R&S®FSV
Signal and Spectrum Analyzer
Universal and wideband

ROHDE & SCHWARZ

R&S®FSV
Signal and
Spectrum Analyzer
At a glance

The R&S®FSV is an exceptionally fast and versatile signal and spectrum analyzer for performance-oriented, cost-conscious users working in the development, production, installation and servicing of RF systems.

In development applications, the R&S®FSV excels due to its outstanding RF properties, a 160 MHz signal analysis bandwidth that is unmatched in its class, and a wide range of analysis packages for analog modulation methods as well as wireless and wideband communications standards.

The R&S®FSV is five times faster than comparable signal and spectrum analyzers and provides measurement routines that are optimized for speed and high data throughput. This is a crucial advantage in production applications.

With its touchscreen for easy operation, compact dimensions, low weight and direct support of power sensors, the R&S®FSV is the best possible choice for installation and service work.

Key facts
- Frequency range up to 4/7/13.6/30/40 GHz
- Up to 160 MHz signal analysis bandwidth
- 0.4 dB level measurement uncertainty up to 7 GHz
- Measurement applications for GSM/EDGE (including EDGE Evolution), WCDMA/HSPA+, LTE, WiMAX™, WLAN, CDMA2000®, 1xEV-DO, vector signal analysis
- Easy on-site upgrading with options
- −110 dBc (1 Hz) phase noise at 10 kHz frequency offset
- +15 dBm third order intercept (TOI)
- Displayed average noise level (DANL) in 1 Hz bandwidth: −155 dBm at 1 GHz, −147 dBm at 30 GHz, with R&S®FSV-B24 preamplifier: −162 dBm at 30 GHz
- Removable hard drive for applications where security is a concern
- Frequency range up to 110 GHz with the R&S®FSV-B21 option integrated in the R&S®FSV30/40 and the R&S®FS-Z60/-Z75/-Z90/-Z110 harmonics mixers

R&S®FSV Signal and Spectrum Analyzer

Benefits and key features

Ready for tomorrow's standards

❚ Fully digital back-end ensures high measurement accuracy and excellent repeatability
❚ 160 MHz signal analysis bandwidth largest in its class; suitable for WLAN IEEE 802.11ac
❚ Largest I/Q memory depth in its class for recording long signal sequences
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Low test costs and high throughput for efficient production

❚ Up to five times faster than other signal and spectrum analyzers
❚ Customized test routines for production applications
❚ Efficient operation via remote control
▷ page 5

Wealth of functions and performance for effective use in labs

❚ Outstanding RF performance for a mid-range analyzer
❚ Unsurpassed level measurement accuracy up to 7 GHz
❚ Power measurement functions for the analysis of digital communications systems
❚ Versatile marker and trace functions
❚ Scalar network analysis: easy measurement of frequency response, bandwidth, gain
▷ page 6

Intuitive operation

❚ Touchscreen operation
❚ Hotkeys for fast access to all important functions
▷ page 7

Easy transition to the next generation in signal analysis

❚ Remote control compatibility with the R&S®FSP and R&S®FSU
❚ Functional compatibility with existing Rohde & Schwarz signal and spectrum analyzers
▷ page 8

Low life-cycle costs

❚ Easy on-site upgrading with options
❚ Easy scalability to handle application-specific requirements
❚ Always up-to-date with free firmware updates
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Ready for tomorrow's standards

Featuring a signal analysis bandwidth of up to 160 MHz – the largest in its class – the R&S®FSV is a sound investment, ready for the future. The R&S®FSV has what is needed to analyze and demodulate existing and future communications standards.

Fully digital back-end ensures high measurement accuracy and excellent repeatability
❙ 28 MHz signal analysis bandwidth with base unit; 40 MHz and 160 MHz optional
❙ 16-bit A/D converter with 128 MHz sampling frequency for wide dynamic range and excellent display linearity
❙ 200 Msample signal memory for largest memory depth in its class
❙ High measurement accuracy and good repeatability with digitally implemented analysis filters

160 MHz signal analysis bandwidth largest in its class; suitable for WLAN IEEE 802.11ac
Wireless communications systems are using ever larger RF bandwidths in their quest to boost data rates and transmission capacity. Due to its large signal analysis bandwidth and wealth of software options, the R&S®FSV signal and spectrum analyzer is the only instrument in its class that can handle all existing and most forthcoming wireless communications applications.

Largest I/Q memory depth in its class for recording long signal sequences
The base unit of the R&S®FSV provides an I/Q memory depth of 200 Msample. This ensures data recording over a long time period even when testing systems with high bandwidths and high sample rates. Conventional signal analyzers have an I/Q memory depth of only a few Msample.

The R&S®FSV is ideally suited for performing wideband modulation measurements during the development and production of chipsets and terminal equipment as well as in the development, maintenance and installation of infrastructures.

Measurement of the power of a wideband WLAN signal using the time domain power function.

