, e.g. for MCPA adjustment
- Code domain power measurement for 3GPP WCDMA optional
- Versatile resolution filters: Gaussian, FFT, channel, RRC
- RMS detector (100 dB dynamic range)
- Transducer factor for correcting antenna or cable frequency responses
- Full choice of detectors
  - RMS, SAMPLE, AVERAGE
  - AUTO/MAX/PEAK
  - QUASI PEAK (QPK)

Characteristics

Signal analyzer

The R&S®FSQ features a digital back end that benefits from the progress in ADC and ASIC development. Time-consuming evaluation algorithms are implemented directly in hardware – a prerequisite for fast measurement and high accuracy.

- 14-bit A/D converter 81.6 MHz
- Digital hardware resampler to match the sampling rate to the signal

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Signal Analyzers R&S®FSQ

- Sampling rate from 10 kHz to 81.6 MHz adaptable to the modulation rate
- SFDR >80 dBfs
- Digital downconversion to baseband with high output bandwidth (28 MHz referred to RF)

Most versatile resolution filter characteristics and largest bandwidth

- Standard resolution filters from 10 Hz to 50 MHz in steps of 1, 2, 3, 5
- FFT filters from 1 Hz to 30 kHz
- 32 channel filters with bandwidths from 100 Hz to 5 MHz
- RRC filters for NADC, TETRA and 3GPP
- EMI filters 200 Hz, 9 kHz, 120 kHz

Full range of analysis functions

- Time domain power in conjunction with channel or RRC filters make the R&S®FSQ a full-fledged channel power meter
- TOI marker, noise/phase noise marker
- Versatile channel/adjacent-channel power measurement functions with wide selection of standards; user-configurable
- Split-screen mode with selectable settings
- CCDF measurement function
- Peak list marker for fast search of all peaks within the set frequency range (search for spurious)

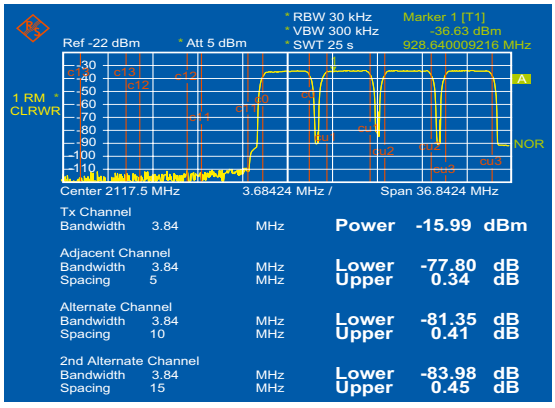
Measurement of adjacent-channel power on a 3GPP four-carrier signal with noise correction

High measurement speed

- 2.5 ms sweep time in frequency domain
- 1 µs sweep time in time domain
- Number of measurement points/trace selectable between 155 and 10001
- Time-selective spectrum analysis with gating function
- Up to 20 measurements/s (man. mode)
- Up to 30 measurements/s (GPIB mode)
- Fast ACP measurement in time domain

Flexible data interchangeability

- LAN interface (10/100 BaseT)
- Network capable workstation by Embedded Windows XP
- All elements of the R&S®FSU screen are represented by a soft front panel function; the complete R&S®FSU screen shows on the remote PC
- Special RSIB interface (Windows and UNIX) links the user´s application to the TCP/IP protocol and acts like an IEC/IEEE-bus driver



- GPIB interface, IEEE 488.2
  - SCPI-compatible GPIB command set
  - R&S®FSE/R&S®FSIQ-compatible GPIB command set
- RS-232-C, VGA output
- USB interface for firmware updates, PC peripherals and data exchange by memory sticks
- Integrated standard disk drive

Options

Up to 120 MHz demodulation bandwidth (option R&S®FSQ-B72)

This option extends the demodulation bandwidth to 60 MHz (f <3.6 GHz) respectively up to 120 MHz (f >3.6 GHz). This is useful for I/Q data extraction for MCPA characterization. Using the option Vector Signal Analyzer R&S®FSQ-K70 the option R&S®FSQ-B72 extends the max. symbol rate from 25 MSymbol/s to 81.6 MSymbol/s.

WLAN measurements

Following application firmware enable measurements on WLAN signals:

- R&S®FSQ-K90 for measurements on 802.11a and 802.11g ODFM signals
- R&S®FSQ-K91 for measurements according to 802.11a, b, g and 802.11j standards

Specifications in brief

You will find detailed and binding data on the enclosed CD (../DATASHEET/FSQ.pdf), or, for the latest updates, visit www.rohde-schwarz.com, search term: FSQ

	R&S®FSQ3	R&S®FSQ8	R&S®FSQ26
Frequency range DC coupled AC coupled	20 Hz to 3.6 GHz 1 MHz to 3.6 GHz	20 Hz to 8 GHz 1 MHz to 8 GHz	20 Hz to 26.5 GHz 10 MHz to 26.5 GHz
Frequency resolution	0.01 Hz		
Frequency display	with marker or frequency counter		
Marker resolution	0.1 Hz to 10 kHz (dependent on span)		
Frequency counter resolution	0.1 Hz to 10 kHz (selectable)		
Frequency span	0 Hz, 10 Hz to 3.6 GHz	0 Hz, 10 Hz to 8 GHz	0 Hz, 10 Hz to 26.5 GHz

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Signal Analyzers R&S®FSQ

Spectral purity (dBc (1 Hz)), SSB phase noise, f = 640 MHz			
Carrier offset			
1 kHz	<–112 dBc (1 Hz), typ. –116 dBc (1 Hz)		
100 kHz	<–120 dBc (1 Hz), typ. –123 dBc (1 Hz)		
10 MHz	<–155 dBc (1 Hz), typ. –160 dBc (1 Hz)		
Sweep			
Span 0 Hz	1 µs to 16000 s in steps of 5%		
Span ≥10 Hz	2.5 ms to 16000 s in steps ≤10%		
Resolution bandwidth			
3 dB bandwidths	10 Hz to 20 MHz in 1/2/3/5 sequences, 50 MHz		
Video bandwidths	1 Hz to 10 MHz in 1/2/3/5 sequences		
Filters			
FFT (3 dB bandwidths)	1 Hz to 30 kHz in 1/2/3/5 sequence		
EMI (6 dB bandwidths)	200 Hz, 9 kHz, 120 kHz		
Channel			
Bandwidths	100/200/300/500 Hz, 1/1.5/2/2.4/2.7/3/3.4/4/4.5/5/6/8.5/9/10/12.5/14/15/16/18 (RRC)/20/21/24.3 (RRC)/25/30/50/100/150/192/200/300/500 kHz, 1/1.228/1.5/2/3/5 MHz		
Level	**R&S®FSQ3**	**R&S®FSQ8**	**R&S®FSQ26**
1 dB compression of input mixer (0 dB RF attenuation, nominal values)	+13 dBm	+13 dBm up to 3.6 GHz	
	–	+10 dBm 3.6 GHz to 8 GHz	+7 dBm 3.6 GHz to 26 GHz
Intermodulation			
Third-order intermodulation (third-order intercept (TOI), level 2 × –10 dBm, Δf >5 × RBW or 10 kHz, whichever is the greater value), for f =			
10 MHz to 300 MHz	typ. +20 dBm	typ. +20 dBm	typ. +20 dBm
300 MHz to 3.6 GHz	typ. +25 dBm	typ. +25 dBm	typ. +27 dBm
3.6 GHz to 8 GHz	–	typ. +23 dBm	–
3.6 GHz to 26.5 GHz	–	–	typ. +15 dBm
Second harmonic intercept point (SHI)			
1 GHz < f_{in} ≤ 1.8 GHz	>35 dBm		
f_{in} > 1.8 GHz	–	>80 dBm	
Maximum dynamic range			
1 dB compression to DANL (1 Hz)	170 dB		
Displayed average noise level			
(0 dB RF attenuation, RBW 10 Hz, VBW 30 Hz, 20 averages, trace average, span 0 Hz, termination 50 Ω, typical values)			
10 MHz ≤ f < 2 GHz	–148 dBm	–148 dBm	–146 dBm
2 GHz ≤ f ≤ 3 GHz	–147 dBm	–147 dBm	–
2 GHz ≤ f < 3.6 GHz	–	–	–143 dBm
3 GHz ≤ f ≤ 3.6 GHz	–147 dBm	–146 dBm	–
3.6 GHz ≤ f < 7 GHz	–	–142 dBm	–
3.6 GHz ≤ f < 8 GHz	–	–	–145 dBm
7 GHz ≤ f < 8 GHz	–	<–142 dBm	–
8 GHz ≤ f < 13 GHz	–	–	–143 dBm
13 GHz ≤ f < 18 GHz	–	–	–141 dBm
18 GHz ≤ f < 22 GHz	–	–	–138 dBm
22 GHz ≤ f < 26.5 GHz	–	–	–136 dBm
Immunity to interference (f ≤3.6 GHz)			
Image frequency	>90 dB, >110 dB typ.		
Intermediate frequency	>90 dB, >110 dB typ.		
Spurious responses (f >1 MHz, without input signal, 0 dB attenuation)	<–103 dBm		
Level display (spectrum mode)			
Screen	625 × 500 pixels (one diagram), max. 2 diagrams with independent settings		
Logarithmic level axis	1 dB, 10 dB to 200 dB in steps of 10 dB		
Linear level axis	10% of reference level per level division, 10 divisions or logarithmic scaling		

	R&S®FSQ3	**R&S®FSQ8**	**R&S®FSQ26**
Traces	max. 6, with two diagrams on screen, max. 3 per diagram		
Trace detector	Max Peak, Min Peak, Auto Peak (normal), Sample, RMS, Average, Quasi Peak		
Number of trace measurement points	625 (default value), 155 to 10001 in steps of about a factor of 2		
Trace functions	Clear/Write, Max Hold, Min Hold, Average		
Setting range of reference level			
Logarithmic level display	–130 dBm to (+5 dBm + RF attenuation), max. 30 dBm, in steps of 0.1 dB		
Linear level display	7.0 nV to 7.07 V in steps of 1%		
Frequency response (DC coupling, RF attenuation ≥10 dB, +20 °C to +30 °C)			
10 MHz to 3.6 GHz	<0.3 dB (σ = 0.1 dB)		
Span <1 GHz			
3.6 GHz ≤ f < 8 GHz		<1.5 dB (σ = 0.5 dB)	
8 GHz ≤ f < GHz	–	–	<2 dB (σ = 0.7 dB)
22 GHz ≤ f < 26.5 GHz			<2.5 dB (σ = 0.8 dB)
f ≥3.6 GHz, span ≥1 GHz	add 0.5 dB to above values		
Attenuator (≥5 dB)	<0.2 dB		
Display nonlinearity (+20 °C to +30 °C, mixer level = –10 dBm)			
Logarithmic level display, RBW = 100 kHz or channel filters,			
S/N >20 dB, 0 dB to –70 dB	<0.1 dB (s = 0.03 dB)		
200 kHz = RBW =10 MHz, S/N >16 dB			
0 dB to –50 dB	<0.2 dB (s = 0.07 dB)		
RBW >10 MHz, S/N >16 dB			
0 dB to –50 dB	<0.5 dB (s = 0.17 dB)		
Linear level display	5% of reference level		
Bandwidth switching error referenced to RBW = 10 kHz			
1 Hz to 100 kHz	<0.1 dB (s = 0.03 dB)		
200 kHz to 3 MHz	<0.2 dB (s = 0.07 dB)		
5 MHz to 50 MHz	<0.5 dB (s = 0.15 dB)		
FFT filter 1 Hz to 3 kHz	<0.2 dB (s = 0.07 dB)		
Total measurement error (0 dB to –70 dB, S/N >20 dB, span/RBW <100, 95% confidence level) (20 °C to 30 °C, mixer level ≤–10 dBm)			
f < 3.6 GHz	0.3 dB (RBW ≤100 kHz) 0.5 dB (RBW >100 kHz)		
3.6 GHz ≤ f <8 GHz	2.0 dB		
8 GHz ≤ f <18 GHz	2.5 dB		
18 GHz ≤ f <26.5 GHz	3.0 dB		
I/Q data			
Sampling rate	programmable: 10 kHz to 81.6 MHz in 0.1 Hz steps		
ADC resolution	14 bit		
I/Q memory	16 Msample each for I and Q data		
Max. information bandwidth	28 MHz		
Interfaces			
Remote control	IEC625-2 (IEEE488.2)		
Serial	RS-232-C (COM), 9-pin Sub-D female		
Printer	parallel (Centronics-compatible)		

General data

	R&S®FSQ3	**R&S®FSQ8**	**R&S®FSQ26**
Display	21 cm TFT LCD colour display (8.4", SVGA)		
Rated temperature range	+5 °C to +40 °C		
AC power supply	100 V AC to 240 V AC, 3.1 A to 1.3 A, 50 to 400 Hz		
Power consumption	typ. 130 VA	typ. 150 VA	
Dimensions (W x H x D)	435 mm × 192 mm × 460 mm		
Weight	14.6 kg	15.4 kg	15.6 kg

Signal Analyzers R&S®FSQ

Optional Electronic Attenuator R&S®FSU-B25

Electronic attenuator	0 dB to 30 dB, 5 dB steps
Preamplifier	20 dB, switchable
Frequency response, with preamplifier or electronic attenuator	
10 MHz to 50 MHz	<1.0 dB
50 MHz to 3.6 GHz	<0.6 dB
3.6 GHz to 8 GHz	<2.0 dB
Displayed average noise level	
(RBW = 1 kHz, VBW = 3 kHz, zero span, sweep time 50 ms, 20 averages, mean marker, normalized to 10 Hz RBW, preamplifier on)	
10 MHz to 2 GHz	<–152 dBm
2.0 GHz to 3.6 GHz	<–150 dBm
3.6 GHz to 8.0 GHz	<–147 dBm
Intermodulation (third-order intermodulation, third-order intercept (TOI), electronic attenuator on, $\Delta f > 5 \times$ RBW or 10 kHz)	
10 MHz to 300 MHz	>17 dBm
300 MHz to 3.6 GHz	>20 dBm
3.6 GHz to 8 GHz	>18 dBm

I/Q Baseband Inputs R&S®FSQ-B71

Frequency range Useful bandwidth with specified output data rate fs = 81.6 MHz	DC to 36 MHz
Input level range (full scale), unbalanced, balanced differential voltage	±31.6 mV to ±5.62 V (50 Ω, 5 dB steps)
Frequency response, 50 Ω, fs = 81.6 MHz, filter off	
DC to 36 MHz	<0.3 dB
I/Q imbalance, DC to 36 MHz	<0.15 dB
Noise level, signal-to-noise ratio, range = 1 V, signal level equal to range	typ. 143 dBc (1 Hz)
Connector, each channel balanced or unbalanced	4 × BNC female
unbalanced setting, common mode	50 Ω/1 kΩ nominal
balanced setting	
common mode	50 Ω/1 kΩ *) nominal
differential	100 Ω/1.5 kΩ nominal
	*) with other input shorted to ground

I/Q Bandwidth Extension R&S®FSQ-B72

Useful bandwidth	
≤3.6 GHz	60 MHz
>3.6 GHz, fs = output sampling rate	
81.6 MHz < fs < 163.2 MHz	0.68 × fs
163.2 MHz = fs = 326.4 MHz	120 MHz
Output sampling rate	
min.	>81.6 MHz
max.	326.4 MHz
Signal-to-noise ratio	
Mixer level =–20 dBm signal level equal to reference level	128 dBc (1 Hz), typ. >125 dBc (1 Hz)
Sampling rate	programmable, >81.6 MHz to 326.4 MHz in 0.1-Hz steps
ADC resolution	8 bit

Ordering information

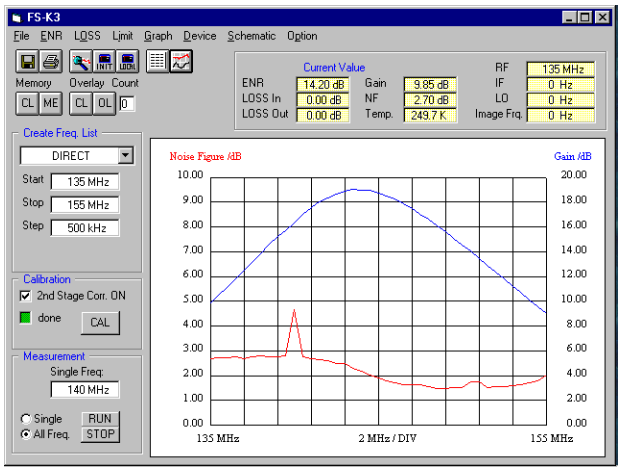
Signal Analyzer		
20 Hz to 3.6 GHz	R&S®FSQ3	1155.5001.03
20 Hz to 8 GHz	R&S®FSQ8	1155.5001.08
20 Hz to 26.5 GHz	R&S®FSQ26	1155.5001.26

Accessories supplied
Power cable, operating manual, service manual; R&S®FSQ26: test port adapter with 3.5 mm female (1021.0512.00) and N female (1021.0535.00) connector

Options		
External Generator Control	R&S®FSP-B10	1129.7246.02
Highly Accurate Reference Frequency	R&S®FSU-B4	1144.9000.02
Tracking Generator, 9 kHz to 3.6 GHz	R&S®FSU-B9	1142.8994.02
Output Attenuator, 0 dB to 70 dB, for R&S®FSU-B9	R&S®FSU-B12	1142.9349.02
LO/IF Connectors for External Mixers	R&S®FSU-B21	1157.1090.02
Preamplifier 20 dB, 3.6 GHz to 26.5 GHz (only factory fitted)	R&S®FSU-B23	1157.0907.02
Electronic Attenuator, 0 dB to 30 dB, with integrated 20 dB preamplifier	R&S®FSU-B25	1144.9298.02
Analog Baseband Inputs	R&S®FSQ-B71	1157.0113.02
I/Q Bandwidth Extension	R&S®FSQ-B72	1157.0336.02
Software		
Noise Measurement Software	R&S®FS-K3	1057.3028.02
Application Firmware for Noise Figure and Gain Measurements	R&S®FS-K30	1300.6508.02
Phase Noise Measurement Software	R&S®FS-K4	1108.0088.02
GSM/EDGE Application Firmware	R&S®FS-K5	1141.1496.02
FM Measurement Demodulator	R&S®FS-K7	1141.1796.02
3GPP BTS/Node B FDD Application Firmware	R&S®FS-K72	1154.7000.02
UE FDD Application Firmware	R&S®FS-K73	1154.7252.02
3GPP HSDPA BTS Application Firmware	R&S®FS-K74	1300.7156.02
W-LAN Application Software		on request
Bluetooth® Measurements	R&S®FS-K8	1157.2568.02
Power Sensor Measurements	R&S®FS-K9	1157.3006.02
CDMA2000 Base Station Test	R&S®FS-K82	1157.2316.02
CDMA2000/1XEV-DV Mobile Test	R&S®FS-K83	1157.2416.02
CDMA2000/1XEV-D0 Base Station Test	R&S®FS-K84	1157.2851.02
CDMA2000 1xEV-DO Mobile Station Test Application Firmware	R&S®FS-K85	1300.6689.02
Vector Signal Analysis	R&S®FSQ-K70	1161.8038.02
WLAN 802.11a Applications Firmware	R&S®FSQ-K90	1157.3064.02
WLAN 802.11a/b/g/j Applications Firmware	R&S®FSQ-K91	1157.3129.02
Extras		
Headphones	–	0708.9010.00
US Keyboard with trackball	R&S®PSP-Z2	1091.4100.02
PS/2 Mouse	R&S®FSE-Z2	1084.7043.02
Colour Monitor, 17", 230 V	R&S®PMC3	1082.6004.04
IEC/IEEE-Bus Cable, 1 m	R&S®PCK	0292.2013.10
IEC/IEEE-Bus Cable, 2 m	R&S®PCK	0292.2013.20
19" Rack Adapter	R&S®ZZA-411	1096.3283.00
Adapter for mounting on telescopic rails (only with 19" Adapter R&S®ZZA-411)	R&S®ZZA-T45	1109.3774.00
Matching Pads, 75 Ω		
L Section	R&S®RAM	0358.5414.02
Series Resistor, 25 Ω	R&S®RAZ	0358.5714.02
SWR Bridge, 5 MHz to 3000 MHz	R&S®ZRB2	0373.9017.52
SWR Bridge, 40 kHz to 4 GHz	R&S®ZRC	1039.9492.52
High-Power Attenuators, 100 W,		
3/6/10/20/30 dB (xx=03/06/10/20/ 30)	R&S®RBU100	1073.8820.xx
High-Power Attenuators, 50 W		
3/6/10/20/30 dB (xx=03/06/10/20/ 30)	R&S®RBU50	1073.8895.xx
20 dB, 6 GHz	R&S®RDL50	1035.1700.52