Signal analysis bandwidth			
Standard	28 MHz bandwidth (standard)	40 MHz bandwidth (optional)	160 MHz bandwidth (optional)
LTE	exceeds the 20 MHz max. channel width of LTE signals	with LTE carrier aggregation, up to two neighboring 20 MHz LTE channels can be analyzed	wireless communications bands can be fully analyzed
WLAN	exceeds the 20 MHz channel width of WLAN IEEE 802.11a/b/g signals	covers WLAN IEEE 802.11n wideband technology	covers WLAN IEEE 802.11ac wideband technology
WCDMA	exceeds the 20 MHz bandwidth required for CCDF measurements on four-carrier WCDMA signals	–	–

Low test costs and high throughput for efficient production

The R&S®FSV signal and spectrum analyzer significantly reduces the testing time and expense in a production environment. It performs everything from simple measurements to complex modulation analyses quickly, reliably and with low measurement uncertainty.

Fast access to I/Q data with a wide bandwidth allows the speedy execution of complex evaluation routines in an external computer and the use of the R&S®FSV as a fast digitizer with a wide dynamic range for fast, flexible and efficient production.

Up to five times faster than other signal and spectrum analyzers

With more than 500 sweep/s in manual operation and up to 1000 sweep/s in remote operation, the R&S®FSV is up to five times faster than other signal and spectrum analyzers. This high measurement speed cuts production time, especially in cases that require the averaging of a large number of measurements (as specified in many standards).

Customized test routines for production applications

The R&S®FSV also offers a number of functions that speed up test routines, shorten alignment and measurement time and increase the overall throughput:
▮ Frequency list mode (LIST MODE):
  fast measurement on up to 300 different frequencies using different analyzer settings with a single remote control command
▮ Measurement of different power levels in the time domain in a single sweep for very fast alignment (multisummary marker)
▮ Fast ACP measurement in the time domain using channel filters or in the frequency domain using FFT sweep
▮ Frequency counter with 0.1 Hz resolution at a measurement time of < 50 ms
▮ Fast FFT sweep mode for accelerated spurious measurements and spurious searches due to fast sweep times, particularly with narrow resolution bandwidths and simultaneously large spans

Efficient operation via remote control
▮ Gbit LAN interface for quickly transferring large quantities of data
▮ Trigger interface for synchronization with the production system in LIST MODE

Measurement speed	
Sweep rate, remote control, 1000 sweep averages	1100/s (0.9 ms/sweep)
LIST MODE, measurement of the level of the fundamental and five harmonics	21 ms
Marker peak search	1.3 ms
Frequency change and query	15 ms
Sweep rate, manual mode	1000/s (1 ms/sweep)
Fastest sweep time (zero span)	1 µs
Fastest sweep time (frequency sweep)	1 ms

Wealth of functions and performance for effective use in labs

This increases the accuracy for power measurements in applications requiring extremely high precision and saves the expense of an additional power meter. The R&S®NRP-Z27/ R&S®NRP-Z37 power sensors contain an integrated power splitter so that the power sensor and the R&S®FSV signal and spectrum analyzer can measure the same signal in parallel without any switching required.
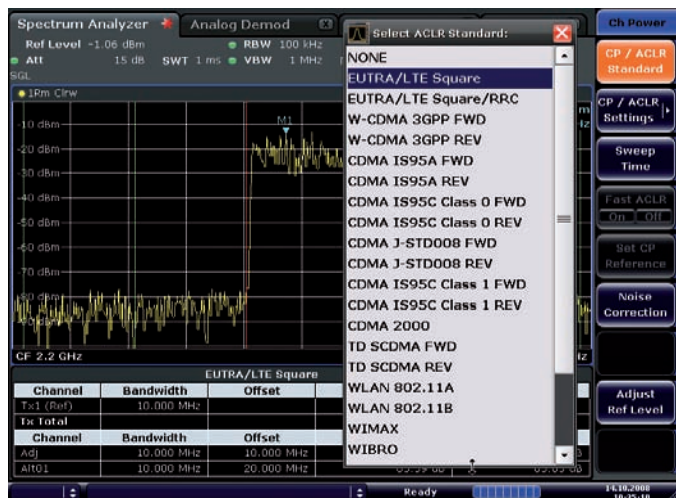
Outstanding RF performance for a mid-range analyzer

▪ Displayed average noise level (DANL):
  –155 dBm (1 Hz) at 1 GHz, –147 dBm (1 Hz) at 30 GHz
▪ Very low DANL even at 9 kHz: typ. –140 dBm (1 Hz)
▪ Third order intercept (TOI) of 15 dBm, typ. 18 dBm
▪ Phase noise at 10 kHz offset from carrier:
  –106 dBc (1 Hz), typ. –110 dBc (1 Hz)
▪ Dynamic range for WCDMA ACLR: 73 dB
▪ Resolution bandwidths from 1 Hz to 10 MHz, as well as 20 MHz and 28 MHz in zero span mode (40 MHz optional)

Unsurpassed level measurement accuracy up to 7 GHz

The R&S®FSV is a leader when it comes to level measurement accuracy. Featuring a measurement uncertainty of 0.4 dB up to 7 GHz, the analyzer delivers accurate and dependable measurement results. This means that the R&S®FSV can also measure levels in the 5.8 GHz ISM band and higher satellite bands with outstanding accuracy, eliminating the need for an additional power meter in many cases. When equipped with the R&S®FSV-K9 option, the R&S®FSV also supports the direct connection of R&S®NRP-Zxx power sensors.

Power measurement functions for the analysis of digital communications systems

Comprehensive power measurement functions are an absolute must when analyzing digital communications systems:
▪ Channel/adjacent channel power measurements
  · Up to 12 user channels and up to 12 adjacent channels
  · Numerous predefined test configurations for transmission standards
▪ Occupied bandwidth (OBW)
▪ Spectrum emission mask measurement
▪ Complementary cumulative distribution function (CCDF)
▪ Burst power measurement
▪ Spurious emissions
▪ C/N and C/N$_0$
▪ Complete selection of detectors: RMS, average, auto peak, pos./neg. peak, sample, quasi peak

Versatile marker and trace functions

▪ Up to 16 markers
▪ Marker measurement functions such as AM modulation factor, TOI, phase noise/noise, frequency counter
▪ Up to six simultaneously active traces with any combination of detectors
▪ Selectable number of sweep points (up to 32 001)
▪ Peak list for evaluating up to 100 peaks at the press of a key
▪ Limit lines for PASS/FAIL monitoring
▪ Transducer factors

Scalar network analysis: easy measurement of frequency response, bandwidth, gain

▪ External generator control allowing signal generators to be used as tracking generators to measure cable loss, filters, amplifiers, converters, multipliers
▪ Tracking generator up to 7 GHz with settable frequency offset up to 1 GHz to measure cable loss, filters, amplifiers, converters
▪ Measured frequency response characteristics can be saved directly as transducer factors and used as correction values for test setups

ACP measurement: a wealth of predefined standards included to simplify making settings.

Intuitive operation

The R&S®FSV is unsurpassed in ease of operation. By offering a touchscreen, an on-screen keyboard and hotkeys, the operating concept sets new standards in meeting the expectations placed on a modern-day signal and spectrum analyzer. The ultimate customer benefit is fast and straightforward operation.

Touchscreen operation

The R&S®FSV enables convenient, intuitive operation with its touchscreen. Users can complete their work faster and in fewer steps while enjoying greater convenience. The straightforward menu-driven design also reduces learning time.

Alternatively, all functions and measurement parameters can be configured in the conventional manner using the keys and rotary knob or mouse/keyboard. The large SVGA display ensures high resolution and good readability.

Hotkeys for fast access to all important functions

The clearly labeled keys allow fast access to all main menu items, settings and functions. Parameters such as frequency and resolution bandwidth can be directly set using these keys. Hardkeys are also provided to simplify access to frequently used functions such as PRESET, SAVE/RECALL and Marker Peak.

R&S®FSV controls

Built-in HELP function:
The context-sensitive help provides a detailed explanation of the current function and lists the associated remote control commands. Even inexperienced users come up to speed quickly, and programming becomes a much easier task

Touchscreen with zoom function:
Convenient, intuitive operation with direct entry exactly where needed; the signal section of interest is marked with a rectangle and the marked section is enlarged to full screen size

AUTO SET function:
Automatic parameter settings at the press of a key, automatic adaptation of settings to the individual measurement signal

USB ports:
Easy firmware updates at the press of a key via USB; simple documentation of measurement results

On-screen keyboard:
Virtual keyboard together with the touchscreen replace an external keyboard

UNDO/REDO softkeys:
Up to six prior operating steps can be undone and redone. This enables users to correct mistakes or quickly toggle between two different states

Easy transition to the next generation in signal analysis

Compatibility with earlier instrument families and the Rohde & Schwarz family concept greatly simplify the transition to the new generation – no matter whether the issue is remote control software programs used on a production line, the space required to replace an instrument in a rack, or the manual operation of an instrument in a development lab. The ultimate customer benefit is security of investments in software, system design and training.

Remote control compatibility with the R&S®FSP and R&S®FSU

The remote control command set used in the R&S®FSV is compatible with that used in the R&S®FSP and R&S®FSU when operating in the spectrum analysis mode and also in most applications. This allows users to continue using existing remote control programs without incurring any additional costs as they transition to the new generation in signal analysis. Replacing signal and spectrum analyzers in development and production environments is easier. Thanks to the fast measurement speed of the R&S®FSV, introducing new instruments in manufacturing is the easiest way ever to increase production throughput and boost efficiency and capacity.