Noise Figure Measurement Software R&S®FS-K3

Provides the high-grade analyzers with features otherwise only offered by special noise measurement systems



Measurements on a GaAs preamplifier show an anomaly at 140 MHz, whose cause is easily traceable in the spectrum analyzer mode

Brief description

Spectrum Analyzers R&S®FSU and R&S®FSP as well as Signal Analyzers R&S®FSQ feature high sensitivity and level accuracy – in conjunction with switchable, calibrated noise sources – and are thus ideal for automatic measurement of noise figure and gain. Noise Figure Measurement Software R&S®FS-K3 provides the high-grade analyzers with features otherwise only offered by special noise measurement systems. At a given frequency or in a selectable frequency range the following parameters can be measured:

- Noise figure in dB
- Noise temperature in K
- Gain in dB

The combination of Noise Figure Measurement Software R&S®FS-K3 and Analyzers R&S®FSU, R&S®FSQ or R&S®FSP offers the following advantages over conventional noise measurement systems:

- Frequency range up to 26.5 GHz (depending on analyzer model) for noise measurements in the microwave range without need for an additional downconverter
- Resolution bandwidths variable in steps of 1/2/3/5 (R&S®FSP: 1/3) for optimum matching to narrowband DUTs

Measurements on frequency-converting DUTs, e.g. low-noise converters
R&S®FS-K3 allows the noise figure and gain for instance of LNCs for direct satellite reception to be measured without any problems despite the great frequency difference of typ. 10 GHz between the input and output. A particular asset in these measurements is the extremely wide dynamic range, allowing the direct determination of gain values up to 60 dB.

Specifications

Frequency range	100 kHz to 26.5 GHz (depending on analyzer model)
Measurement bandwidth	1 kHz to 5 MHz
Noise measurements	
Level range	0 to 25 dB
Resolution	0.01 dB
Measurement accuracy	±0.2 dB (preamplification 20 dB, noise figure 5 dB, bandwidth 1 MHz)
Gain measurements	
Level range	0 dB to 60 dB
Resolution	0.01 dB
Measurement accuracy (noise figure 5 dB, bandwidth 1 MHz)	±0.2 dB (preamplification 20 dB,

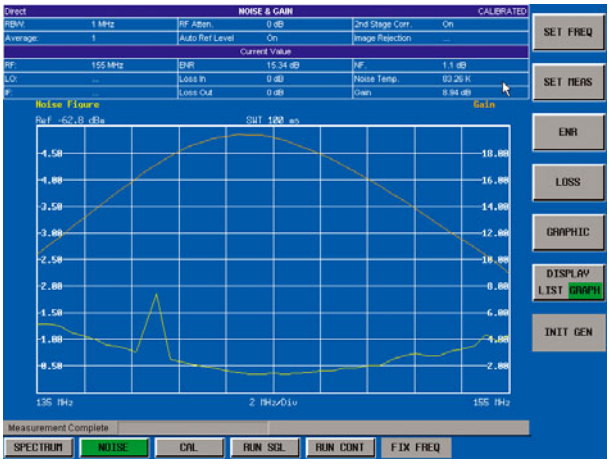
Required hardware and software	
Analyzers	R&S®FSU, R&S®FSQ, R&S®FSP
Recommended noise source	NoiseCom 346
Power supply	via 28 V connector on rear panel of R&S®FSU/FSQ/FSP (BNC)
Preamplifier	gain approx. 20 dB, noise figure max. 5 dB
Control via external PC/IEC/IEEE bus	
Software	Windows 9x/ME/NT/2000/XP
Interface	IEC625-1 (IEEE488)
Interface card	National Instruments AT/TNT/PC card
Control via Spectrum Analyzer	
R&S®FSP/FSU/FSQ	keyboard R&S®PSP-Z2

Ordering information

Noise Measurement Software	R&S®FS-K3	1057.3028.02

Application Firmware for Noise Figure and Gain Measurements R&S®FS-K30 for R&S®FSP/FSU/FSQ

Outperforming any conventional noise measurement system



Measurements on a GaAs preamplifier show an anomaly at 140 MHz, whose cause is easily traceable in the spectrum analyzer mode

New

Brief description

The Spectrum Analyzers R&S®FSP and R&S®FSU as well as the Signal Analyzers R&S®FSQ feature high sensitivity and level accuracy – in conjunction with switchable, calibrated noise sources – are thus ideal for automatic measurement of noise figure and gain. Application Firmware R&S®FSK30 provides the high-grade analyzers with features otherwise only provided by special noise measurement systems. At a specified frequency or in a selectable frequency range the following parameters can be measured:

- Noise figure in dB
- Noise temperature in K
- Gain in dB

Compared to conventional noise measurement systems, R&S®FS-K30 used with the Analyzers R&S®FSP/FSU or R&S®FSQ has the advantage that a large variety of further RF measurements can also be performed. The measurement results are output as a graph or a list.

Up to four measurements can be represented in a diagram. All functions can be remote-controlled.

Easy to operate

The firmware runs on the R&S®FSP/FSU and R&S®FSQ analyzers that operate under Windows XP. The measurement results can be further processed, e.g. for documentation or presentation, using Windows standard software. A practically unlimited number of complete measurement routines can be stored. They facilitate reproducible and error-free measurements and include:

- Frequency range
- Noise source characteristics
- Type of DUT (amplifier, mixer, lownoise converter)
- Analyzer settings
- Measurement results

Specifications in brief

Frequency range	100 kHz to 26.5 GHz (depending on analyzer model)
Measurement bandwidth	
R&S®FSP; R&S®FSU/FSQ	1 kHz to 10 MHz; 1 kHz to 50 MHz
Noise measurements	
Level range; resolution	0 dB to 25 dB; 0.01 dB
Measurement accuracy	±0.2 dB (meas. with preamplifier (gain 20 dB, noise figure 5 dB) and 1 MHz bandwidth, valid for DUTs with noise figure 1 to 10 dB and gain >10 dB)
Gain measurements	
Level range; resolution	0 dB to 60 dB; 0.01 dB
Measurement accuracy	±0.2 dB (preamplification 20 dB, noise figure 5 dB, bandwidth 1 MHz)

Required hardware and software	
Analyzers	R&S®FSP/FSU/FSQ
Recomm. noise source	NoiseCom 346 (see data sheet R&S®FS-K30)
Power supply	via 28 V connector for R&S®FSP/FSU/FSQ (BNC)
Preamplifier	gain approx. 20 dB, noise figure max. 5 dB

Ordering information

Application Firmware for Noise Figure and Gain Measurement for R&S®FSP/FSU/FSQ	R&S®FS-K30	1300.6508.02
Options		
External Generator Control	R&S®FSP-B10	1129.7246.02
Electronic Attenuator, 0 to 30 dB, 20 dB preamp.	R&S®FSU-B25	1144.9298.02
Electronic Attenuator, 0 dB to 30 dB, 5 dB steps, integrated preamplifier	R&S®FSP-B25	1129.7746.02
3.6 to 26.5 GHz RF preamplifier for R&S®FSU26[1)]	R&S®FSU-B23	1157.0907.02
3.6 to 26.5 GHz RF preamplifier for R&S®FSQ26[1)]	R&S®FSQ-B23	1157.0907.02

1) Factory installation only, not for retrofit and R&S®FSU-B25 required.

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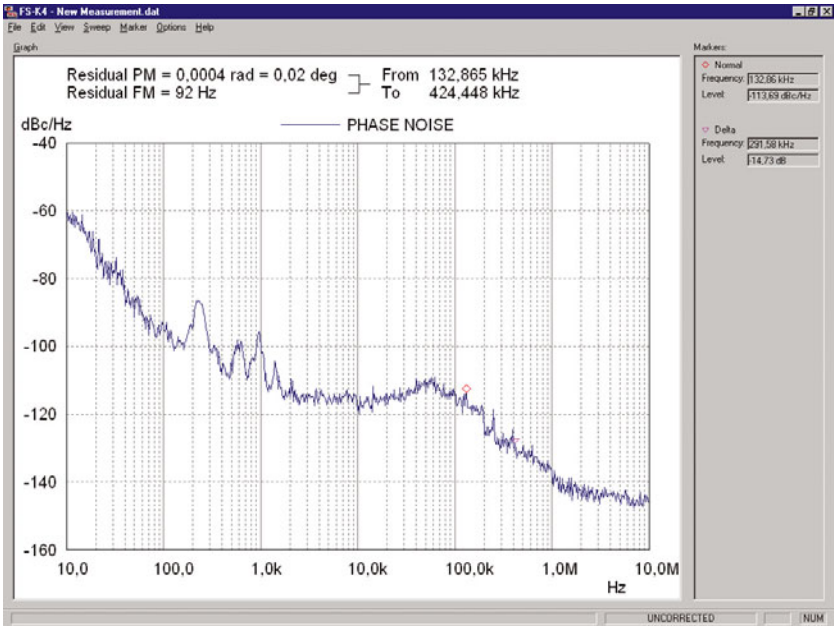
Phase Noise Measurement Software R&S®FS-K4

Phase noise measurements with Spectrum Analyzers R&S®FSU, R&S®FSP, Signal Analyzers R&S®FSQ and EMI Test Receivers R&S®ESIB/ESPI



Brief description

The Phase Noise Measurement Software R&S®FS-K4 extends the measurement capabilities of Rohde&Schwarz Spectrum Analyzers and EMI Test Receivers to give a phase noise tester. The R&S®FSU and the R&S®FSP are ideal for this purpose because of their low inherent phase noise and noise figure.

Main features

- User-editable sweep settings
- Fast residual FM/φM measurements
- Comprehensive marker functions
- Storage of results and settings
- Detailed screen printouts

Specifications

Averaging	
RBW:VBW ratio in video averaging	1:10, 1:1, 10:1
Trace averaging	implemented
Smoothing window	1 to 199 points

Carrier offset frequency range/number of decades

The maximum number of decades that can be represented in a phase noise diagram is defined by the carrier offset frequency range

R&S® Analyzer and Test Receiver models	**FSU3/7**	**FSU26 FSQ3/8, ESIB7 FSP3/7, ESPI3/7**	**FSU46 FSQ26, ESIB26/40 FSP13/30/40**
Lower offset limit	3 Hz	10 Hz	10 Hz
Upper offset limit	1 GHz	1 GHz	10 GHz
Max. number of decades	9	8	9

Nominal measurement accuracy (RSS error, 95% confidence level)

Minimum phase noise level 95 dB below reference level, FFT deactivated, return loss of source >14 dB (VSWR <1.5: 1), signal-to-noise ratio ≥10 dB

Center frequency	**≤3.5 GHz**	**≤7 GHz**	**≤18 GHz**	**≤26.5 GHz**	**≤40 GHz**
Offset ≤10 MHz	1.5 dB	1.6 dB	1.9 dB	1.9 dB	1.9 dB
Offset >10 MHz	1.8 dB	2 dB	2.9 dB	3.4 dB	3.9 dB

Repeatability	
95% confidence level, RBW:VBW 10:1, trace averaging <15, smoothing window ≥9	±0.8 dB

System phase noise

A systematic measurement uncertainty is introduced by the inherent phase noise of the measuring instrument.

System Requirements	
Control via external PC/IEEE bus	Windows 9x/NT4.0/2000/XP (English version), IEEE488 interface, AT/TNT/PCMCIA IEEE card

Ordering Information

Phase Noise Measurement Software	R&S®FS-K4	1108.0088.02

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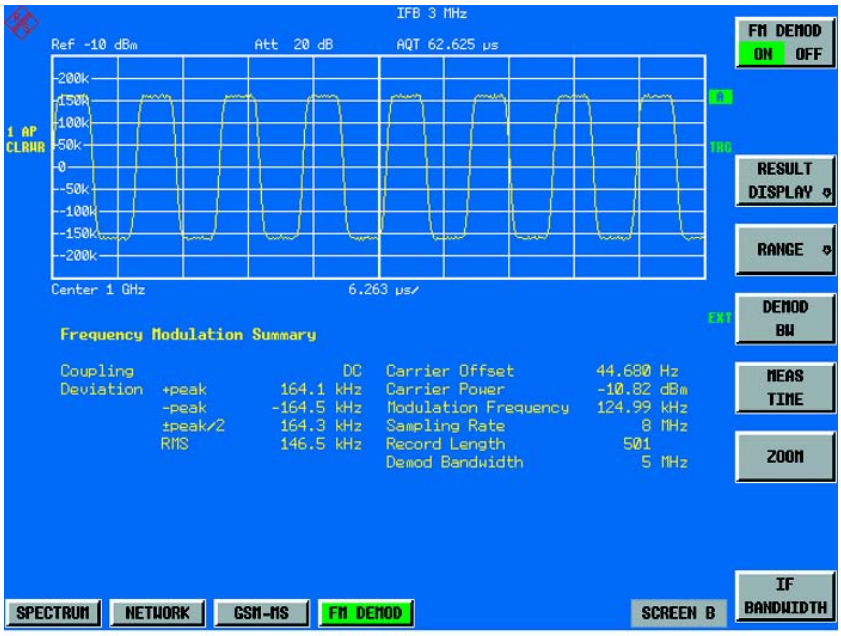
AM/FM/PM Measurement Demodulator R&S®FS-K7

AM/FM/PM Measurement Demodulator for Spectrum Analyzer R&S®FSP for determining analog modulation parameters



***Bluetooth* modulation characteristics: The frequency deviation of the signal is determined for a specified bit sequence (…1111 0000…or 10101010…) and displayed as a measured trace and in numerical form**

Brief description

Option R&S®FS-K7 adds FM demodulation to the functions of Spectrum Analyzer R&S®FSP. The universal characteristics of the digital measurement demodulator open up a wide range of applications, e.g. measurements of synthesizer settling or frequency deviation. This makes R&S®FSP with option R&S®FS-K7 ideal for measuring modulation characteristics such as those required in the development and production of *Bluetooth*® modules.

Main features

Display

- Frequency modulation (FM) or carrier power as a function of time
- RF spectrum (FFT)
- Table with numeric values for peak and RMS deviation, modulation frequency (AF), carrier offset, carrier power

Features

- Digital measurement demodulator with wide bandwidth range from 12.5 kHz to 10 MHz
- Restoration of sampled signal with high measurement accuracy
- Ideal for production and development of *Bluetooth* modules
- Great memory depth for long measurement sequences (I/Q memory 2 x 128 ksample)

Measurements

The measurement results can be subsequently displayed as

- Frequency (FM) or carrier power versus time or as an
- RF spectrum (FFT)

The main modulation parameters such as frequency deviation (peak, RMS), modulation frequency or carrier power are also numerically indicated in a table.

The sampled signal is restored and the signal is displayed in its original form. The sampling rate is automatically matched to the demodulation bandwidth.

Sequences with a length of up to 8.3 s (demodulation bandwidth 12.5 kHz) or 65 ms (demodulation bandwidth 1.6 MHz) can be recorded in the large I/Q memory of the R&S®FSP. This allows long bit sequences, such as occur with *Bluetooth*® signals, to be completely investigated. The demodulated data can also be read out via GPIB, RS-232-C or LAN and processed on an external PC.

The FM and RF level trigger function with a wide dynamic range provides special trigger capabilities. This also allows signals to be tested for which no external trigger signal is available.

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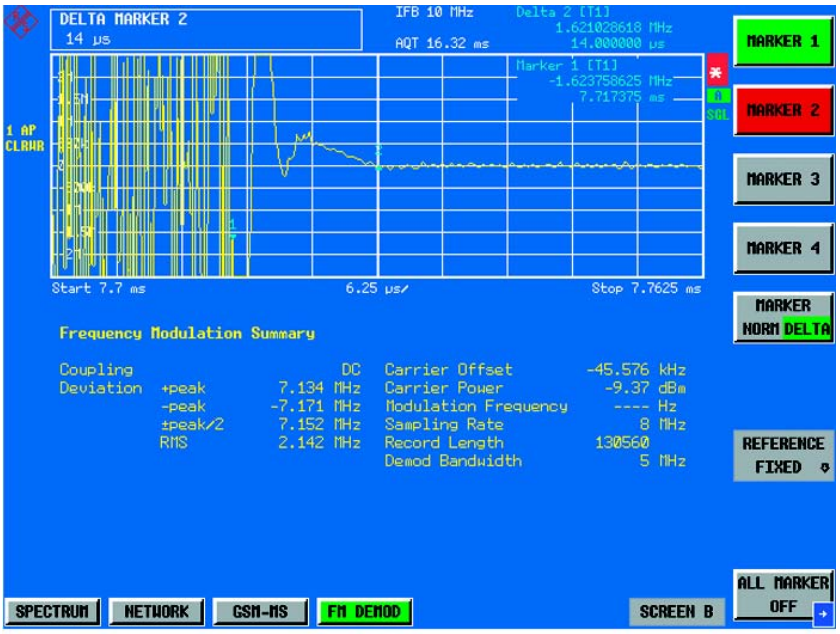
AM/FM/PM Measurement Demodulator R&S®FS-K7

Transient response of synthesizer: With the FM measurement demodulator function, the transient response of a synthesizer can be measured in digital communication systems like GSM or Bluetooth transmitters



Specifications

Measurement of analog modulation signals	
Demodulation bandwidth	12.5 kHz to 10 MHz
Max. record time	
Demodulation bandwidth ≤1.6 MHz	≥85 s/(demodulation bandwidth/kHz)
Demodulation bandwidth >1.6 MHz	≥34 s/(demodulation bandwidth/kHz)
Readout	trace with frequency or RF power versus time, RF spectrum and table with numerical display of peak and rms values of deviation, modulation frequency, carrier offset, carrier power (power of unmodulated carrier)
Frequency demodulation	
AF	DC to 5 MHz (max. 0.5 × demodulation bandwidth)
Deviation range	5 MHz (max. 0.5 × demod. bandwidth)
Deviation uncertainty (AF + dev. ≤0.5 × demodulation bandwidth and AF ≤0.1 × IF bandwidth)	<3% of result + residual FM
Residual FM[1)]	
Demodulation bandwidth ≤200 kHz, rms	
RF ≤1 GHz	typ. 80 Hz
RF >1 GHz	typ. 80 Hz × √(f/1 GHz)
Carrier power versus time	
AF	DC to 5 MHz (max. 0.5 × demodulation bandwidth)
Display range	noise floor to +30dBm
Max. dynamic range	
Demod. bandwidth 200 kHz	typ. 75 dB
Display nonlinearity	
S/N >16 dB	typ. 0.2 dB
Incidental AM with FM (AF + deviation ≤0.5 × demodulation bandwidth and deviation ≤0.1 × IF bandwidth	typ. 0.1dB + residual AM
Unmodulated carrier power	
Measurement uncertainty (S/N >16 dB, RF = 50 kHz to 3 GHz)	typ. 1 dB
AF	
Range	≤5 MHz (max. 0.5 × demod. bandwidth)
Resolution	5 digits
Uncertainty	0,1%
RF spectrum	
Span	12.5 kHz to 10 MHz
Resolution bandwidth (FFT filters)	1 Hz to 10 MHz
Shape factor 60:3 dB	2.5 nominal

1) RF input level ≥(reference level/dBm –10) dBm and RF input level ≥(RF attenuation/dB –30) dBm.