Functional compatibility with existing Rohde & Schwarz signal and spectrum analyzers

The Rohde & Schwarz family concept is also highly beneficial. The same operating concept and the largely identical functions in all analyzers are provided by the new generation as well. The R&S®FSV represents a further development of the existing concept. New features include operation with the touchscreen and on-screen keyboard along with new functions such as AUTO SET and UNDO/REDO. Users can learn how to operate the new signal and spectrum analyzer in a minimum of time.

The special compatibility mode with the R&S®FSP and R&S®FSU makes it easy to continue using existing remote control programs.
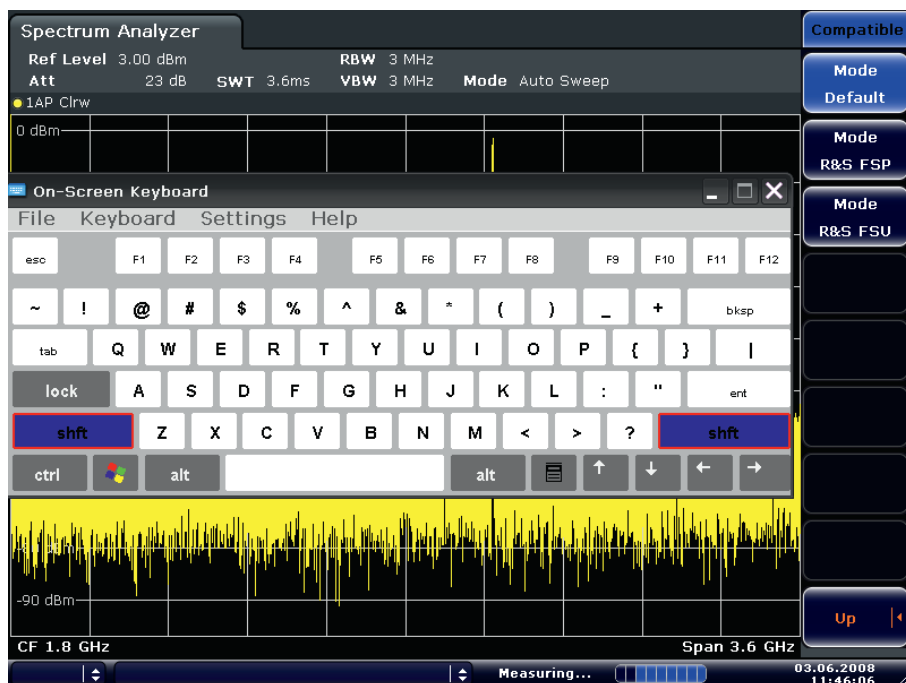
Low life-cycle costs

Easy on-site upgrading with options

The R&S®FSV can meet new requirements in the fastest possible time. The plug&play concept used for upgrading the instrument with options is unique. Users can add almost any option without having to open the instrument.

This concept offers a variety of benefits:
❙ No additional alignment after installation
❙ No recalibration
❙ No need to send the instrument in to a service center (i.e. negligible downtime)
❙ No installation costs
❙ Easy expandability for additional tasks

Easy scalability to handle application-specific requirements

The base unit already has all functions expected in a modern-day signal and spectrum analyzer. With its wide variety of options, it is possible to customize the R&S®FSV to handle diverse applications in accordance with equipment needs and the available budget.

Always up-to-date with free firmware updates

The firmware used in the R&S®FSV can easily be updated with a USB memory stick or via the LAN interface. Firmware updates are free of charge and can be easily downloaded from www.rohde-schwarz.com.

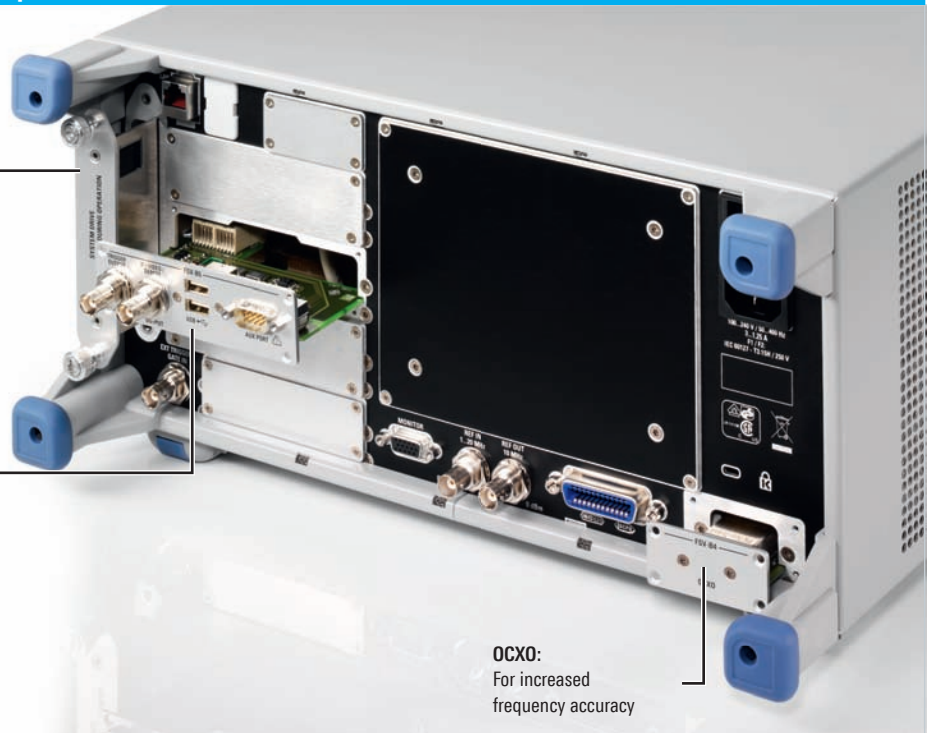**Instrument rear panel with plug-in options**

Instrument hard drive:
Can be easily removed and replaced with a second hard drive (R&S®FSV-B19) if measurement results and instrument settings need to be kept confidential

Additional interfaces:
IF/video output, trigger output, two additional USB ports, AUX port

OCXO:
For increased frequency accuracy

Ready for future expansion

Applications
Transmitter and modulation measurements in wireless communications systems

Software option/ technology	Power	Modulation quality	Spectrum measurement	Miscellaneous	Special features
R&S®FSV-K8 ▪ Bluetooth®/EDR	▪ Output power ▪ Average and peak power ▪ EDR relative TX power	▪ Deviation ▪ Initial carrier frequency tolerance (ICFT) ▪ Carrier frequency drift ▪ EDR frequency stability ▪ EDR modulation accuracy	▪ Adjacent channel power ▪ EDR ▪ In-band spurious emissions	▪ Trigger: IF power, external, free run ▪ Support for packet types DH1, DH3 and DH5 and power classes 1 to 3	▪ In line with Bluetooth® RF test specification 2.0
R&S®FSV-K10 ▪ GSM/EDGE/ EDGE Evolution	▪ Power measurement in time domain including carrier power	▪ EVM ▪ Phase/frequency error ▪ Origin offset suppression	▪ Modulation spectrum ▪ Transient spectrum	–	▪ Single burst and multiburst
R&S®FSV-K72/-K73 ▪ WCDMA	▪ Code domain power ▪ Code domain power versus time ▪ CCDF	▪ EVM ▪ Peak code domain error ▪ Constellation diagram ▪ I/Q offset ▪ Residual code domain error ▪ Gain imbalance ▪ Center frequency error (chip rate error)	▪ Spectrum mask ▪ ACLR ▪ Power measurement	▪ Channel table with summary of channels used on base station ▪ Timing offset ▪ Power versus time	▪ Automatic detection of active channels and decoding of payload information ▪ Automatic detection of encryption code ▪ Automatic detection of HSDPA modulation format ▪ Support for signals with compressed mode ▪ Support for HSPA+ (HSDPA+ and HSUPA+)
R&S®FSV-K76/-K77 ▪ TD-SCDMA	▪ Code domain power ▪ Code domain power versus time ▪ CCDF	▪ EVM ▪ Peak code domain error ▪ Constellation diagram ▪ Residual code domain error ▪ I/Q offset ▪ Gain imbalance ▪ Center frequency error (chip rate error)	▪ Spectrum mask ▪ ACLR ▪ Power measurement	▪ Channel table with summary of channels used on base station ▪ Timing offset ▪ Power versus time	▪ Automatic detection of active channels and decoding of payload information ▪ Automatic detection of HSDPA modulation format ▪ Support for HSPA+ (HSDPA+ and HSUPA+)
R&S®FSV-K82/-K83 ▪ CDMA2000®	▪ Carrier power ▪ Code domain power ▪ Code domain power versus time ▪ CCDF	▪ RHO ▪ EVM ▪ Peak code domain error ▪ Constellation diagram ▪ Residual code domain error ▪ I/Q offset ▪ Gain imbalance ▪ Center frequency error (chip rate error)	▪ Spectrum mask ▪ ACLR ▪ Power measurement	▪ Channel table with summary of channels used on base station ▪ Timing offset	▪ Automatic detection of active channels and decoding of payload information ▪ Robust demodulation algorithms for reliable measurement of multicarrier signals