Ordering information

Measurement Demodulator for R&S®FSP	R&S®FS-K7	1141.1796.02

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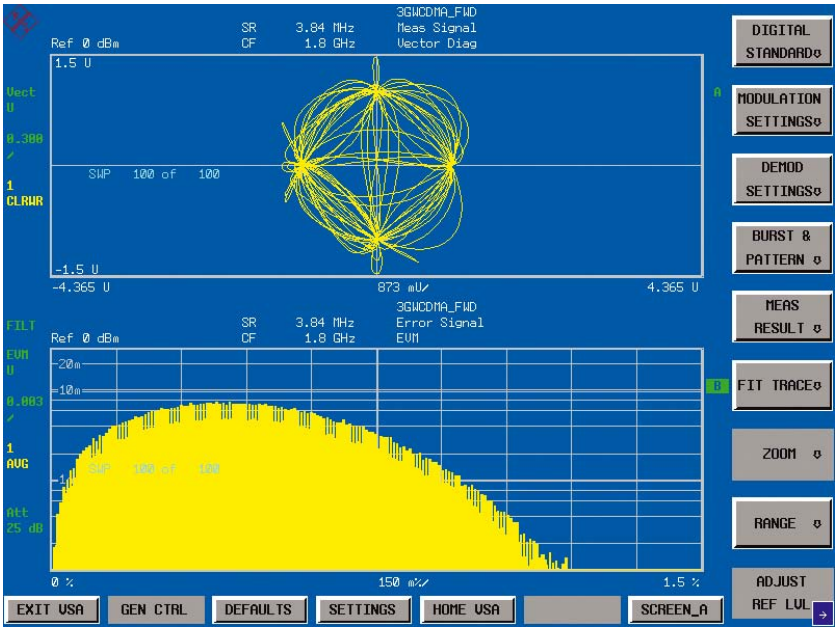
Option Vector Signal Analyzer R&S®FSQ-K70

New

Universal demodulation, analysis and documentation of digital radio signals



The vector diagram enables convenient analysis of the degradation of modulation accuracy caused, for example, by nonlinearities, phase noise or amplitude-dependent phase response of amplifiers, converters, etc; the upper screen (A) shows the complete constellation diagram, the lower screen (B) the probability distribution of the error vector magnitude (EVM)

Brief description

Universal analysis of digital radio signals

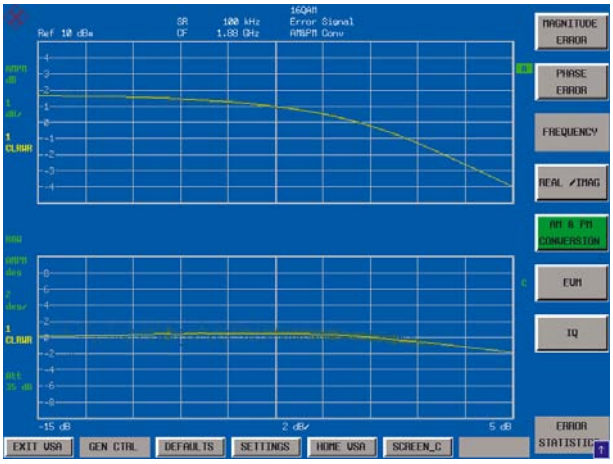
The vector signal analyzer option upgrades the Signal Analyzers R&S®FSQ, adding universal demodulation and analysis capability down to bit stream level for digital radio signals. The option supports all common mobile radio communication standards.

Measurement and analysis of digital modulation signals

In addition to performing standard measurements such as determination of modulation accuracy, carrier leakage or I/Q imbalance, you can also study the information statistics of these parameters such as the standard deviation of carrier frequency error calculated over 10 measurements.

AM/φM and AM/AM distortion example with a 16QAM signal (pictures bottom)

The right picture shows the constellation diagram where the outer constellation points are drawn to the center of the diagram as a result of the amplifier compression; the left picture shows the AM/AM and AM/φM conversion curve of the same signal



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Option Vector Signal Analyzer R&S®FSQ-K70

Main features

For all major mobile radio communication standards

- GSM & EDGE
- WCDMA-QPSK
- CDMA2000-QPSK
- *Bluetooth*™
- TETRA
- PDC
- PHS
- DECT
- NADC

For all common digital modulation modes

- BPSK, QPSK, OQPSK, π/4 DQPSK
- 8PSK, D8PSK, 3π/8 8PSK
- (G)MSK, 2, 4, (G)FSK
- 16, 32, 64, 128, 256 (D)QAM
- 20.4 MHz symbol rate
- 28 MHz I/Q demodulation bandwidth

Optimum representation of results

- In-phase and quadrature signals versus time
- Magnitude and phase versus time
- Eye, vector and constellation diagrams
- Table with modulation errors
- Demodulated bit stream
- Statistical evaluation of modulation parameters
- Amplifier distortion measurements

Characteristics

Multiple test functions in one unit

The Signal Analyzers R&S®FSQ in conjunction with the option R&S®FSQ-K70 replace several individual instruments:

- High-grade spectrum analyzer
- Vector demodulator
- Constellation analyzer

Any mobile radio standard at a key stroke

All major digital modulation standards can be activated at a key stroke. The instrument is then completely configured for measurements in line with the activated standard. The corresponding synchronization sequences are of course offered along with the standard.

Versatile in the lab

The R&S®FSQ with the option R&S®FSQ-K70 supports by providing user-selectable bit and symbol rates, filters, modulation schemes and synchronization sequences.

Efficient in production

The high measurement speed of 60 sweeps/s in the analyzer mode and typically 20 measurements/s using the vector signal analyzer function is ideal for applications in production.

Specifications in brief

You will find detailed and binding data on the enclosed CD (../DATASHEET/FSQ-K70.pdf), or, for the latest updates, visit www.rohde-schwarz.com, search term: FSQ-K70

Modulation formats

FSK (including GFSK)	2 FSK, 4 FSK
MSK (including GMSK)	Yes
PSK (EDGE)	BPSK, QPSK, OQPSK, DQPSK, π/4 DQPSK, 8PSK, D8PSK, 3π/8 8PSK
QAM	
Absolute encoding	16QAM, 32QAM, 64QAM, 128QAM, 256QAM
Differential encoding	D16QAM, D32QAM, D64QAM, D128QAM, D256QAM

Predefined standards

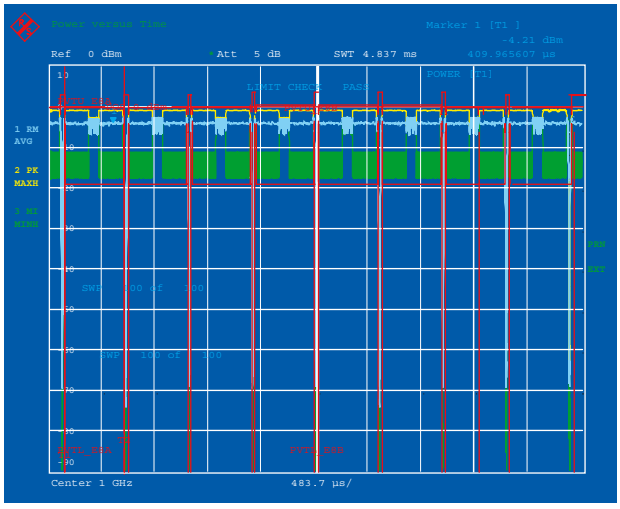
Cellular	
3GPP WCDMA (QPSK)	Forward link, reverse link
CDMA2000 1× (QPSK, OQPSK)	Forward link, reverse link
EDGE	Normal burst
GSM	Access burst, frequ. correction burst, normal burst, synchronization burst
NADC	Forward link, reverse link
PDC	Downlink, uplink
PHS	Communication burst, control burst
Wireless networking	
Bluetooth™	DH1/DH3/DH5 packets
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, none
User- selectable (Alpha, B × T)	0.1 to 1
Symbol rate	
Maximum symbol rate with option R&S®FSQ-B72 for FSQ	25 MHz 81.6 MHz
Maximum bandwidth	28 MHz

Ordering information

Vector Signal Analyzer for R&S®FSQ	R&S®FSQ-K70	1161.8038.02
Recommended extras and options	See data sheet Signal Analyzer R&S®FSQ, PD 0757.7652	
I/Q Baseband Inputs	R&S®FSQ-B71	1157.0113.02
I/Q Bandwidth Extension	R&S®FSQ-B72	1157.0336.02

GSM/EDGE Application Firmware R&S®FS-K5 for R&S®FSP

The solution for easy and fast GSM and EDGE measurements



Power-versus-time measurement: details of burst can be zoomed – rising edge, falling edge, high resolution display of top of burst

Brief description

The Application Firmware R&S®FS-K5 allows the user to perform the most important GSM and EDGE transmitter measurements with the push of a button:

- Phase/frequency error (GSM)
- Modulation accuracy (EDGE) including 95:th percentile and origin offset suppression
- Power-versus-time
- Carrier power
- Modulation spectrum
- Transient spectrum
- Spurious emissions

Only very few parameters have to be set manually such as carrier frequency, reference level, external attenuator. R&S®FS-K5 can be installed in all models of the R&S®FSP spectrum analyzer family:

- **R&S®FSP3:** 9 kHz to 3 GHz: Covers the basic TX frequency range
- **R&S®FSP7:** 9 kHz to 7 GHz: Adds harmonics measurement capability
- **R&S®FSP13:** 9 kHz to 13 GHz: Covers the entire spurious emissions frequency range
- **R&S®FSP30/40:** 9 kHz to 30/40 GHz: Adds microwave link frequency ranges

The application firmware can be used throughout the total frequency range of the basic spectrum analyzer. This covers all GSM bands of interest such as GSM900, GSM1800, GSM1900, R-GSM, GSM 450 and even IF frequencies used in transmitters and receivers.

Features and benefits

R&D, development

- Ideal development tool with easy-to-use GSM measurement functions in a cost-effective analyzer

Low measurement uncertainty for high confidence

- <0.5 dB total level uncertainty and <0.7° phase error for GSM

Standard-conformant measurements for performance verification

- Phase/frequency error (GSM), modulation accuracy (EDGE) and power-versus-time measurement with synchronization to midamble

Designed for speed

- Fast modulation spectrum routine for frequency list mode: ±1.8 MHz/200 bursts in <25 seconds

Really portable – usable anywhere

- Lightweight, <11 kg with R&S®FSP3
- Comprehensive documentation and storage of results and hard copies on internal hard disk, print or transfer to a PC later – even via LAN /Ethernet

Trigger functions to meet many demands

- Simplified test setup, no trigger from device under test necessary
- IF power trigger for gated measurements

GSM/EDGE Application Firmware R&S®FS-K5 for R&S®FSP

Specifications

- Specifications are ensured under the following conditions:
- 15 minutes warmup time at ambient temperature, specified environmental conditions met, calibration cycle adhered to, and total calibration performed.
- Data designated "nominal" apply to design parameters and are not tested.
- The specifications below apply to R&S®FSP3, R&S®FSP7, R&S®FSP13 and R&S®FSP30 equipped with R&S®FS-K5. They are based on the data sheet specifications of Spectrum Analyzers R&S®FSP and are not checked separately. Level measurement uncertainties given with a tolerance are measurement uncertainties with a confidence level of 95%. Data without tolerances are typical values at 900 MHz.
- The specified level measurement errors do not take into account systematic errors due to the reduced S/N ratio.

Measurement	Specification	Test specification, permissible measurement uncertainty acc. to I-ETS 300 609-1
Phase/frequency error (GMSK modulation)		11.10.1 13.1
Phase error, floor (S/N>40 dB) RMS Peak	<0.7° <2°	
Phase error, uncertainty (S/N >40 dB) RMS Peak	<0.2° <0.7°	<1.5° <5°
Frequency error uncertainty (S/N >40 dB)	<1.5 Hz + error of reference frequency	±10 Hz
Modulation accuracy (3π/8 shifted 8PSK modulation)		
EVM, residual (S/N >40 dB) RMS Peak	<0.5% <1.5%	
95:th percentile	<1.5%	
Resolution	0.03%	
Frequency error uncertainty (S/N >40 dB)	<1 Hz + error of reference frequency	
Origin offset suppression (S/N >40 dB) Measurement range	–20 dBc to –50 dBc	
Mean carrier power		11.10.1 13.3
Absolute level uncertainty (–50 dBm to +30 dBm, 10 MHz to 3 GHz)	0.5 dB	1 dB
Relative level uncertainty (from 0 dB to –50 dB from reference level)	0.2 dB	0.7 dB
Power versus time		11.10.1 13.3
Uncertainty of reference	0.5 dB	1 dB
Relative uncertainty 0 to –50 dB from reference –50 to –70 dB from refer.	0.2 dB 0.5 dB	0.7 dB
Internal symbol timing uncertainty	<37 ns	
Trigger reference uncertainty	¼ bit	¼ bit
Dynamic range (RBW = 600 kHz)	70 dB (with trace average) 60 dB (with peak hold)	

Measurement	Specification	Test specification, permissible measurement uncertainty acc. to I-ETS 300 609-1
Spectrum due to modulation		11.10.1 13.4
Level measurement uncertainty		
Absolute (–50 dBm to +30 dBm, 10 MHz to 3 GHz)	<0.5 dB	1 dB
Relative[1)]		
Δf ≤0.1 MHz	<0.2 dB	0.5 dB
0.1 MHz<Δf≤1.8 MHz (0 dBc to –70 dBc)	<0.2 dB	0.7 dB
1.8 MHz <Δf≤ 6 MHz	<0.5 dB	1.5 dB
Δf≥6 MHz	<0.5 dB	2 dB
Dynamic range (carrier power = 30 dBm)		
Frequency offset		
200 kHz	65 dB	
400 kHz	67 dB	
600 kHz	68 dB	
1200 kHz	72 dB	
1800 kHz	76 dB	
1.8 MHz to 6 MHz (RBW = 100 kHz)	76 dB to 84 dB	
>6 MHz (RBW = 100 kHz)	84 dB	
Spectrum due to transients		11.10.1 13.4
Level measurement uncertainty		
Absolute (–50 dBm to +30 dBm, 10 MHz to 3 GHz)	<0.5 dB	1.5 dB
Relative		
0 dB to 50 dB from reference level	<0.2 dB	0.7 dB
>50 dB from reference level	<0.5 dB	1.5 dB
Dynamic range with 30 dBm mean carrier power		
Frequency offset		
400 kHz	62 dB	
600 kHz	64 dB	
1200 kHz	68 dB	
1800 kHz	71 dB	

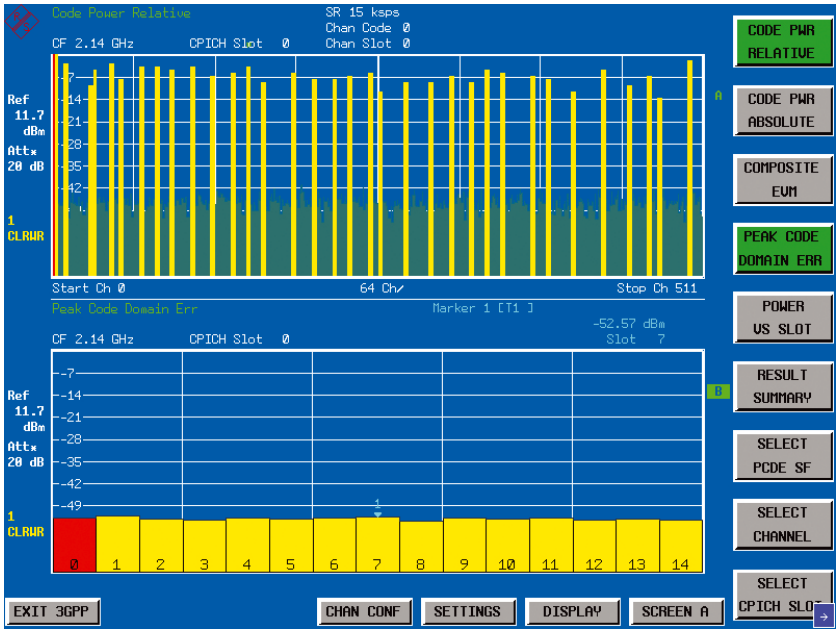
1) Does not include the level uncertainty due to R&S®FSP inherent noise.

Ordering information

GSM Mobile Station Test Application Firmware for Spectrum Analyzer R&S®FSP	R&S®FS-K5	1141.1496.02

WCDMA 3GPP Application Firmware R&S®FS-K72/-K73

3GPP transmitter measurements on base stations and modules with Signal Analyzer R&S®FSQ and Spectrum Analyzers R&S®FSU and R&S®FSP



Peak code domain error measurement: The peak code domain error is projected to the codes of the highest spreading factors; the maximum value of all codes per slot is displayed

Brief description

Application Firmware R&S®FS-K72/-K73 can be installed on all models of the Signal Analyzer R&S®FSQ and Spectrum Analyzers R&S®FSU and R&S®FSP, and enhances the range of applications to include code domain power and modulation measurements on 3GPP FDD signals.

Featuring wide dynamic range for adjacent channel power, the R&S®FSU and the R&S®FSQ are ideal tools for WCDMA base station transmitter measurements in development and production. The R&S®FSP is the ideal development tool with easy-to-use measurement functions integrated into a cost-effective analyzer, especially in mobile radio development.

Main features

- Adds measurement functions to the R&S®FSU, R&S®FSQ and R&S®FSP analyzer families in line with the 3GPP specifications for the FDD mode
- Application Firmware R&S®FS-K72 provides the functionality needed for base station testing. Application Firmware R&S®FS-K73 provides user equipment (UE) functionality:

Measurement	R&S®FSU R&S®FSP	R&S®FSU/ FSP with R&S®FS-K72	R&S®FSU/ FSP with R&S®FS-K73
Maximum output power	x		
CPICH power accuracy		x	N/A
Frequency error		x	x [1]
Power control dynamic range		x	
Total power dynamic range		x	N/A
Occupied bandwidth	x		
Spectrum emission mask	x	x	x
ACLR	x		
Spurious emissions	x		
Error vector magnitude		x	x
Peak code domain error		x	x

[1] Frequency relative to frequency received from BS.