Software option/ technology	Power	Modulation quality	Spectrum measurement	Miscellaneous	Special features
R&S®FSV-K84/-K85 ▪ 1xEV-DO	▪ Carrier power ▪ Code domain power ▪ Code domain power versus time ▪ CCDF	▪ RHO_{Pilot} (R&S®FSV-K84) ▪ RHO_{Data} (R&S®FSV-K84) ▪ RHO_{MAC} (R&S®FSV-K84) ▪ $RHO_{Overall}$ ▪ EVM ▪ Peak code domain error ▪ Constellation diagram ▪ Residual code domain error ▪ I/Q offset ▪ Gain imbalance ▪ Center frequency error (chip rate error)	▪ Spectrum mask ▪ ACLR ▪ Power measurement	▪ Channel table with summary of channels used on base station ▪ Timing offset	▪ Automatic detection of active channels and decoding of payload information ▪ Robust demodulation algorithms for reliable measurement of multicarrier signals
R&S®FSV-K91/-K91n ▪ WLAN ▪ IEEE 802.11a/b/g/j/n	▪ Power measurement in time and frequency domains ▪ Rising/falling edge ▪ CCDF	▪ EVM ▪ Constellation diagram ▪ I/Q offset ▪ Gain imbalance ▪ Quadrature error ▪ Center frequency error (symbol clock error)	▪ Spectrum mask ▪ ACP ▪ Spectrum flatness	▪ Bit stream ▪ Signal field ▪ Averaging over multiple measurements	▪ 40 MHz bandwidth for WLAN IEEE 802.11n
R&S®FSV-K93 ▪ WiMAX™ ▪ IEEE 802.16e ▪ OFDM ▪ OFDMA	▪ Power measurement in time and frequency domains ▪ Rising/falling edge ▪ CCDF	▪ EVM ▪ Constellation diagram ▪ I/Q offset ▪ Gain imbalance ▪ Quadrature error ▪ Center frequency error (symbol clock error)	▪ Spectrum mask ▪ ACP ▪ Spectrum flatness	▪ Bit stream ▪ Signal field ▪ Averaging over multiple measurements ▪ Burst summary list ▪ Graphical display of DL map	▪ Automatic demodulation in line with DL map ▪ User-editable spectrum mask
R&S®FSV-K100/ -K101/-K102/-K104/ -K105	▪ Power measurement in time and frequency domains ▪ CCDF	▪ EVM ▪ Constellation diagram ▪ I/Q offset ▪ Gain imbalance ▪ Quadrature error ▪ Center frequency error (symbol clock error)	▪ Spectrum flatness	▪ Bit stream ▪ Allocation summary list ▪ Signal flow diagram ▪ Averaging over multiple measurements	▪ Automatic detection of modulation, cyclic prefix length and cell ID ▪ MIMO measurements

R&S®FSV-K7 option
# AM/FM/φM measurement demodulator

The R&S®FSV-K7 AM/FM/φM measurement demodulator option converts the R&S®FSV into an analog modulation analyzer for amplitude-, frequency- or phase-modulated signals. It measures not only characteristics of the useful modulation, but also factors such as residual FM or synchronous modulation.

## Display and analysis alternatives
▮ Modulation signal versus time
▮ Spectrum of the modulation signal (FFT)
▮ RF signal power versus time
▮ Spectrum of the RF signal (FFT over max. 18 MHz)
▮ Table with numeric display of
  · Deviation or modulation factor, RMS weighted, +peak, –peak, ± peak/2
  · Modulation frequency
  · Carrier frequency offset
  · Carrier power
  · Total harmonic distortion (THD) and SINAD

Specifications in brief	
Demodulation bandwidth	100 Hz to 28 MHz, 40 MHz optional
Recording time (depends on demodulation bandwidth)	7.5 ms to 3932 s
AF filters	
Highpass filters	20 Hz, 50 Hz, 300 Hz
Lowpass filters	3 kHz, 15 kHz, 23 kHz, 150 kHz and 5 %, 10 % or 25 % of demodulation bandwidth
Deemphasis	25/50/75/750 µs
Modulation frequency	< 14 MHz, > 20 MHz optional, max. 0.5 × demodulation bandwidth
Measurement uncertainty (deviation or modulation factor)	3 %
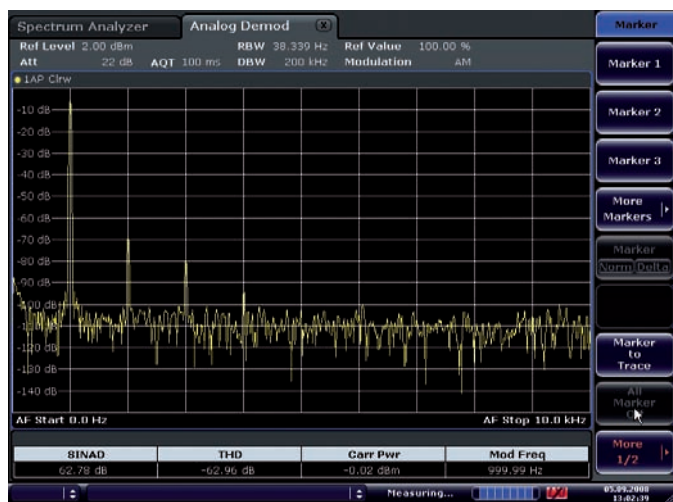
THD measurement on an amplitude-modulated signal. The first harmonic of the modulation signal is well suppressed by 69 dB. This corresponds to a THD (D2) < 0.1 %.
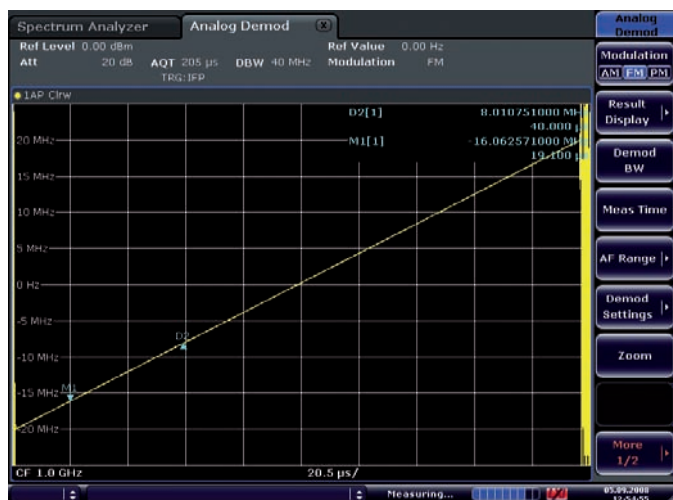
Measurement of the linearity of an FM ramp versus 40 MHz bandwidth.

R&S®FSV-K7S option
FM stereo measurement application

The R&S®FSV-K7S option expands the functionality of the R&S®FSV-K7 option by providing measurements on FM stereo transmitters.

An integrated stereo decoder measures the frequency deviation of the left, right, mono and stereo channels as well as the pilot and RDS carrier. The variety of analysis capabilities is expanded to include THD measurement, time-domain analysis (oscilloscope mode display) and frequency-domain analysis (AF spectrum) of the corresponding channel. To perform standard-compliant S/N ratio measurements, both the compulsory audio filters and the quasi peak detectors are available. A clear result summary displays the numeric results for all measurement channels at the same time; crosstalk attenuation measurements are possible without having to switch between channels. This means that all measurements necessary on FM stereo transmitters can be performed with the R&S®FSV-K7S option.
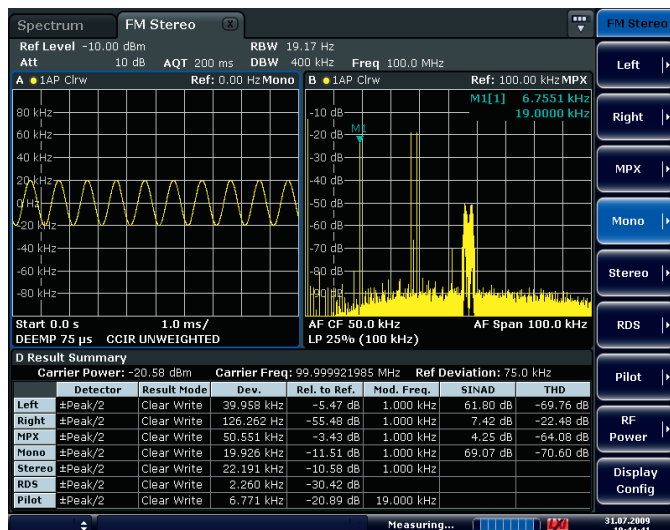
Comprehensive measurement functions for complete FM stereo analysis
❙ Frequency deviation measurement in the MPX, L, R, M and S channels and of the pilot and RDS carrier
❙ Crosstalk measurement
❙ Carrier power and carrier frequency measurement
❙ Audio frequency measurement
❙ Absolute and relative deviation measurement for easy-to-perform S/N ratio and crosstalk attenuation measurement
❙ AF spectrum display and per channel
❙ Up to 4 measurement windows

A variety of audio filters and detectors for standard-compliant measurements
❙ ITU-R filter, weighted and unweighted
❙ Highpass filters 20 Hz, 50 Hz, 300 Hz and lowpass filters 3 kHz, 15 kHz, 23 kHz and 150 kHz
❙ Selectable deemphasis 50 µs, 75 µs, 750 µs
❙ Detectors: ±peak/2, +peak, –peak, RMS, RMSxSQR2, quasi peak (in line with ITU-R 468) and quasi peakxSQR2
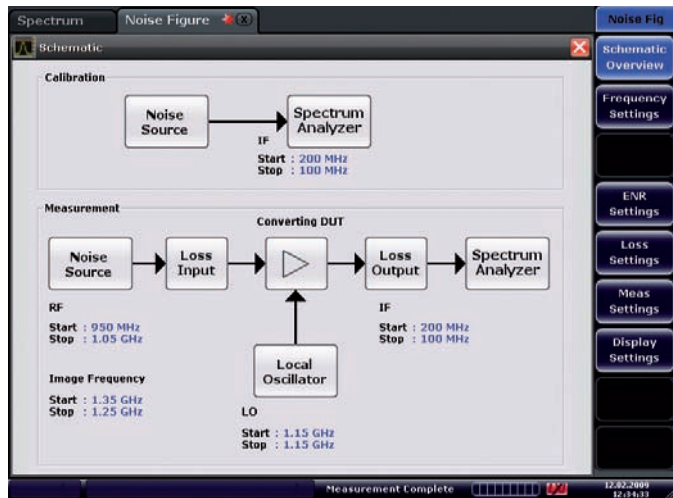
Built-in THD measurement
❙ Automatically tuned to the fundamental
❙ Simultaneous display of SINAD and THD values
❙ Selective THD measurement of individual harmonics using marker functions in the AF spectrum display

The result summary clearly displays the measurement results of all the channels; further switching is not required. Additional displays such as the mono signal or the MPX spectrum display support further analysis.