Configuration overview

	Base station		User equipment (UE)	
	R&S®FSQ/ R&S®FSU	R&S®FSP	R&S®FSQ/ R&S®FSU	R&S®FSP
R&S®FS-K72	●	●		
R&S®FS-K73			●	●
R&S®FSP-B15		●		●
R&S®FSP-B70		●		○ [1]

[1] Extends measurement range from one slot to one frame.

WCDMA 3GPP Application Firmware R&S®FS-K72

- Code domain power (code domain analyzer)
- Code domain power versus time
- Error vector magnitude (EVM)
- Peak code domain error
- Timing offset

Code domain power measurements

The main application of R&S®FS-K72/ -K73 is the determination of the power in the individual code channels referred to as code domain power measurement. The power ratios between the individual channels, for instance, can be checked for compliance with the nominal values. Moreover, this measurement is a very efficient tool for detecting impairments such as clipping or intermodulation that are not obvious from the spectrum alone. The power of the different codes is shown versus the code number. To investigate power control, the power characteristic in a code channel can be displayed versus all slots of a frame (10 ms).

The R&S®FSP requires the option R&S®FSP-B70 to perform measurements over more than one slot in the code domain.

Specifications in brief

You will find detailed and binding data on the enclosed CD (../DATASHEET/FS-K7x.pdf), or, for the latest updates, visit www.rohde-schwarz.com, search term: FS-K72

Measurement	R&S®FSP	R&S®FSQ/ R&S®FSU
Code domain power (applies to code domain power and code domain power vs slot)		
Measurement uncertainty		
R&S®FS-K72: Total signal power R&S®FS-K73: Maximum output power	<0.5 dB	<0.3 dB
R&S®FS-K72: CPICH power R&S®FS-K73: Minimum output power	<0.5 dB	<0.4 dB
Absolute code power Relative code power	<0.6 dB <0.1 dB	<0.4 dB <0.1 dB
Frequency error Measurement range Measurement uncertainty (S/N >40 dB) + error of reference frequency	<1 kHz <1.5 Hz	<1 kHz <1.5 Hz
Composite EVM		
Measurement range	2% to 25%	1.5% to 25%
Inherent EVM	<2%	<1.5%
Measurement uncertainty	<1%	<0.5%
Peak code domain error		
Measurement range	0 dB to –55 dB	0 dB to –60 dB
Inherent PCDE	–55 dB	–60 dB
Measurement uncertainty	<1 dB (0 dB to 40 dB)	<1 dB (0 dB to 40 dB)
Output power		
Measurement uncertainty Absolute Relative	<0.5 <0.2	<0.3 dB <0.1 dB
Occupied bandwidth (99 %)		
Measurement uncertainty	<85 kHz	<85 kHz
ACLR (adjacent-channel leakage ratio, 3.84 MHz BW, 5 MHz offset only R&S®FS-K73: test model .1 with 32 DPCH)		
Dynamic range (without noise correction)	65 dB	77 dB
Measurement uncertainty	<0.3 dB + error due to S/N	<0.2 dB + error due to S/N
Spurious emissions		
Level uncertainty <3.6 GHz Level uncertainty 3.6 GHz to 13 GHz	<0.5 dB <2.5 dB	<0.5 dB <2.5 dB
Spectrum emission mask	<1.5 dB	<1 dB

Ordering information

R&S®FS-K72

Application Firmware R&S®FS-K72 can be integrated into any member of the R&S®FSU and R&S®FSQ family. Options R&S®FSP-B70 and option R&S®FSP-B15 are prerequisites for operating the application firmware on any member of the R&S®FSP spectrum analyzer family.

WCDMA 3GPP Application Firmware	R&S®FS-K72	1154.7000.02
3GPP HSDPA BTS Application Firmware (R&S®FS-K72 required)	R&S®FS-K74	1300.7156.02
Pulse Calibrator for R&S®FSP	R&S®FSP-B15	1155.1006.02
Demodulator Hardware for R&S®FSP	R&S®FSP-B70	1157.0559.02

R&S®FS-K73

Application Firmware R&S®FS-K73 can be integrated into any member of the R&S®FSQ & R&S®FSU families. Option R&S®FSP-B15 is a prerequisite for operating the application firmware on any member of the R&S®FSP spectrum analyzer family.

WCDMA 3GPP Application Firmware	R&S®FS-K73	1154.7252.02
Pulse Calibrator for R&S®FSP	R&S®FSP-B15	1155.1006.02

Recommended extras

R&S®FSP-B70 extends the measurement range of the Application Firmware R&S®FS-K73 for the Spectrum Analyzer R&S®FSP from one slot to one frame.

Demodulator Hardware for R&S®FSP	R&S®FSP-B70	1157.0559.02

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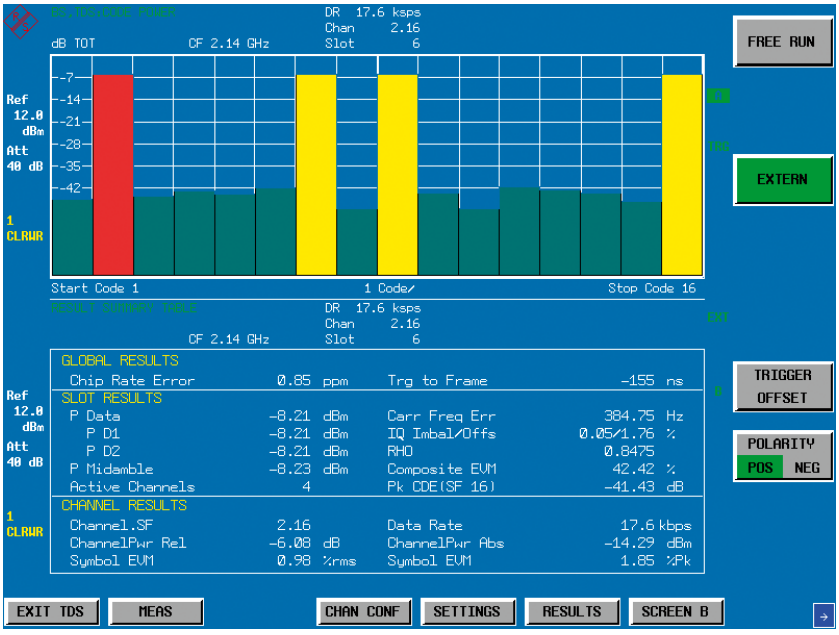
TD-SCDMA Test Application Firmware R&S®FS-K76/-K77

New

Base station and mobile station tests on TD-SCDMA with the R&S®FSQ, R&S®FSU and R&S®FSP



Code domain power measurement on a signal with 4 active channels (1)

Active and inactive channels are displayed; inactive channels (noise, interference) are displayed with a spreading factor of 16

The table also shows the main parameters of the total signal at a glance, e.g. total power, pilot power, frequency error and error of chip rate, as well as the parameters of the marked code channel such as code power and EVM

Brief description

Application Firmwares R&S®FS-K76 and R&S®FS-K77 can be installed on any analyzer of the R&S®FSQ/FSU/FSP series.

R&S®FS-K76 enhances the range of applications with code domain power and modulation measurements on TD-SCDMA base stations. R&S®FS-K77 provides user equipment (UE) functionality.

Featuring a wide dynamic range for adjacent channel power, the R&S®FSQ and the R&S®FSU are ideal tools for base station transmitter measurements in development. The R&S®FSP is the ideal partner in development and production, featuring low uncertainty in level measurement, high measurement speed and excellent RF characteristics.

Main features

- Adds measurement functions in line with 3GPP as well as China Wireless Telecommunication Standard Group (CWTS) specifications to the R&S®FSQ/FSU/FSP analyzer families
- R&S®FS-K76 provides the functionality needed for base station testing
- R&S®FS-K77 provides user equipment functionality

Characteristics

TD-SCDMA

Two variants of the TD-SCDMA standard are available. One is the low chip rate (LCR) option of the TDD mode in 3GPP. The second is standardized by the China Wireless Telecommunication (CWTS) Standard group and is also known as TSM. The main difference between these two variants is that they connect to differ-

Measurement	R&S®FSU/FSP/FSQ	R&S®FSU/FSP/FSQ with R&S®FS-K76	R&S®FSU/FSP/FSQ with R&S®FS-K77
Maximum output power	3	3	3
Frequency error	–	3	3
P-CCPCH power	–	3	N/A
Power control dynamic range	–	3	3
Total power dynamic range	–	3	3
Occupied bandwidth	3	3	3
Spectrum emission mask	–	3	3
ACLR	3	3	3
Spurious emissions	3		

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TD-SCDMA Test Application Firmware R&S®FS-K76/-K77

ent core networks. R&S®FS-K76 and R&S®FS-K77 support both variants.

Code domain power measurements
The main application is to determine the power in the individual code channels, referred to as code domain power measurement. The power ratios between the individual channels, for instance, can be checked for compliance with the nominal values. Moreover, this measurement is a very efficient tool for detecting transmitter impairments such as clipping or intermodulation that are not obvious from the spectrum alone.

Remote control
All measurements can be remote-controlled. The results and demodulated data bits can be transferred via the IEC/IEEE bus. This makes R&S®FS-K76 and R&S®FS-K77 ideal for use in production.

Specifications

The specifications are based on the specifications of the R&S®FSU, R&S®FSQ and R&S®FSP analyzers and have not been checked separately.
The specifications apply under the following conditions: 15 minutes warm up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to and internal calibration performed. Data with tolerances: measurement uncertainties with a confidence level of 95%. Data without tolerances: typical values. The specified level measurement uncertainties do not take into account systematic errors due to reduced S/N ratio.

Measurement	R&S®FSP	R&S®FSQ/FSU
Code domain power		
Measurement uncertainty		
Total signal power	<0.5 dB	<0.3 dB
Code power		
Absolute	<0.6 dB	<0.1 dB
Relative	<0.4 dB	<0.1 dB
Frequency error		
Measurement range	<4 kHz	<4 kHz
Uncertainty (S/N > 40 dB)	<1.5 Hz + error of reference frequency	<1.5 Hz + error of reference frequency
Composite EVM		
Measurement range	1.5% to 25%	1% to 25%
Inherent EVM	<1.5%	<1%
Measurement uncertainty	<0.5%	<0.25%
Peak code domain error (PCDE)		
Measurement range	0 dB to –50 dB	0 dB to –54 dB
Inherent PCDE	–44 dB	–54 dB
Measurement uncertainty	<1 dB (0 dB to –40 dB)	<1 dB (0 dB to –40 dB)

Measurement	R&S®FSP	R&S®FSQ/FSU
Output power		
Measurement uncertainty		
Absolute	<0.5 dB	<0.3 dB
Relative	<0.3 dB	<0.1 dB
Occupied bandwidth (99%)		
Measurement uncertainty	<20 kHz	<20 kHz
Spectrum emission mask		
Level uncertainty		
<3.6 GHz	<0.5 dB	<0.5 dB
3.6 GHz to 13 GHz	<2.5 dB	<2.5 dB
Trigger to frame		
Accuracy	<500 ns	<500 ns (R&S®FSU) <100 ns (R&S®FSQ)

Ordering information

Application Firmware R&S®FS-K76 and R&S®FS-K77 can be integrated into any member of the R&S®FSU/FSQ or R&S®FSP families.

TD-SCDMA Base Station Test Application Firmware	R&S®FS-K76	1300.7291.02
TD-SCDMA Mobile Station Test Application Firmware	R&S®FS-K77	1300.8100.02
Recommended extras		
High-Power Attenuator 20 dB, 50 W, 0 Hz to 6 GHz	R&S®RDL50	1035.1770.52
TV Trigger/RF Power Trigger (R&S®FSP only)	R&S®FSP-B6	1129.8594.02

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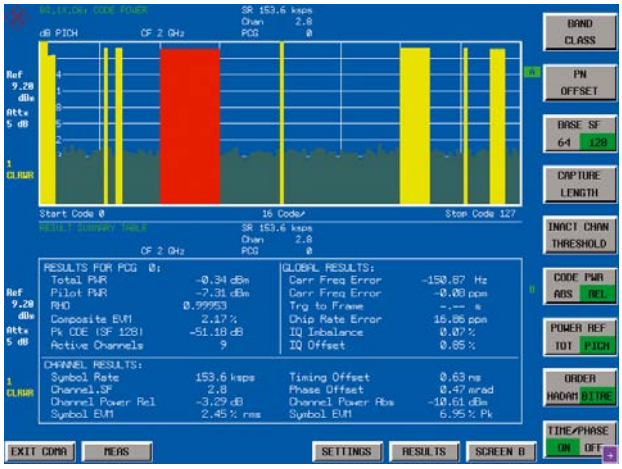
cdma2000 Base Station Test Application Firmware R&S®FS-K82
1xEV-DO Base Station Test Application Firmware R&S®FS-K84

New

Transmitter measurements on 3GPP2 signals with Signal Analyzer R&S®FSQ and Spectrum Analyzers R&S®FSU and R&S®FSP



Code domain power measurement on a signal with 9 active channels:
Active and inactive channels are displayed in bit-reversed order; inactive channels (noise, interference) are displayed with the base spreading factor. The table also shows the main parameters of the total signal at a glance, as well as the parameters of the marked code channel

Brief description

The R&S®FS-K82/FS-K84 application firmware packages can be installed on all models of the Signal Analyzers R&S®FSQ and Spectrum Analyzers R&S®FSU/FSP. R&S®FS-K82 enhances the range of applications to include code domain power and modulation measurements on cdma2000 signals for radio configurations 1 to 5. cdmaOne base station signals can be analyzed by using radio configuration 1 or 2. R&S®FS-K84 adds the capability to measure code domain power modulation accuracy on all four channel types (pilot, preamble, MAC and DATA) of a 1xEV-DO base station signal.

Featuring wide dynamic range for adjacent channel power, the R&S®FSQ and the R&S®FSU are ideal tools for cdma2000 base station transmitter measurements in development and production.

The R&S®FSP is the ideal development tool with easy-to-use measurement functions integrated into a cost-effective analyzer – the workhorse for every engineer.

Main features

- Adds measurement functions in line with 3GPP2 specifications to the R&S®FSU, R&S®FSQ and R&S®FSP analyzer families
- R&S®FS-K82: provides the functionality needed for cdma2000 testing
- R&S®FS-K84: provides 1xEV-DO functionality
- Provides the functionality needed for base station testing as well as the related parameters
  - Code domain power (code domain analyzer)
  - Code domain power versus time (R&S®FS-K82)
  - Rho
  - Error vector magnitude (EVM)
  - Peak code domain error
  - Power versus symbol
  - Symbol constellation
  - Channel table
  - Code domain error power
  - Power versus chip (R&S®FS-K84)

Measurement overview

Measurement	R&S®FSU/ FSP/FSQ	R&S®FSU/ FSP/FSQ with R&S®FS-K82	R&S®FSU/ FSP/FSQ with R&S®FS-K84
Maximum output power	x	x	x
Frequency error		x	x
Power control dynamic range		x	N/A
Power versus chip		N/A	x
Total power dynamic range		x	x
Occupied bandwidth	x	x	x
Spectrum emission mask		x	x
ACLR	x	x	x
Spurious emissions	x		
Rho		x	N/A
$Rho_{overall-1}$		N/A	x
$Rho_{overall-2}$		N/A	x
Rho_{pilot}		N/A	x
Error vector magnitude		x	x
Peak code domain error		x	x
Power versus time			x

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cdma2000 Base Station Test Application Firmware R&S®FS-K82

Code domain power measurements

The main application is the determination of the power in the individual code channels referred to as code domain power measurement. The power ratios between the individual channels, for instance, can be checked for compliance with the nominal values. Moreover, this measurement is a very efficient tool for detecting transmitter impairments such as clipping or intermodulation that are not obvious from the spectrum alone.

cdma2000

R&S®FS-K82 supports the analysis of orthogonal transmit diversity signals. Not only the signals for the separate antennas can be studied, but also the combined signal as it is seen by a mobile receiver.

1xEV-DO

The code domain analysis in R&S®FS-K84 comprises the analysis of the four different channel types of the signals. The modulation quality of the pilot, preamble, data and MAC parts can be evaluated separately. The modulation formats and the preamble length are automatically detected.

Remote control

All measurements can be remote-controlled. The results and demodulated data bits can be transferred via the IEC/IEEE bus. This makes R&S®FS-K82 and R&S®FS-K84 ideal for use in production.

Specifications

The specifications are based on the data sheet specifications of the Spectrum Analyzer R&S®FSQ, R&S®FSU and R&S®FSP and have not been checked separately. Specifications apply under the following conditions: 15 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to and internal calibration performed. Data with tolerances are measurement uncertainties with a confidence level of 95%. The specified level measurement errors do not take into account systematic errors due to reduced S/N ratio.

Common parameters

Measurement	R&S®FSP	R&S®FSU/ R&S®FSQ
Code domain power (applies to code domain power and code domain power versus slot)		
Measurement uncertainty		
Total signal power	<0.5 dB	<0.3 dB
Pilot power	<0.6 dB	<0.4 dB
Code power, absolute Code power, relative	<0.6 dB <0.1 dB	<0.4 dB <0.1 dB
Composite EVM		
Measurement range	1.5% to 25%	1% to 25%
Inherent EVM	<1.5%	<1%
Measurement uncertainty (% of reading)	<0.5	<0.25
Output power		
Measurement uncertainty, absolute Measurement uncertainty, relative	<0.5 dB <0.2 dB	<0.3 dB <0.1 dB
Occupied bandwidth (99%)		
Measurement uncertainty	<85 kHz	<85 kHz
Spurious emissions		
Level uncertainty <3.6 GHz Level uncertainty 3.6 GHz to 13 GHz	<0.5 dB <2.5 dB	<0.5 dB <2.5 dB
Trig to Frame		
Accuracy	<210 ns	<210 ns

R&S®FS-K82 only

Measurement	R&S®FSP	R&S®FSU/R&S®FSQ
Peak code domain error (PCDE)		
Measurement range	0 dB to 55 dB	0 dB to 60 dB
Inherent PCDE	55 dB	60 dB
Frequency error		
Measurement range Measurement uncertainty (S/N >40 dB) + error of reference frequency	<1 kHz <1.5 Hz	<1 kHz <1.5 Hz

R&S®FS-K84 only

Measurement	R&S®FSP	R&S®FSU/R&S®FSQ
Peak code domain error (PCDE)		
Measurement range	0 dB to –53 dB	0 dB to –58 dB
Inherent PCDE Pilot MAC Data Preamble	 –50 dB –53 dB –47 dB –50 dB	 –55 dB –58 dB –52 dB –55 dB
Measurement uncertainty	<1 dB (0 dB to –40 dB)	<1 dB (0 dB to –40 dB)
Frequency error		
Measurement range Measurement uncertainty (S/N >40 dB) + error of reference frequency	<8 kHz <1.5 Hz	<8 kHz <1.5 Hz

Ordering information

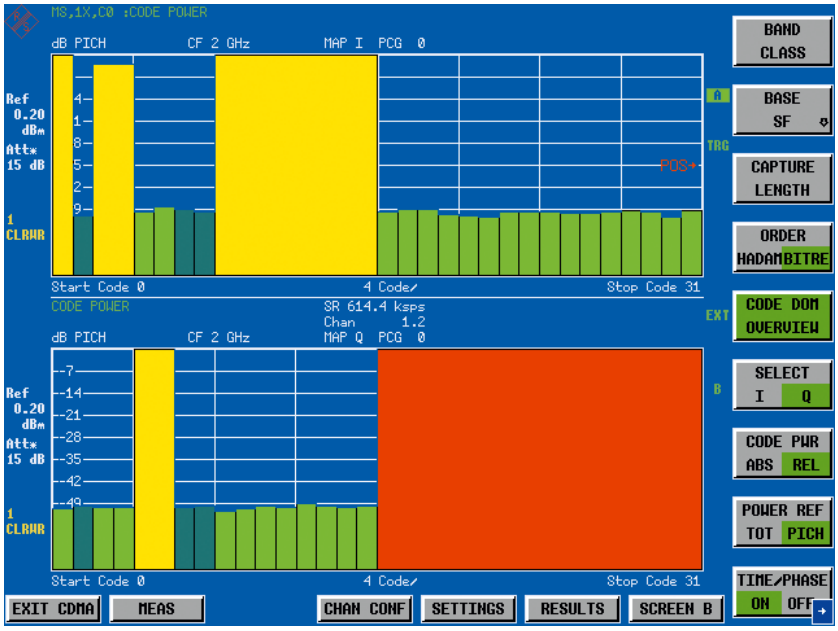
Application Firmware R&S®FS-K82 and R&S®FS-K84 can be integrated into any member of the R&S®FSU, R&S®FSQ or R&S®FSP families.

Application Firmware		
cdma2000 Base Station Test	R&S®FS-K82	1157.2316.02
1xEV-DO Base Station Test	R&S®FS-K84	1157.2851.02
Recommended extras		
High-Power Attenuator 20 dB, 50 W, 0 GHz to 6 GHz	R&S®RDL50	1035.1770.52

cdma2000/1xEV-DV Mobile Station Test Application Firmware R&S®FS-K83

New

Transmitter measurements on cdma2000 and 1xEV-DV reverse link with Signal Analyzer R&S®FSQ and Spectrum Analyzers R&S®FSU and R&S®FSP



Code domain power measurement on a signal with high data rate transmission

Active and inactive channels are displayed in bit-reversed order; inactive channels (noise, interference) are displayed with the base spreading factor. The upper half shows the inphase part of the signal, the lower half the quadrature part

Brief description

Application Firmware R&S®FS-K83 can be installed on all models of the Signal Analyzers R&S®FSQ and Spectrum Analyzers R&S®FSU and R&S®FSP.

Application Firmware R&S®FS-K83 enhances the range of applications to include code domain power and modulation measurements on cdma2000 signals for radio configurations 3 and 4 and 1xEV-DV revision C signals.

Featuring wide dynamic range for adjacent channel power, the R&S®FSQ and the R&S®FSU are ideal tools for cdma2000 mobile station transmitter measurements in development.

The R&S®FSP is the ideal partner in development and production, featuring low uncertainty in level measurement, high measurement speed as well as excellent RF characteristics.

Main features

- Adds measurement functions in line with 3GPP2 specifications to the R&S®FSU, R&S®FSQ and R&S®FSP analyzer families
- Provides the functionality needed for mobile station testing as well as the related parameters
  - Code domain power
  - Code domain power versus time
  - Rho

Measurement	R&S®FSU/FSP/FSQ	R&S®FSU/FSP/FSQ with R&S®FS-K83
Maximum output power	X	X
Frequency error	–	X
Power control dynamic range	–	X
Total power dynamic range	–	X
Occupied bandwidth	X	X
Spectrum emission mask	–	X
ACLR	X	X
Spurious emissions	X	–
Rho	–	X
Error vector magnitude	–	X
Peak code domain error	–	X
Time and phase offset	–	X

cdma2000/1xEV-DV Mobile Station Test Application Firmware R&S®FS-K83

– Error vector magnitude (EVM)
– Peak code domain error
– Power versus symbol
– Symbol constellation
– Channel table
– Code domain error power

Code domain power measurements

The main application is the determination of the power in the individual code channels referred to as code domain power measurement. The power ratios between the individual channels, for instance, can be checked for compliance with the nominal values. Moreover, this measurement is a very efficient tool for detecting transmitter impairments such as clipping or intermodulation that are not obvious from the spectrum alone.

1xEV-DV

To facilitate higher data rates, revision C of the 1xEV-DV standard has added two new channels for fast acknowledgment and quality indication of the radio channel. These new channels are automatically detected by the firmware.

Specifications

The specifications are based on the data sheet specifications of the R&S®FSU, R&S®FSQ and R&S®FSP analyzers and have not been checked separately.

Specifications apply under the following conditions: 15 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to and internal calibration performed. Data with tolerances: measurement uncertainties with a confidence level of 95%. Data without tolerances: typical values. The specified level measurement errors do not take into account systematic errors due to reduced S/N ratio.

Measurement	R&S®FSP	R&S®FSU/FSQ
Code domain power (applies to code domain power and code domain power versus slot)		
Measurement uncertainty		
Total signal power	<0.5 dB	<0.3 dB
Pilot power	<0.6 dB	<0.4 dB
Code power; absolute	<0.6 dB	<0.4 dB
Code power; relative	<0.1 dB	<0.1 dB
Frequency error		
Measurement range uncertainty (S/N >40 dB)	<2 kHz <1.5 Hz + error of reference frequency	<2 kHz <1.5 Hz + error of reference frequency
Composite EVM		
Measurement range	1.5% to 25%	1% to 25%
Inherent EVM	<1.5%	<1%
Measurement uncertainty	<0.5%	<0.25%

Measurement	R&S®FSP	R&S®FSU/FSQ
Peak code domain error		
Measurement range	0 dB to –55 dB	0 dB to –60 dB
Inherent PCDE		
SF = 16	–49 dB	–54 dB
SF = 32	–52 dB	–57 dB
SF = 64	–55 dB	–60 dB
Measurement uncertainty	<1 dB (0 dB to –40 dB)	<1 dB (0 dB to –40 dB)
Output power		
Measurement uncertainty, absolute	<0.5 dB	<0.3 dB
Measurement uncertainty, relative	<0.3 dB	<0.1 dB
Occupied bandwidth (99%)		
Measurement uncertainty	<85 kHz	<85 kHz
Spectrum emission mask		
Level uncertainty		
<3.6 GHz	<0.5 dB	<0.5 dB
3.6 GHz to 13 GHz	<2.5 dB	<2.5 dB
Trigger to frame		
Accuracy	<210 ns	<210 ns

Ordering information

Application Firmware R&S®FS-K83 can be integrated into any member of the R&S®FSQ, R&S®FSU or R&S®FSP families

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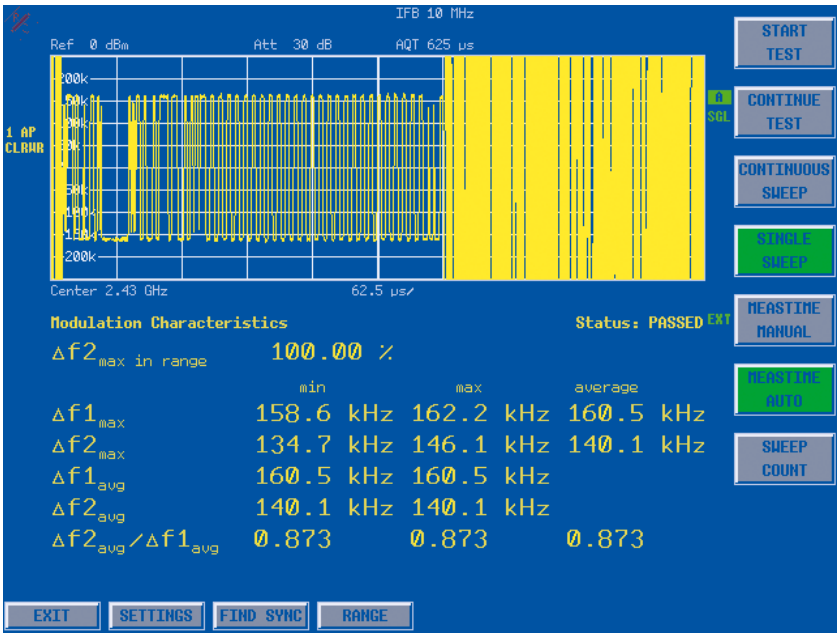
cdma2000/1×EV-DV Mobile Station Test Application Firmware	R&S®FS-K83	1157.2416.02
cdma2000 1xEV-DO MS Application Firmware	R&S®FS-K85	1300.6689.02
Recommended extras		
High-Power Attenuator 20 dB, 50 W, 0 GHz to 6 GHz	R&S®RDL50	1035.1770.52

Bluetooth Application Firmware R&S®FS-K8

***Bluetooth* transmitter measurements with Spectrum Analyzers R&S®FSP and R&S®FSU**



Measurement of modulation characteristics

Brief description

Application Firmware R&S®FS-K8 enhances the range of applications of the Spectrum Analyzers R&S®FSP and R&S®FSU to include measurements on *Bluetooth* transmitters. All measurements are carried out in line with the *Bluetooth* RF Test Specification (*Bluetooth* SIG) Rev. 1.1. Integrated limit value monitoring is provided for all measurements and allows analysis of the results in the development and production of *Bluetooth* modules.

Main features

- Enhanced measurement functionality for the spectrum analyzers of the R&S®FSP and R&S®FSU families in line with *Bluetooth* RF Test Specification (*Bluetooth* SIG) Rev. 1.1
- Measurement functions
  - Output power
  - Adjacent channel power (ACP)
  - Modulation characteristics
  - Initial carrier frequency tolerance (ICTF)
  - Carrier frequency drift
- Simultaneous display of traces and all numerical measurement results
- Automatic limit value monitoring
- Ideal for use in development and production of *Bluetooth* modules

Measurements

Output power

This measurement is provided for determining the maximum and average output power of the device under test during a burst. A complete packet is recorded in the time domain. The peak power is determined from the total trace contents, whereas the average power is derived from at least 20% to 80% of the burst. Triggering is effected to the sync word.

Adjacent channel power (ACP)

This measurement is provided for determining the power of all adjacent channels. The power of up to 79 channels in total can be measured (39 lower channels + TX channel + 39 upper channels).

Modulation characteristics

This measurement is provided for determining the maximum frequency deviation of all 8-bit test sequences of the payload. In addition, the average value of the maximum frequency deviations per packet is calculated and displayed.

Initial carrier frequency tolerance

This measurement is provided for determining the carrier offset of the four preamble bits. In accordance with the RF test specification, the carrier offset is calculated from the midpoint of the first preamble bit to the midpoint of the bit following the preamble.

Carrier frequency drift

This measurement is provided for determining the maximum frequency drift between the average value of the preamble bits and an arbitrary 10-bit group of the payload. The maximum drift rate of the payload is determined in addition.

Bluetooth Application Firmware R&S®FS-K8

Specifications

The specifications below are based on the data sheet specifications of the Spectrum Analyzer R&S®FSP and have not been checked separately.
Specifications apply under the following conditions:
15 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to and internal calibration performed.
Data with tolerances denotes measurement uncertainties with a confidence level of 95%.
Unless otherwise stated, specifications are quoted for an RF input level +30 dBm to –50 dBm within the *Bluetooth* band (ISM) 2400 MHz to 2483.5 MHz and default settings.

Output power	
Measurements	average and peak power to *Bluetooth* RF Test Specification
Level range	+30 dBm to –50 dBm
Level uncertainty	<0.7 dB (s = 0.25 dB)
Packet type	longest supported (DH1, DH3, DH5)
Payload	PRBS9
Synchronization	RF burst or preamble
Trigger	IF power, external, free run
Modulation characteristics	
Measurements	FM deviation according to *Bluetooth* RF Test Specification Δf1max, Δf2max, Δf1avg, Δf2avg and Δf2avg/Δf1avg
Deviation range	±250 kHz
Deviation uncertainty	<3 kHz (signal level >–25 dBm, 10 averages)
Packet type	longest supported (DH1, DH3, DH5)
Payload	10101010 and 11110000, auto detect
Synchronization	preamble
Trigger	IF power, external, free run

Initial carrier frequency tolerance (ICFT)	
Measurements	ICFT to *Bluetooth* RF Test Specification
Measurement range	±250 kHz
Uncertainty	<2 kHz + carrier frequency × reference error (signal level >–30 dBm)
Packet type	DH1
Payload	PRBS9
Synchronization	preamble
Trigger	IF power, external, free run
Carrier frequency drift	
Measurements	carrier frequency drift to *Bluetooth* RF Test Specification drift/packet and drift/50 µs
Measurement range	±250 kHz
Uncertainty	<2 kHz (signal level > –30 dBm)
Packet type	all supported (DH1, DH3, DH5)
Payload	10101010
Synchronization	preamble
Trigger	IF power, external, free run
Adjacent channel power (ACP)	
Measurements	adjacent channel power according to *Bluetooth* RF Test Specification
Level range	max. +20 dBm
Packet type	DH1
Payload	PRBS9
Synchronization	none
Trigger	external, free run

Ordering information

Bluetooth **Application Firmware for Measurements with R&S®FSP and R&S®FSU**	R&S®FS-K8	1157.2568.02

WLAN 802.11a Application Firmware R&S®FSP-K90

Specifications

New

The specifications of R&S®FSP-K90 are based on the specifications of the Spectrum Analyzer R&S®FSP and have not been checked separately. They are valid under the following conditions:

15 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to, and internal calibration performed. Data with tolerance limits: measurement uncertainties with a confidence level of 95%. Data without tolerance limits: typical values. The specified level measurement errors do not take into account systematic errors due to reduced S/N ratio.

Frequency	
Frequency range	
RF input	
R&S®FSP3	10 MHz to 3 GHz
R&S®FSP7	10 MHz to 7 GHz
R&S®FSP13	10 MHz to 13.6 GHz
R&S®FSP30	10 MHz to 30 GHz
R&S®FSP40	10 MHz to 40 GHz
Frequency setting	frequency channel number
Level	
Level range (RF input)	50 dBm to +30 dBm
Level setting	autorange, manual
Signal acquisition	
Supported standards	802.11a, 802.11g (OFDM)
Modulation format	BPSK, QPSK, 16QAM, 64QAM
Demodulator setting	manual
Capture length (continuous)	4.06 ms
Number of bursts that can be analyzed	1 to 10922 bursts (manual)
Result length (all evaluations vs. carriers –14 to +14; EVM vs. symbol and vs.carrier, constellation vs. symbol and vs. carrier)	capture length, 1 to 10922 bursts
Sweep time	
Spectrum mask	100 ms
ACPR	300 ms
Burst length (automatic detection of number of data symbols, manual)	1 to 1366 data symbols
Triggering (RF input)	free run, IF power, external

Adjustable parameters	
Pilot tracking	phase on/off, timing on/off, level on/off
Channel estimation	preamble and data, preamble
Measurement uncertainty	
Residual EVM (level 23 dBm to +30 dBm, average of 20 bursts, input = RF (f = 2.4 GHz or 5 GHz)	
Channel estimation = preamble and data	43 dB
Channel estimation = preamble	41 dB
Frequency error	
Lock range	40 ppm
Uncertainty	1 Hz + reference frequency uncertainty
Level uncertainty	
Test of spectrum mask	0.2 dB
Output power	
f <3.6 GHz	0.5 dB
3 GHz ≤ f ≤ 7 GHz	typ. 1 dB
ACPR (adjacent channel power ratio)	0.5 dB

Ordering information

WLAN 802.11a Application Firmware	R&S®FSP-K90	1300.6650.02
Spectrum Analyzer, 9 kHz to 3 GHz	R&S®FSP3	1164.4391.03
Spectrum Analyzer, 9 kHz to 7 GHz	R&S®FSP7	1164.4391.07
Spectrum Analyzer, 9 kHz to 13.6 GHz	R&S®FSP13	1164.4391.13
Spectrum Analyzer, 9 kHz to 30 GHz	R&S®FSP30	1164.4391.30
Spectrum Analyzer, 9 kHz to 40 GHz	R&S®FSP40	1164.4391.40
Recommended options and extras	see also data sheet Spectrum Analyzer R&S®FSP	

WLAN 802.11a Application Firmware R&S®FSQ-K90
WLAN 802.11a/b/g/j Application Firmware R&S®FSQ-K91

New

Transmitter measurements on WLAN 802.11 signals with the Signal Analyzer R&S®FSQ:

R&S®FSQ-K90: 802.11a (OFDM only)

R&S®FSQ-K91: 802.11a/b/g/j

Constellation diagram of all or (selectable) single carriers

Brief description

Application Firmware R&S®FSQ-K90 and R&S®FSQ-K91 expands the application range of the Signal Analyzers R&S®FSQ by spectrum and modulation measurements on OFDM signals in accordance with the WLAN standard IEEE 802.11a. The measurements specified by this standard can thus be performed at a keystroke, for example:

- Output power (burst power)
- Spectrum mask with limit lines and PASS/FAIL display
- Spectrum flatness (including display of group delay)
- Constellation error
- RF carrier leakage
- Carrier frequency and symbol clock error
- Adjacent channel power

Further analysis and evaluation facilities are often required in the development and verification phase:

- Constellation diagram for all carriers or a single carrier
- Constellation overview of all carriers
- EVM of single carriers
- EVM versus symbols or time
- Group delay
- Time-gated spectrum (FFT)
- Time-gated CCDF and crest factor
- Bit stream
- Analysis at the RF, IF, inverted IF or in the baseband (option R&S®FSQ-B71)
- Selectable tracking (phase, timing, level)

Application Firmware R&S®FSQ-K91 additional covers DSS/CCK signals

- Modulation formats BPSK, QPSK
- Data rates 1 MBps, 2 MBps, 5.5 MBps (CCK), 11 MBps (CCK)
- Modulation measurements
- Constellation diagram
- EVM according to definition 802.11b
- IQ offset, imbalance and quadratur error
- Frequency and symbol clock error
- Spectrum mask
- On/Off switching time
- Amplitude statistics (CCDF and Crest factor)

Main features

- Frequency range from 20 MHz to 3/8/26 GHz, depending on base unit
- Very low residual EVM of below –44 dB/–46 dB
- Automatic or manual setting of modulation format
- Analysis at the RF or in the baseband (optional)
- All measurement functions remote-controllable via IEC/IEEE bus or LAN
- High measurement rate of >2 measurements/s (54 Mbps, 16 payload symbols)
- Supports 802.11g OFDM

WLAN 802.11a Application Firmware R&S®FSQ-K90
WLAN 802.11a/b/g/j Application Firmware R&S®FSQ-K91

Specifications in brief

You will find detailed and binding data on the enclosed CD (../DATASHEET/FSQ-K90.pdf), or, for the latest updates, visit www.rohde-schwarz.com, search term: FSQ-K90

OFDM Analysis (802.11a, 802.11g-OFDM, 802.11j) (for R&S®FSQ-K90 only OFDM analysis applies)

Signal acquisition		
Supported standards		802.11a, 802.11g (OFDM), 802.11j (10 MHz), 802.11j (20 MHz)
Modulation format		BPSK, QPSK, 16QAM, 64QAM
Demodulator setting		auto, manual with/without test of signal field
Capture length	continuous	24 µs to 50 ms
Number of bursts that can be analyzed	manual	1 to 10922
Result length	PVT, spectrum FFT, CCDF EVM versus symbol and versus carrier, constellation versus symbol/versus carrier, spectrum flatness, bit stream, signal field	capture length, 1 to 10922 bursts or gate length capture length, 1 to 10922 bursts
Sweep time	spectrum mask	100 ms
	ACPR	300 ms
Burst length	automatic detection of number of data symbols or manual	1 to 1366 data symbols
Triggering	RF input	free run, IF power, external
	I/Q baseband input	free run, envelope of I/Q voltage, external
Result display		
Result list	min/mean/max min/mean/max min/mean/max	EVM all carriers EVM payload I/Q offset gain imbalance quadrature error center freq error symbol clock error mean burst power crest factor
Power vs Time		Full Burst, rising/falling edge
EVM		EVM vs Symbol EVM vs Carrier
Spectrum		Spectrum Mask (IEEE & ETSI) ACP (802.11j: Abs/Rel) Spectrum FFT Spectrum Flatness

DSSS/CCK Analysis (802.11b)

Signal acquisition		
Supported standards		802.11b,
Modulation format		DBPSK, DQPSK, CCK, short PLCP, long PLCP
Demodulator setting		auto, manual with/without test of signal field
Capture length	continuous	24 µs to 66 µs
Number of bursts that can be analyzed	manual	1 to 10922
Result length	PVT, spectrum FFT, CCDF EVM versus symbol and versus carrier, constellation versus symbol bit stream PLCP header	capture length, 1 to 10922 bursts or gate length capture length, 1 to 10922 bursts
Sweep time	spectrum mask, ACPR	200 ms
Burst length	automatic detection of number of data symbols or manual	1 to 4095 bytes
Triggering	RF input	free run, IF power, external
	I/Q baseband input	free run, envelope of I/Q voltage, external
Result display		
Result list	min/mean/max min/mean/max	peak vector error burst EVM I/Q offset gain imbalance quadrature error center freq error chip clock error rise time/fall time mean burst power peak burst power crest factor
Power versus Time		up ramp/down ramp
EVM		EVM versus symbol
Spectrum		spectrum mask, ACPR, spectrum FFT
Constellation		constellation diagram
Statistics		bitstream, PLCP header, CCDF
Limit check	Values according to standard	result list, power versus time, EVM, spectrum mask, ACP

Ordering information

WLAN 802.11a Application Firmware	R&S®FSQ-K90	1157.3064.02
WLAN 802.11a/b/g/j Application Firmware		
	R&S®FSQ-K91	1157.3129.02
Upgrade from R&S®FSQ-K90 to R&S®FSQ-K91	R&S®FSQ-K90U	1300.8000.02
Recommended extras	see also data sheet Signal Analyzer R&S®FSQ	
I/Q Baseband Inputs	R&S®FSQ-B71	1157.0113.02
I/Q Bandwidth Extension	R&S®FSQ-B72	1157.0336.02

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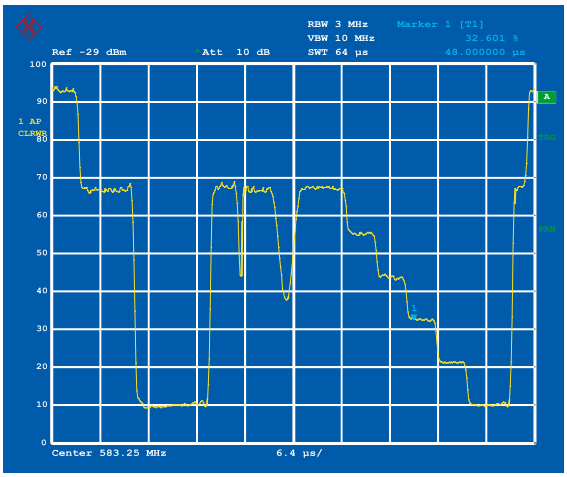
TV Trigger/RF Power Trigger R&S®FSP-B6

Makes the Spectrum Analyzers R&S®FSP suitable for analog TV measurement applications



Amplitude of RF carrier in line 17

Brief description

Option R&S®FSP-B6 makes the Spectrum Analyzers R&S®FSP suitable for analog TV measurement applications and provides a settable RF level trigger for measurements on pulsed RF signals that are used in TDMA transmission systems.

Main features

Analog TV applications

- Standards B/K, D/K, I, L and M
- Trigger to even, odd field or any line
- Measurement of modulation quality
- CCVS signal output
- Trigger to external CCVS signal

RF power trigger

- Large trigger bandwidth
- Settable trigger level
- Measurement on TDMA systems without trigger output

TV trigger

Measurements on analog TV signals require triggering to specific lines in the video signal. To this end, option R&S®FSP-B6 provides a trigger signal from a TV demodulator. Triggered to the desired line (horizontal sync) or a field (vertical sync), R&S®FSP displays the TV video signal in the time domain. So it is easy to measure the vision carrier amplitude in lines 17 or 18 for instance. The high level accuracy and the excellent display linearity of R&S®FSP ensure high-precision measurements.

R&S®FSP is fitted with a CCVS connector at the rear panel, thus allowing a visual assessment of the picture quality on a connected monitor. The connector is also used as an input to trigger R&S®FSP to an external CCVS signal.

RF power trigger

Using this feature R&S®FSP can be triggered by means of an RF level. The bandwidth available for triggering is ± 40 MHz about the R&S®FSP center frequency. The trigger level can be set in a range of 40 dB. This makes it very easy for the user to measure for instance the spectrum due to modulation of TDMA signals such as GSM or EDGE. A trigger from the DUT is not required and also quite often not available. Therefore elaborate additional circuits are not required to generate a trigger signal. In conjunction with the comprehensive R&S®FSP trigger functions such as pre-trigger and trigger-delay, the wide range of resolution bandwidths (10 Hz to 10 MHz) and the high display resolution (min. 31.25 ns), pulsed signals can be investigated in detail with minimum effort.

Specifications in brief

You will find detailed and binding data on the enclosed CD (../DATASHEET/FSP-B6.pdf), or, for the latest updates, visit www.rohde-schwarz.com, search term: FSP-B6

RF trigger	
Trigger source	RF level
Trigger level, setting range	40 dB, settable in 1 dB steps
RF bandwidth	80 MHz

TV trigger	
Trigger source	internal TV demodulator, video polarity selectable or external CCVS signal
Standards	B/G, D/K, I, L, M
Level range	
RF input	–10 dBm to –40 dBm (mixer level)
CCVS input	500 mV to 2 V (V_{pp})
Triggering	vertical and horizontal TV sync signals, any line within a 625- or 525-line system

Ordering information

TV Trigger/RF Power Trigger	R&S®FSP-B6	1129.8594.02

Contents Overview | Chapter Overview | Type Index | R&S Addresses

Harmonic Mixers R&S®FS-Z60/-Z75/-Z90/-Z110

Frequency range extension to 110 GHz for Spectrum Analyzers R&S®FSP40, R&S®FSU26/46/50, Signal Analyzer R&S®FSQ26 and EMI Test Receivers R&S®ESIB26 and R&S®ESIB40

Brief description

Harmonic Mixers R&S®FS-Z60/-Z75/-Z90/-Z110 extend the frequency range of Spectrum Analyzers R&S®FSEM/K and EMI Test Receivers R&S®ESIB26 and R&S®ESIB40 and Signal Analyzers R&S®FSIQ26.

The mixers are available with standard waveguide flanges to cover the following bands:

- R&S®FS-Z60: 40 GHz to 60 GHz (V band)
- R&S®FS-Z75: 50 GHz to 75 GHz (V band)
- R&S®FS-Z90: 60 GHz to 90 GHz (E band)
- R&S®FS-Z110: 75 GHz to 110 GHz (W band)

Main features

No additional biasing required
Due to their double diode design these mixers feature flat frequency response and require no additional biasing which makes them especially suitable for automated measurements. High accuracy requirements are met when operating the mixers with R&S®FSP/FSU/FSQ/ESIB. Therefore the harmonic mixers are suitable for EMC measurement applications.

Individual conversion loss table supplied
For each mixer an individual conversion loss table with 50 frequency points is supplied as a hardcopy and as a file on floppy disk. The data file can be transferred to the hard disk of the measuring instruments mentioned above. Once the file is activated, all additionally required parameters for mixer operation will be set automatically. This makes for extreme ease of operation. For quick reference each mixer is labelled with a look-up table with reduced number of data points.

High sensitivity
The low conversion loss and the high LO frequency range enable the user to measure even very low level signals.

High large-signal immunity
With a typical 1 dB compression point of +6 dBm and low conversion loss the mixers feature a very high dynamic range. Measurements of low level signals are possible even in the presence of high level signals, which considerably facilitates practical use.

Transparent spectrum display
Due to the high LO frequency (up to 15.2 GHz) and the resultant low order of harmonics used the number of unwanted responses is low. This yields a highly transparent spectrum display. Additionally the unwanted components can be automatically identified and suppressed by R&S®FSP/FSU/FSQ/ESIB.

Wide image-free frequency range
When operated with the R&S®FSP/FSU/FSQ/ESIB the high intermediate frequency of 741.4 MHz results in a wide frequency range without the display of image frequency responses. With low level input signals an image-free frequency range of 1482.8 MHz is obtained. This is sufficient for many applications and allows signal identification without additional measures being required.

Harmonic Mixers R&S®FS-Z60/-Z75/-Z90/-Z110

Specifications

Frequency range/level	**R&S®FS-Z60**	**R&S®FS-Z75**	**R&S®FS-Z90**	**R&S®FS-Z110**
Frequency range	40 GHz to 60 GHz	50 GHz to 75 GHz	60 GHz to 90 GHz	75 GHz to 110 GHz
Maximum input level (LO level <19 dBm) CW RF CW RF (+40 °C to +60 °C)	 +16 dBm +13 dBm			
1 dB compression	+6 dBm nominal			
Odd-order suppression	typ. 20 dB			
Conversion loss (when used with R&S®FSE/FSIQ/ESIB)	≤25 dB, typ. 18 dB	≤34 dB, typ. 25 dB	≤37.5 dB, typ. 34 dB	≤40 dB, typ. 32 dB
Frequency response within any 5-GHz band	<3 dB	<3 dB	<5 dB	<6 dB
Displayed average noise level when used with R&S®FSE/R&S®FSIQ/ESIB (RBW 1 kHz, VBW 100 Hz, 20 averages, trace average)	≤–107 dBm typ. –114 dBm	≤–98 dBm typ. –107 dBm	≤–94 dBm typ. –98 dBm	≤–92 dBm typ. –100 dBm
Measurement uncertainty				
Level uncertainty (95% confidence level, when used with R&S®FSE/R&S®FSIQ/ESIB) LO level +12.5 to +18.5 dBm)	<3.0 dB (+25 °C) <4.5 dB (+5 °C to +40 °C)			
Temperature drift (max.) +5 °C to +40 °C –20 °C to +60 °C	 <1.5 dB <2.5 dB			
RF input	WR 19, UG-383/ U-M flange (modified)	WR 15, UG-385/ U flange	WR 12, UG-387/ U flange	WR 10, UG-387/ U-M flange (modified)
VSWR	<3.5:1, typ. 2.2:1	<3.5:1, typ. 2.2:1	<3.6:1, typ. 2.5:1	<3:1, typ. 2.3:1
LO input/IF output				
Connector	SMA-connector			
LO signal				
Frequency range	9.81 GHz to 15.19 GHz	8.21 GHz to 12.62 GHz	8.21 GHz to 12.62 GHz	9.4 GHz to 14 GHz
Harmonic number	4	6	6	8
Optimum LO level	+15.5 dBm	+15.5 dBm	+15.5 dBm	+14 dBm
Maximum LO level	+19 dBm			
IF signal				
IF (nom.)	741.4 MHz	741.4 MHz	741.4 MHz	–
General data				
Nominal temperature range	+5 °C to +40 °C			
Limit temperature range	–20 °C to +60 °C			
Dimensions in mm (W × H × D)	28.6 × 33.8 × 63.5	20 × 29.5 × 60	20 × 29.5 × 60	28.6 × 33.8 × 63.5
Weight	170 g	150 g	150 g	150 g

Ordering information

Harmonic Mixer		
40 GHz to 60 GHz	R&S®FS-Z60	1089.0799.02
50 GHz to 75 GHz	R&S®FS-Z75	1089.0847.02
60 GHz to 90 GHz	R&S®FS-Z90	1089.0899.02
75 GHz to 110 GHz	R&S®FS-Z110	1089.0947.02
Required option for external mixing (for R&S®FSEK/M, R&S®ESIB26/40, R&S®FSIQ26)	R&S®FSE-B21	1084.7243.02
Accessories supplied [1]		
Operating manual, disk with conversion loss data, chart with conversion loss data, carrying case		

1) Connection cable is supplied with option R&S®FSE-B21.

Vector Network Analyzers R&S®ZVB

Frequency ranges up to

R&S®ZVB4: 4 GHz

R&S®ZVB8: 8 GHz

with 2 or 4 measurement ports

New

Brief description

The network analyzers of the R&S®ZVB family feature an innovative reflectometer concept that sets new standards. Each test port is provided with a separate generator, measurement channel and reference channel. This concept of independent reflectometers allows parallel measurements to be performed, a precondition for higher levels of performance even as the complexity of measurement tasks steadily increases. Based on this concept, the R&S®ZVB is especially able to carry out multiport measurements extremely quickly, e.g. on balanced SAW filters, duplex filters or antenna switching modules.

The R&S®ZVB combines excellent performance with low weight and compact design. Intelligent and user-friendly functions offer maximum ease of operation. They allow, for example, the large number of measured quantities involved in multiport and balanced measurements to be handled easily, and also offer a variety of ways to optimize production sequences – a smart solution that satisfies even the most exacting demands.

Main features

- Multiport measurements
- Balanced measurements, mixed-mode S parameters
- Separate generator for each test port
- Parallel measurements
- Calibration techniques:
  - TOSM, TRL/LRL, TOM, TRM, TNA
  - Multiport calibration techniques
  - Model-adaptable standards
- Extremely fast measurement times with simultaneous data transfer
- Dynamic range >123 dB
- IF bandwidths 1 Hz to 500 kHz
- Level sweep range 50 dB
- Up to 20001 points per trace
- Unlimited number of independent channels and traces
- Parallel loading of setups (preloading, setup swap)
- Operation via front-panel keys or mouse and keyboard
- Online help
- Measurement wizard
- Optimization of production sequences

Characteristics

The innovative concept implemented in the R&S®ZVB significantly enhances the analyzer's performance in terms of measurement speed, available configuration options and system characteristics. The test set is made up of independent reflectometer units, each with a separate generator, measurement channel and reference channel for the individual test ports. The use of a common frequency reference ensures high measurement accuracy and frequency selectivity. Electronic switches for forward/reverse switchover of measurement paths are not required in the test set. For this reason, no asymmetries occur between the analyzer test ports as may otherwise be the case as a result of the cascading of switches.

This means, for example, that the maximum output power of up to +13 dBm is available at each of the four test ports irrespective of the direction of measurement. With a specified dynamic range of >123 dB, the R&S®ZVB features very fast measurement times - even for applications requiring an extremely wide dynamic range.

Vector Network Analyzers R&S®ZVB

The instrument concept of independent reflectometers also allows parallel measurements to be performed at maximum speed. With its two or four internal generators, the analyzer carries out measurements on different port groups of a DUT simultaneously and independently. For example, the four parameters S11 to S44 representing the reflection coefficients of a four port DUT can be simultaneously measured and displayed, provided that there is adequate isolation between the ports. This reduces measurement time by a factor of approx. 4 compared with instruments featuring just one generator and an internal RF switch. Data processing in the instrument is also carried out in parallel, ranging from RF and IF through to digitization and display. Moreover, data transfer can be performed simultaneously with measurement. This means extremely fast measurement times even with complex tasks such as multiport measurements.

Functions and options

Function	Description	Standard/option
Two test ports	Integrated bidirectional RF test ports	Standard
Four test ports	Integrated bidirectional RF test ports	Standard
Active test set (PORT BIAS)	Input of DC power for supply of amplifiers via inner conductor of test port; requires external DC power supply	Standard
Multiport measurements	Complete S parameter matrix, wave quantities, wave quantity ratios, impedances, admittances, Z and Y parameters of multiport DUTs	Standard
Balanced measurements	Mixed-mode S parameters, mixed-mode Z and Y parameters, impedances and admittances of balanced DUTs	Standard
Calibration techniques	TOSM, TRL/LRL, TOM, TRM, TNA, normalization	Standard
Unlimited number of measurement diagrams, traces, decoupled measurements	Any number of traces can be created and freely assigned to measurement diagrams; simultaneous display of decoupled measurements	Standard
Setup swap; preloading	Several instrument setups can be loaded simultaneously into RAM; fast switchover between instrument setups	Standard
Segmented sweep, lin/log sweep	Optimization of sweeps by focusing on frequency ranges of interest	Standard
Level sweep; time-domain sweep	Measurement of DUT compression; determination of measured quantities as a function of time	
20001 points per trace	High frequency resolution for swept measurements	Standard
IF bandwidths 1 Hz to 500 kHz (in 1/2/5 steps)	Optimization of measurement speed and dynamic range	Standard
Level sweep	Wide level sweep range of 50 dB for compression measurements (no attenuators required)	Standard
Online support functions	Online help for current function, UNDO function for resetting the last one to five entries, Windows XP key for accessing the operating system, complete listing of current instrument setup	Standard
Measurement wizard	Step-by-step guidance through desired instrument setup, including calibration if required	Standard
Trace mathematics, equation editor, marker functions, trace statistics	Functions for online processing of measured data, linking of traces by means of any type of equations, for adjustments and statistical analyses	Standard
Limit lines	Online generation of envelopes from traces; import (and export) of data for limit lines	Standard
Trigger functions	Trigger options for starting a sweep, sweep segment, frequency point or partial measurement	Standard
Power viewer	Functions as a power meter: values derived from a USB sensor are displayed as a trace, requires Rohde&Schwarz power sensor with USB interface	Software
Oven-controlled crystal oscillator	Enhanced frequency accuracy	Option R&S®ZVAB-B4
COM/DCOM control	Control of R&S®ZVB firmware by external programs	Standard
Interfaces (2 × LAN, 4 × USB, IEC BUS, 10 MHz REF, MONITOR, USER CONTROL, EXT TRIGGER)	Control of R&S®ZVB, control of external devices or handlers by R&S®ZVB, fast TTL handler and sequence control, connection of peripherals, e.g. printer or storage media (see also interface description)	Standard
DC MEAS inputs	Measurement inputs for DC voltage, allowing PAE (power added efficiency) measurements	Standard

Vector Network Analyzers R&S®ZVB

Specifications in brief

You will find detailed and binding data on the enclosed CD (../DATASHEET/ZVB.pdf), or, for the latest updates, visit www.rohde-schwarz.com, search term: ZVB

Measurement range	
Number of test ports	4
Frequency range	
R&S ZVB4	300 kHz to 4 GHz
R&S ZVB8	300 kHz to 8 GHz
Frequency resolution	100 µHz
Number of measurement points	user-selectable, 1 to 20001
Time for measurement and data transfer	
for 201 measurement points (No additional time for data transfer is needed, as it is performed simultaneously during the measurement.)	<8 ms
Measurement bandwidths 1/2/5 steps	1 Hz to 500 kHz
Dynamic range	
between PORT 1 and PORT 2 and between PORT 3 and PORT 4 without system error correction at 10 Hz measurement bandwidth	
500 MHz to 4 GHz	>123 dB
Measurement accuracy	
Uncertainty of transmission measurements	
Above 50 MHz, for +5 dB to –60 dB	0.1 dB or 1°
Uncertainty of reflection measurements	
Above 300 kHz, for +3 dB to –15 dB	0.4 dB or 3°
Effective system data (up to 4 GHz)	
Directivity	>46 dB
Source match	>40 dB
Reflection tracking	>0.04 dB
Load match	>46 dB
Transmission tracking	>0.06 dB

Test port output	
Power range, 50 MHz to 4 GHz	–40 dBm to +13 dBm
Power uncertainty at –10 dBm without power calibration above 50 MHz (18 °C to 28 °C)	2 dB
Harmonics, 50 MHz to 4 GHz at +10 dBm	<–20 dBc
Test port input	
Match without system error correction up to 4 GHz	>16 dB
Maximum nominal input level	+13 dBm
Power measurement uncertainty, at –10 dBm without power calibration (18 °C to 28 °C), above 10 MHz	1 dB
Noise level, at 10 Hz measurement bandwidth, 100 MHz to 4 GHz	<–110 dBm
Interfaces	
IEC/IEEE BUS	remote control, IEEE 488, IEC 60625
LAN 1/LAN 2	2 network connectors, RJ-45
USB	2 connectors for USB devices (USB 1.1); 2 additional USB connectors on the front panel
MONITOR	IBM-PC-compatible VGA monitor connector, 15-pin Sub-D (for ext. monitor)
SER CONTROL	several control and trigger signals, 25-pin Sub-D, 3.3 V TTL for controlling external generators, for limit checks, sweep signals, etc
General data	
Display	21 cm (8.4") diagonal colour LCD
Resolution	800 × 600 × 262144 (high colour)
Operating temperature range	5 °C to 40 °C
Power supply	100 V to 240 V (AC) ±10% 50 Hz to 60 Hz ±5%,
Power consumption	450 W, typ. 350 W (standby: typ. 10 W)
Dimensions (W × H × D)	435 mm × 234 mm × 350 mm
Weight	20 kg

Vector Network Analyzers R&S®ZVB

Ordering information

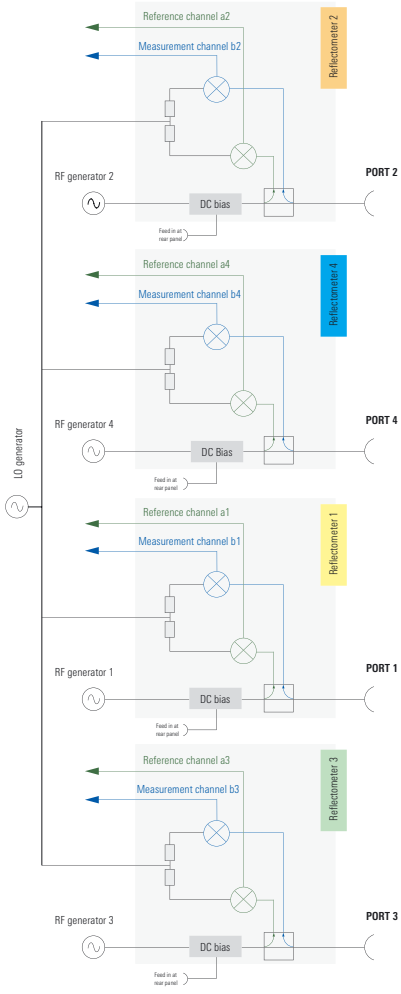
Order designation	Type	Frequency range	Order No.
Vector Network Analyzers			
Vector Network Analyzer, 2 ports	R&S®ZVB4	300 kHz to 4 GHz	1145.1010.04
Vector Network Analyzer, 2 ports	R&S®ZVB8	300 kHz to 8 GHz	1145.1010.08
Vector Network Analyzer, 4 ports	R&S®ZVB4	300 kHz to 4 GHz	1145.1010.06
Vector Network Analyzer, 4 ports	R&S®ZVB8	300 kHz to 8 GHz	1145.1010.10
Options			
Oven-Controlled Crystal Oscillator (OCXO)	R&S®ZVAB-B4		1164.1757.02
Extras			
Test Cables			
N (m)/N (m), 50 Ω	R&S®ZV-Z11	0 Hz to 18 GHz	1085.6505.03
N (m)/PC 3.5 mm, 50 Ω	R&S®ZV-Z13	0 Hz to 18 GHz	1134.3997.02
Calibration Kits			
N, 50 Ω	R&S®ZV-Z21	0 Hz to 18 GHz	1085.7099.02
N, 50 Ω	R&S®ZCAN	0 Hz to 3 GHz	0800.8515.52
PC 3.5 mm	R&S®ZV-Z32	0 Hz to 26.5 GHz	1128.3501.02
PC 3.5 mm (incl. sliding matches)	R&S®ZV-Z33	0 Hz to 26.5 GHz	1128.3518.02
TRL Suppl. Kit, N, 50 Ω	R&S®ZV-Z26	0.4 Hz to 18 GHz	1085.7318.02
TRL Suppl. Kit, PC 3.5 mm	R&S®ZV-Z27	0.4 Hz to 26.5 GHz	1085.7401.02
Sliding Matches			
N (m), 50 Ω	R&S®ZV-Z41	1.7 GHz to 18 GHz	1085.8095.02
N (f), 50 Ω	R&S®ZV-Z41	1.7 GHz to 18 GHz	1085.8095.03
N, PC 3.5 mm, 50 Ω (m/f pair)	R&S®ZV-Z42	0 Hz to 26.5 GHz	1128.3524.02
Hardware and Measurement Add-Ons			
USB Compact Keyboard	R&S®ZV-Z75		1157.6870.03
USB Mouse[1]	R&S®ZV-Z76		1157.7060.02
Cable for DC Input[2]	R&S®ZV-Z71		1164.1005.02
Bias Network	R&S®ZV-Z61	2 MHz to 4 GHz	1106.8130.02
DC Block	R&S®FSE-Z3	5 MHz to 7 GHz	4010.3895.00
Power Splitter 2 × 50 Ω	R&S®RVZ	0 Hz to 2.7 GHz	0800.6612.52
Attenuators			
1 W	R&S®DNF	0 Hz to 12.4 GHz	0272.4x10.50[3]
50 W	R&S®RBU50	0 Hz to 2 GHz	1073.8695.xx[4]
100 W	R&S®RBU100	0 Hz to 2 GHz	1073.8495.xx[4]
Matching Pads 50 Ω → 75 Ω			
Series resistor	R&S®RAZ	0 Hz to 2.7 GHz	0358.5714.02
L-section	R&S®RAM	0 Hz to 2.7 GHz	0358.6514.02
Miscellaneous			
19" Rack Adapter with front handles	R&S®ZZA-511		1096.3290.00

1) Supplied as standard.

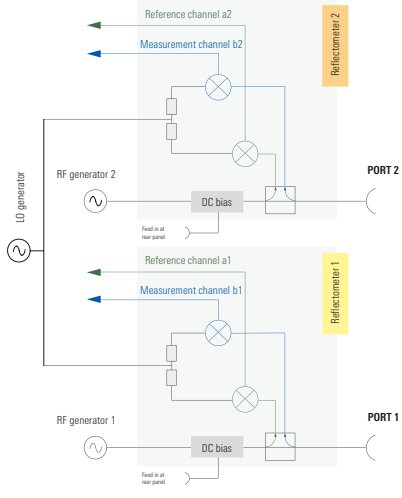
2) Mini DIN female to four banana plugs.

3) x = 0:3 dB, x = 1:6 dB, x = 2:10 dB, x = 3:20 dB, x = 4:30 dB.

4) xx = 03:3 dB, xx = 06:6 dB, xx = 10:10 dB, xx = 20:20 dB, xx = 30:30 dB.



Testset R&S®ZVB: 4 port model



Testset R&S®ZVB: 2 port model

Vector Network Analyzers R&S®ZVM, R&S®ZVK

R&S®ZVM: 10 Hz to 20 GHz

R&S®ZVK: 10 Hz to 40 GHz

Extremely fast, high-precision and versatile vector network analyzers

Vector Network Analyzer R&S®ZVM

Brief description

R&S®ZVM and R&S®ZVK extend the frequency range of the Rohde&Schwarz network analyzers to 20 GHz and 40 GHz. Their outstanding performance in terms of speed, dynamic range and accuracy shows already in standard applications such as S-parameter or group delay measurements. In addition, R&S®ZVM and R&S®ZVK can be used for complex measurement tasks, for example measurements on frequency-converting DUTs (conversion loss, intermodulation, spurious) and nonlinear measurements (intercept point and compression point).

Short measurement times

A powerful microprocessor system combined with ultra-fast synthesizers makes for extremely short measurement times even with a large number of test points and small measurement bandwidths. This in conjunction with short IEC/IEEE bus access and transfer times considerably speeds up automated test and production sequences.

Wide dynamic range

The extremely low-noise front end, using fundamental mixing, yields a dynamic range that, with appropriate configuration, by far exceeds the specified values of 115 dB and 110 dB. This exceptionally wide range makes it possible to measure RF components with high stopband attenuation and achieve high accuracy also at low power levels.

Measurements on linear and nonlinear components

The system concept of R&S®ZVM and R&S®ZVK with two independent synthesizers for the generator and receiver sections enables versatile measurements with excellent accuracy, wide dynamic range and high measurement speed on linear and nonlinear DUTs such as amplifiers and mixers. Three generators (one internal, two external) can be configured and controlled independently of each other. The fundamental mixing concept of R&S®ZVM and R&S®ZVK and the resulting high selectivity make additional external filters superfluous. The receiver will even detect weak signals such as intermodulation products and spurious, since the full sensitivity and dynamic range of R&S®ZVM and R&S®ZVK are available also for frequency-converting DUTs.

Typical measurements on amplifiers, frequency converters, multipliers, dividers, synthesizers etc are:

- Sidebands of mixers with fixed or tracking IF
- Any harmonics versus frequency or power
- Intermodulation products of amplifiers and mixers (e.g. IP3, IP5, IP7...)
- Spurious
- Mixture products of DUTs with multiple frequency conversion, multipliers, dividers and combinations of such components
- K factor
- Power added efficiency (PAE)

Contents Overview | Chapter Overview | Type Index | R&S Addresses

Vector Network Analyzers R&S®ZVM, R&S®ZVK

	R&S®ZVM	R&S®ZVK
Frequency range	10 MHz to 20 GHz	10 MHz to 40 GHz
Frequency resolution	100 µHz	
Impedance	50 Ω	
Test ports	PC 3.5 male	2.92 mm male
Measurement time (normalized)	<0.5 ms/point	<0.7 ms/point
Output power	+5 dBm/+2 dBm to –85 dBm	0 dBm/–5 dBm to –85 dBm
Power uncertainty	<1 dB to 2 dB	
Dynamic range[1] **(IF bandwidth 10 Hz)** [1] When using direct receiver access, dynamic range and sensitivity are increased to typ. 10 dB	>85 dB (<0.5 GHz) >115 dB (0.5 GHz to 8 GHz) >110 dB (8 GHz to 16 GHz) >100 dB (16 GHz to 20 GHz)	>80 dB (<0.5 GHz) >110 dB (0.5 GHz to 8 GHz) >105 dB (8 GHz to 16 GHz) >90 dB (16 GHz to 20 GHz) >90 dB (20 GHz to 28 GHz) >80 dB (28 GHz to 40 GHz)
Measurement bandwidths	1 Hz to 10 kHz (in 9 steps) and 26 kHz	
Calibration techniques	TOM, TRM, TNA, TOM-X, AutoKal (all Rohde&Schwarz patents), TRL, TOSM, normalization techniques	

Embedding and de-embedding of virtual networks, CAE software

The Virtual Embedding Networks option enables virtual embedding of arbitrary linear two-port networks into the test setup.

In testing for example components that have to be matched to a given impedance, an automatic embedding process allows the necessary matching network to be taken into account through mathematical algorithms of R&S®ZVM and R&S®ZVK. Conversely, by de-embedding, the influence of a known network can be eliminated.

The required data (*.S1P, *.S2P, *.S4P, *.flp) are obtained from a measurement of the existing network or generated by CAE tools from the theoretical model.

Time-domain measurements

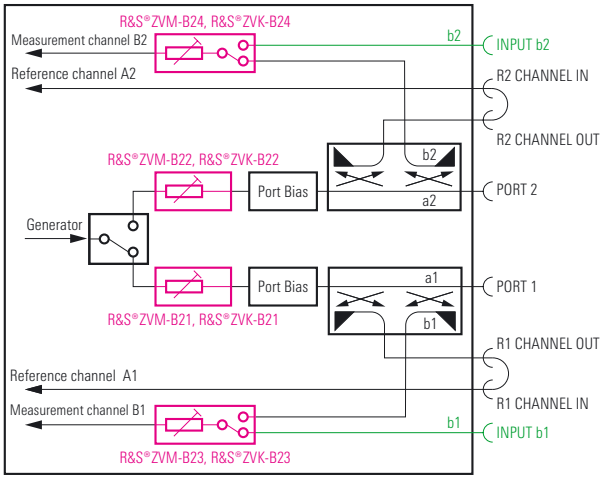
By transforming measurement data from the frequency to the time domain, discontinuities or impedances along the DUT can be displayed as a function of DUT length. With a maximum number of 2001 points, R&S®ZVM and R&S®ZVK can measure even very long DUTs with high resolution. Five filters allow the location of a discontinuity and the sidelobe suppression to be determined with optimum resolution. The S-parameters of a given discontinuity can be displayed in the time domain by setting a window (gating).

Special calibration techniques

R&S®ZVM and R&S®ZVK feature modern calibration techniques patented by Rohde&Schwarz that allow full two-port calibration using fewer or only partially known standards. This simplifies the design of calibration standards used for example in test fixtures or on wafers. Thus calibration in non-coaxial systems can be performed with a minimum of effort at maximum accuracy and dynamic range.

Internal PC and Ethernet

R&S®ZVM and R&S®ZVK are based on Windows NT. The user has complete access to the hard disk, the floppy disk drive and all interfaces of the internal PC. This allows, for example, the connection of an external monitor, the installation of any type of printer, or the use of software tools on R&S®ZVM or R&S®ZVK for result processing or control of the network analyzers via the IEC/IEEE bus or an internal RSIB data bus. R&S®ZVM and R&S®ZVK can thus act as controllers of their own or for a complete test or production system. Moreover, the internal PC enables control and data exchange via Ethernet.



Test set of R&S®ZVM and R&S®ZVK

Contents Overview | Chapter Overview | Type Index | R&S Addresses

Vector Network Analyzers R&S®ZVM, R&S®ZVK

Specifications in brief

You will find detailed and binding data on the enclosed CD (../DATASHEET/ZVM_K.pdf), or, for the latest updates, visit www.rohde-schwarz.com, search term: ZVM

Unless otherwise stated, specifications apply to test ports PORT 1 and PORT 2, a nominal output power of –10 dBm at the source port and an IF bandwidth ≤10 kHz.

Measurement range

Characteristic impedance	50 Ω		
Port connectors			
R&S®ZVM	3.5 mm (male)		
R&S®ZVK	2.92 mm (male)		
Frequency			
Range R&S®ZVM	10 MHz to 20 GHz		
Range R&S®ZVK	10 MHz to 40 GHz		
Uncertainty	$4 \times 10^{-6} + 1 \times 10^{-6} \times$ operating time in years		
Resolution	100 µHz		
Number of test points	1 to 2001 (selectable)		
Measurement time per point			
with min. 400 points	R&S®ZVM	R&S®ZVK	
and IF bandwidth of	10 Hz	10 kHz	10 kHz
with system error correction	<200 ms	<0.9 ms	<1.1 ms
normalized	<100 ms	<0.5 ms	<0.7 ms
Dynamic range (without system error correction, specified at IF bandwidth of 10 Hz, without optional attenuator, typical values are approx. 10 dB higher)			
R&S®ZVM	>115 dB		
R&S®ZVK	>110 dB		
Measurement bandwidths			
(IF bandwidths)	1 Hz to 10 kHz (half-decade steps) and 26 kHz (full)		

Measurement accuracy

After system error correction:
Specifications are based on a matched DUT, an IF bandwidth of 10 Hz, and a nominal output power of –10 dBm at the source port. Better values can be achieved depending on calibration kit. Dependance on frequency see data sheet

R&S®ZVM uncertainty	
Transmission measurements	0.1 dB or 1°
Reflection measurements	0.4 dB or 3°
R&S®ZVK uncertainty	
Transmission measurements	0.1 dB or 1°
Reflection measurements	1 dB or 6°

Effective system data

Frequency range	**50 MHz to 20 GHz**		**above 20 GHz**
	R&S®ZVM	**R&S®ZVK**	**R&S®ZVK**
Directivity	>46 dB	>42 dB	>38 dB
Source match	>36 dB	>36 dB	>33 dB
Reflection tracking	<0.1 dB	<0.1 dB	<0.1 dB
Load match	>46 dB	>42 dB	>38 dB
Transmission tracking	<0.1 dB	<0.1 dB	<0.2 dB

Output power

Range (without optional generator step attenuator)		
	R&S®ZVM	**R&S®ZVK**
up to 16 GHz	–20 to +5 dBm	–20 to 0 dBm
above 16 GHz	–20 to +2 dBm	–20 to –5 dBm
Uncertainty at –10 dBm		
150 MHz to 16 GHz (20 °C to 26 °C)	1 dB	1 dB
Linearity (referred to –10 dBm)		
above 150 MHz (20 °C to 26 °C)	<0.4 dB	<0.4 dB
Resolution	0.1 dB	0.1 dB

Spectral purity

Harmonics		
at maximum nominal source power	<–23 dBc	<–25 dBc
at –10 dBm source power	<–30 dBc	<–30 dBc
Spurious	<–35 dBc	<–35 dBc
SSB phase noise		
1 Hz bandwidth, 10 kHz from carrier	up to <–100 dBc	

Input level

Maximum nominal input level	
without optional receiver step attenuator	+5 dBm
with receiver step attenuator set to ≥30 dB	+27 dBm
Damage level	
without optional receiver step attenuator	+27 dBm
with receiver step attenuator set to ≥30 dB	+30 dBm
RMS noise level	
at IF bandwidth 10 Hz	up to <–110 dBm

Reference channel inputs

R CHANNEL IN	**R&S®ZVM**	**R&S®ZVK**
Connectors	SMA (female)	2.92 mm (female)
Maximum nominal input level	+5 dBm	+5 dBm
Damage level	+20 dBm	+20 dBm

Display

Screen	26 cm colour LCD, VGA, 256 Colors
Sweep modes	frequency, power, and time
Parameter formats (examples)	S parameters and derived quantities like SWR, impedance, admittance, group delay, etc, as well as nonlinear parameters (optional) like n dB compression point, SOI and TOI Complex parameters are displayed either in a complex form or formatted to magnitude, phase, real or imaginary part
Diagrams (examples)	Cartesian: linear, simple or double logarithmic, segmented polar: linear, logarithmic or segmented, Smith (any zoom), inverted Smith, Charter
Scaling (examples)	0.001 dB to 50 dB; 1 m° to 200 k°; 1 pU to 1 GU (automatically variable number of grid lines through MAX/MIN scaling)
Multichannel display	up to 4 independent display channels
Screen formats (examples)	overlay, dual/quad channel split
Markers	8 normal markers or 7 delta markers for each display channel
Marker resolution	4 significant digits

Vector Network Analyzers R&S®ZVM, R&S®ZVK

Marker formatting	selectable, independent of trace formatting
Automatic marker functions	marker tracking, marker search, marker target, band filter functions (Q, shape factor, etc)
Trace mathematics	all four arithmetical operations with up to three operands
Display lines	horizontal lines, circles or radial lines
Limit lines	pairs of curves formed from line segments in Cartesian diagrams, any circles in polar diagrams

Further connectors (rear panel)

PORT BIAS 1/2	DC bias inputs for PORT 1/2
EXT TRIGGER	input for external trigger signal
LEVEL	input for external level control
DC MEAS INPUTS DC 1/2	DC measurement inputs
EXT FREQ REF IN	input for external reference frequency
EXT FREQ REF OUT	output of internal reference frequency
EXTERNAL GENERATOR	Connectors for high-speed control of an external generator from Rohde& Schwarz families
BLANK (input)	TTL signal
TRIGGER (output)	TTL signal
ANALYZER MONITOR	IBM-PC-compatible VGA connector for analyzer screen
PC Monitor	IBM-PC-compatible VGA connector for PC screen
Mouse	IBM-PC-compatible PS/2 connector
Keyboard	IBM-PC-compatible 5-contact DIN connector
USER (input/output)	16 bit TTL, user-programmable, 25-contact sub-D
COM 1/COM 2	IBM-PC-compatible serial interfaces, RS-232-C, 9-contact sub-D
IEC/IEEE BUS	remote-control interface IEEE488, IEC625, 24-contact (for general applications)
IEC system bus	remote-control interface IEEE488, IEC625, 24-contact (for control of generators, e.g. as local oscillators in mixer measurements)
LPT	IBM-PC-compatible printer interface, Centronics, 25-contact sub-D
MULTIPORT	control of optional three-port and four-port adapters

General data

Operating temperature range	5 °C to 40 °C
Power supply	100 V to 120 V (AC) with tolerance ±10%, 6 A, 50 Hz to 400 Hz with tolerance –6% and +10% or
	200 V to 240 V (AC) with tolerance ±10%, 3 A, 50 Hz to 60 Hz with tolerance –6% and +10%
Power consumption	280 W (standby: 10 W)
Dimensions (W × H × D)	435 mm × 281 mm × 584 mm
Weight	30 kg

Options overview

Option	Type	Features and benefits
Time Domain	R&S®ZVR-B2	Localization of discontinuities, determination of reflection coefficients of discontinuities as a function of length/delay, supplementary function for calibration, tuning of filters, optimization of connectors, etc
Mixer Measurements	R&S®ZVR-B4	Easy converter and mixer measurements (conversion gain). Convenient measurements of amplifier and mixer products vs. frequency (spurious, harmonics, intermodulation products, etc)
Nonlinear Measurements	R&S®ZVR-B5	Display of compression point and SOI/TOI versus frequency
Power Calibration	R&S®ZVR-B7	High absolute power accuracy of generators (internal and external) and receivers for amplifier and mixer measurements
Virtual Embedding Networks	R&S®ZVR-K9	Replacing various test fixtures with physical matching networks by one single standard fixture and virtual networks. High accuracy and reproducibility, e.g. in SAW filter measurements
Ethernet Interface for internal PC	R&S®FSE-B16	Control and data transfer of R&S®ZVM or R&S®ZVK via Ethernet
IEC/IEEE bus Interface for internal PC	R&S®FSE-B17	Control of R&S®ZVM or R&S®ZVK and external test equipment by internal PC
Generator Step Attenuator PORT 1	R&S®ZVM-B21, R&S®ZVK-B21	Decrease of minimum generator output power down to –90 dBm at PORT 1
Generator Step Attenuator PORT 2	R&S®ZVM-B22, R&S®ZVK-B22	Decrease of minimum generator output power down to –90 dBm at PORT 2
Receiver Step Attenuator PORT 1	R&S®ZVM-B23, R&S®ZVK-B23	Increase of maximum receiver input power at PORT 1 to +27 dBm Direct access to measurement channel b1
Receiver Step Attenuator PORT 2	R&S®ZVM-B24, R&S®ZVK-B24	Increase of maximum receiver input power at PORT 2 to +27 dBm Direct access to measurement channel b22

Vector Network Analyzers R&S®ZVM, R&S®ZVK

Ordering information

Order designation	Type	Frequency range	Order No.
Vector Network Analyzer			
4-channel, 50 Ω, active test set	R&S®ZVM R&S®ZVK	10 MHz to 20 GHz 10 MHz to 40 GHz	1127.8500.60 1127.8651.60
Options			
Time Domain	R&S®ZVR-B2	–	1044.1009.02
Mixer Measurements[1]	R&S®ZVR-B4	–	1044.1215.02
Nonlinear Measurements	R&S®ZVR-B5	–	1044.1321.02
Power Calibration[2]	R&S®ZVR-B7	–	1044.1544.02
Virtual Embedding Networks[3]	R&S®ZVR-K9	–	1106.8830.02
Ethernet AUI for int. PC	R&S®FSE-B16	–	1073.5973.02
Ethernet BNC for int. PC	R&S®FSE-B16	–	1073.5973.03
Ethernet RJ-45 for int. PC	R&S®FSE-B16	–	1073.5973.04
IEC/IEEE bus Interface for internal PC	R&S®FSE-B17	–	1066.4017.02
Generator Step Attenuator for R&S®ZVM, PORT 1	R&S®ZVM-B21	–	1128.1009.11
Generator Step Attenuator for R&S®ZVM, PORT 2	R&S®ZVM-B22	–	1128.1009.21
Receiver Step Attenuator for R&S®ZVM, PORT 1[4]	R&S®ZVM-B23	–	1128.1009.12
Receiver Step Attenuator for R&S®ZVM, PORT 2[5]	R&S®ZVM-B24	–	1128.1009.22
Generator Step Attenuator for R&S®ZVK, PORT 1	R&S®ZVK-B21	–	1128.1409.11
Generator Step Attenuator for R&S®ZVK, PORT 2	R&S®ZVK-B22	–	1128.1409.21
Receiver Step Attenuator for R&S®ZVK, PORT 1[4]	R&S®ZVK-B23	–	1128.1409.12
Receiver Step Attenuator for R&S®ZVK, PORT 2[5]	R&S®ZVK-B24	–	1128.1409.22
R&S®ZVM, R&S®ZVK accessories			
Test Cables (pairs)			
PC3.5 (f)/PC3.5 (m), 50 Ω (for R&S®ZVM)[6]	R&S®ZV-Z14	0 Hz to 26.5 GHz	1134.4093.02
2.92 mm (f)/2.92 mm (m), 50 Ω (for R&S®ZVK)[6]	R&S®ZV-Z15	0 Hz to 40 GHz	1134.4193.02
Calibration Kits			
PC3.5 (for R&S®ZVM)	R&S®ZV-Z32	0 Hz to 26.5 GHz	1128.3501.02
PC3.5 incl. Sliding Matches (for R&S®ZVM)	R&S®ZV-Z33	0 Hz to 26.5 GHz	1128.3518.02
2.92 mm (for R&S®ZVK)	R&S®ZV-Z34	0 Hz to 40 GHz	1128.3530.02
2.92 mm incl. Sliding Matches (for R&S®ZVK)	R&S®ZV-Z35	0 Hz to 40 GHz	1128.3547.02
N, 50 Ω	R&S®ZV-Z21	0 Hz to 18 GHz	1085.7099.02
TRL Supplementary Kit, N, 50 Ω	R&S®ZV-Z26	0.4 GHz to 18 GHz	1085.7318.02
TRL Supplementary Kit, PC3.5, 50 Ω	R&S®ZV-Z27	0.4 GHz to 26.5 GHz	1085.7401.02
TOM-X Supplementary Kit, N, 50 Ω	R&S®ZV-Z28	0 Hz to 18 GHz	1085.7499.03
TOM-X Supplementary Kit, PC3.5, 50 Ω	R&S®ZV-Z29	4 GHz to 26.5 GHz	1085.7647.03
Sliding Matches			
N (m), 50 Ω	R&S®ZV-Z41	1.7 GHz to 18 GHz	1085.8095.02
N (f), 50 Ω	R&S®ZV-Z41	1.7 GHz to 18 GHz	1085.8095.03
PC3.5 pair m, f (for ZVM)	R&S®ZV-Z42	0 Hz to 26.5 GHz	1128.3524.02
2.92 mm pair m, f (for ZVK)	R&S®ZV-Z44	0 Hz to 40 GHz	1128.3553.02
General accessories			
Hardware Options N, 50 Ω			
AutoKal[7]	R&S®ZVR-B1	0 Hz to 8 GHz	1044.0625.02
3-Port Adapter[7]	R&S®ZVR-B8	0 Hz to 4 GHz	1086.0000.02
4-Port Adapter (2 × SPDT)[7]	R&S®ZVR-B14	0 Hz to 4 GHz	1106.7510.02
4-Port Adapter (SP3T)[7]	R&S®ZVR-B14	0 Hz to 4 GHz	1106.7510.03
Test Cables (pairs)			
N (m)/N (m), 50 Ω	R&S®ZV-Z11	0 Hz to 18 GHz	1085.6505.03
N (m)/N (m), 75 Ω	R&S®ZV-Z12	0 Hz to 4 GHz	1085.6570.02
N (m)/PC3.5 (m), 50 Ω	R&S®ZV-Z13	0 Hz to 18 GHz	1134.3997.02
Calibration Kits			
N, 50 Ω	R&S®ZCAN	0 Hz to 3 GHz	0800.8515.52
N, 75 Ω	R&S®ZCAN	0 Hz to 3 GHz	0800.8515.72
Attenuators			
1 W	R&S®DNF	0 Hz to 12.4 GHz	0272.4x10.50[8]
50 W	R&S®RBU 50	0 Hz to 2 GHz	1073.8695.xx[9]
100 W	R&S®RBU100	0 Hz to 2 GHz	1073.8495.xx[9]
Matching Pads, N, 50 Ω → N, 75 Ω			
Series Resistor	R&S®RAZ	0 Hz to 2.7 GHz	0358.5714.02
L Section	R&S®RAM	0 Hz to 2.7 GHz	0358.5414.02
Various Accessories, N, 50 Ω			
T Check	R&S®ZV-Z60	0 Hz to 4 GHz	1108.4990.50
Bias Network	R&S®ZV-Z61	2 MHz to 4 GHz	1106.8130.02
DC Block	R&S®FSE-Z3	5 MHz to 7 GHz	4010.3895.00
Power Splitter 2 × 50 Ω	R&S®RVZ	0 Hz to 2.7 GHz	0800.6612.52
External SWR-Bridges			
N (f), 50 Ω	R&S®ZRA	40 kHz to 150 MHz	1052.3607.52
N (f), 50 Ω	R&S®ZRB2	5 MHz to 3 GHz	0373.9017.52
N (f), 75 Ω	R&S®ZRB2	5 MHz to 2 GHz	0802.1018.73
N (f), 50 Ω	R&S®ZRC	40 kHz to 4 GHz	1039.9492.52
N (f), 75 Ω	R&S®ZRC	40 kHz to 2.5 GHz	1039.9492.72
Miscellaneous			
Transit Case	R&S®ZZK-965	–	1013.9437.00
19"-Rack Adapter with front handles	R&S®ZZA-96	–	0396.4928.00

1) Harmonics and arbitrary frequency conversion measurement included.

2) Power meter and sensor required.

3) Only for R&S®ZVR, R&S®ZVC, R&S®ZVM, R&S®ZVK.

4) Comprises test port 'Input b1', for bypassing coupler at PORT 1.

5) Comprises test port 'Input b2', for bypassing coupler at PORT 2.

6) For ruggedized port.

7) Two adapters PC 3.5 (f)/N (f) or 2.92 mm (f)/N (f) required.

8) x = 0: 3 dB, x = 1: 6 dB, x = 2: 10 dB, x = 3: 20 dB, x = 4: 30 dB.

9) xx = 03: 3 dB, xx = 06: 6 dB, xx = 10: 10 dB, xx = 20: 20 dB, xx = 30: 30 dB.

SWR Bridges R&S®ZRA, R&S®ZRB2, R&S®ZRC, R&S®VCA-Z1

Measurement of reflection coefficient of RF circuits and components

R&S®ZRA: 40 kHz to 150 MHz

R&S®ZRB2: 5 MHz to 3 GHz

R&S®ZRC: 40 kHz to 4 GHz

R&S®VCA-Z1: 5 MHz to 850 MHz

SWR Bridge R&S®ZRC with calibration standards

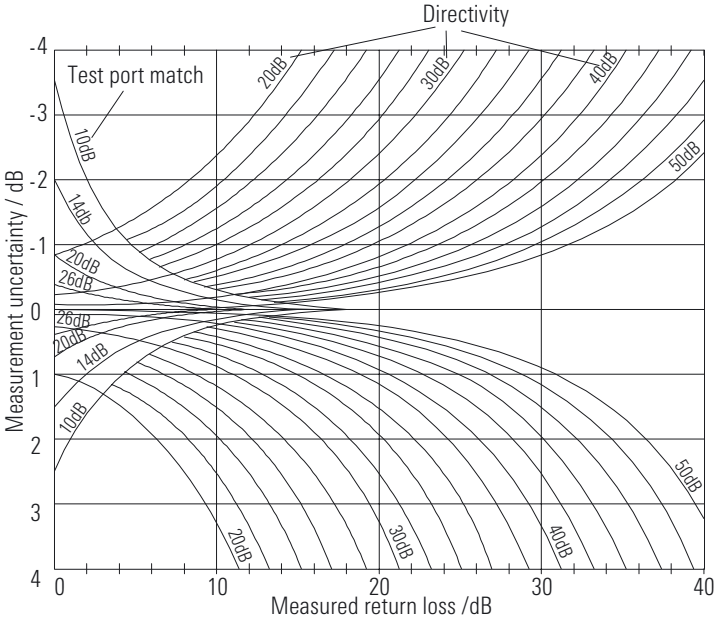
Brief description

SWR bridges are used for measuring the reflection coefficient of RF circuits and components. The output signal from the signal generator, e.g. the tracking generator of Spectrum Analyzer FSx or one Network Analyzer R&S®ZVx is applied to the device under test via the SWR bridge. Depending on the reflection coefficient of the device under test, part of the signal is reflected to the bridge and then routed to the receiver, e.g. to the test input of FSx or in the case of external test sets to the additional test input "Input b2" or "Input b1", where it is detected and displayed.

Measurement accuracy

The accuracy of the bridge is limited by its directivity as well as by the SWR of the bridge at the test port. The measurement of small reflection coefficients is affected by the finite directivity. Reflection coefficients that are smaller than the directivity cannot be measured directly. In measurements of large reflection coefficients, the accuracy depends primarily on the matching at the test port.

The diagram shown allows a quantitative evaluation of the measurement accuracy.



Measurement uncertainties as a function of directivity and test port matching of the bridge

SWR Bridges R&S®ZRA, R&S®ZRB2, R&S®ZRC, R&S®VCA-Z1

Specifications in brief, ordering information

Designation	R&S®ZRA	R&S®ZRB2	R&S®ZRB2 (precision)	R&S®ZRB2
Impedance	50 Ω	50 Ω	50 Ω	75 Ω
Frequency range	40 kHz to 150 MHz	5 MHz to 2.5 GHz	5 MHz to 3 GHz	5 MHz to 2 GHz
Directivity	≥45 dB (up to 1 MHz)	≥40 dB	≥46 dB (up to 2 GHz)	≥40 dB
	≥40 dB (up to 150 MHz)		≥40 dB (up to 2.5 GHz)	
			≥34 dB (up to 3 GHz)	
Test port matching	≥20 dB (up to 200 kHz)	≥23 dB	≥26 dB (up to 2.5 GHz)	≥20 dB (up to1.5 GHz)
	≥30 dB (0.2 MHz to 50 MHz)		≥22 dB (up to 3 GHz)	
	≥20 dB (up to 150 MHz)			
Insertion loss[1]	7.5 dB + 6 dB	7 dB + 6 dB	7 dB + 6 dB	8 dB + 6 dB
Power-handling capacity	0.5 W	0.5 W	0.5 W	0.5 W
Test port connector	N female	N female, N male	N female, N male	N female
Accessories supplied	–	–	–	–
Rated temperature range	0 °C to +50 °C	0 °C to +50 °C	0 °C to +50 °C	0 °C to +50 °C
Storage temperature range	–40 °C to +70 °C	–40 °C to +70 °C	–40 °C to +70 °C	–40 °C to +70 °C
Connectors[2]	N female	N female	N female	N female
Weight	240 g	240 g	240 g	250 g
Dimensions[3]	72 mm × 57mm × 33 mm	72 mm × 57 mm × 20 mm	72 mm × 57 mm × 20 mm	72 mm × 57 mm × 22 mm
Order numbers	1052.3607.52	373.9017.53 373.9017.56	373.9017.52 373.9017.55	802.1018.73

Designation	R&S®ZRC	R&S®ZRC	R&S®VCA-Z1
Impedance	50 Ω	75 Ω	75 Ω
Frequency range	40 kHz to 4 GHz	40 kHz to 2.5 GHz	5 MHz to 850 MHz
Directivity	≥40 dB (up to 3 GHz)	≥40 dB	≥40 dB (up to 300 MHz)
			≥34 dB (up to 850 MHz)
Test port matching	≥12 dB + 11 dB log	≥8 dB + 12 dB log	≥20 dB
	(f/40 kHz) (up to 400 kHz)	(f/40 kHz) (up to 400 kHz)	
	≥23 dB (up to 3 GHz)	≥20 dB (400 kHz to 2.5 GHz)	
	≥20 dB (3 GHz to 4 GHz)		
Insertion loss[1]	7 dB + 6 dB	7 dB + 6 dB	8 dB + 5 dB
Power-handling capacity	0.5 W	0.5 W	0.5 W
Test port connector	N female, N male	N female, N male	BNC male
Accessories supplied	short/open, termination, connector adapter	short/open, termination, connector adapter	–
Rated temperature range	0 °C to +50 °C	0 °C to +50 °C	0 °C to +50 °C
Storage temperature range	–40 °C to +70 °C	–40 °C to +70 °C	–40 °C to +70 °C
Connectors[2]	N female	N female	BNC female
Weight	340 g	340 g	250 g
Dimensions[3]	72 mm × 77 mm × 24 mm	72 mm × 77 mm × 24 mm	72 mm × 57 mm × 22 mm
Order numbers	1039.9492.52 1039.9492.55	1039.9492.72 1039.9492.75	1052.5900.02

1) Input attenuation ----> test port + test port ---> output.

2) Input, output.

3) In mm without connectors.