	Detector	Result Mode	Dev.	Rel. to Ref.	Mod. Freq.	SINAD	THD
Left	±Peak/2	Clear Write	39.958 kHz	−5.47 dB	1.000 kHz	61.80 dB	−69.76 dB
Right	±Peak/2	Clear Write	126.262 Hz	−55.48 dB	1.000 kHz	7.42 dB	−22.48 dB
MPX	±Peak/2	Clear Write	50.551 kHz	−3.43 dB	1.000 kHz	4.25 dB	−64.08 dB
Mono	±Peak/2	Clear Write	19.926 kHz	−11.51 dB	1.000 kHz	69.07 dB	−70.60 dB
Stereo	±Peak/2	Clear Write	22.191 kHz	−10.58 dB	1.000 kHz		
RDS	±Peak/2	Clear Write	2.260 kHz	−30.42 dB			
Pilot	±Peak/2	Clear Write	6.771 kHz	−20.89 dB	19.000 kHz		

Carrier Power: −20.58 dBm   Carrier Freq: 99.999921985 MHz   Ref Deviation: 75.0 kHz

R&S®FSV-K30 option
Noise figure and gain measurement application

The R&S®FSV-K30 option expands the R&S®FSV signal and spectrum analyzer by adding measurement functionality otherwise only provided by special noise measurement analyzers.

The following parameters can be measured at a specified frequency or in a selectable frequency range:
❙ Noise figure in dB
❙ Noise temperature in K
❙ Gain in dB

The R&S®FSV-K30 can perform a wider variety of RF measurements than is possible with conventional noise measurement systems. The R&S®FSV supports the measurement of harmonics, intermodulation, spurious responses and many other RF-relevant criteria (for measurements on amplifiers and on frequency-converting DUTs, e.g. low-noise converters).

Noise measurements
❙ Measurement range 0 dB to 35 dB
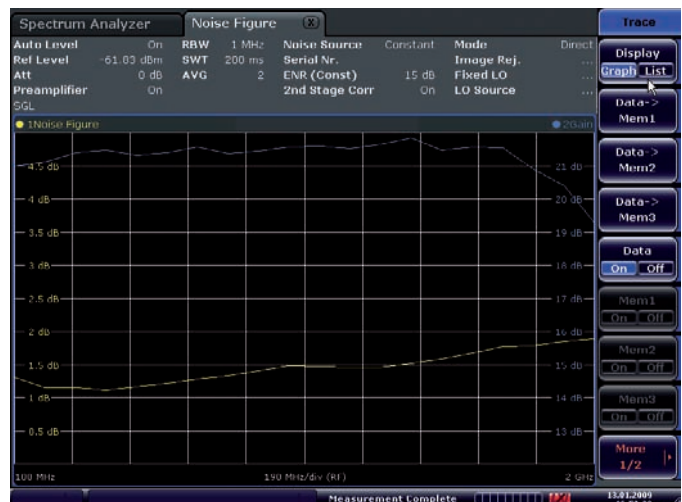❙ Resolution 0.01 dB
❙ Device measurement uncertainty 0.05 dB

Gain measurements
❙ Measurement range –20 dB to +60 dB
❙ Resolution 0.01 dB
❙ Measurement accuracy ±0.2 dB

The schematic view of the test setup simplifies measurements on frequency-converting DUTs.

Tabular representation of measurement results.

Measurements on an amplifier.

R&S®FSV-K40 option
Phase noise measurement application

Phase noise is an important parameter in wireless communications systems. The R&S®FSV-K40 option enables the R&S®FSV to perform fast and easy phase noise measurements in development and production.

Equipped with the R&S®FSV-K40 option, the R&S®FSV can measure the single sideband phase noise across a selectable carrier offset frequency range with logarithmic display of the offset range. Based on the measured phase noise, the user can also determine the residual FM/PM and the jitter.

Phase noise measurement
❙ Carrier offset frequency range selectable from 1 Hz to 1 GHz in 1/3/10 sequence (1 Hz, 3 Hz, 10 Hz, 30 Hz, etc.)
❙ Number of averages, sweep mode and filter bandwidth for every measurement subrange can be individually selected to optimize the measurement speed
❙ Fast results for the subranges are obtained by starting the measurement at the maximum carrier offset
❙ Verification of carrier frequency and power prior to each measurement to prevent incorrect measurements
❙ Improvement of dynamic range by measuring the inherent thermal noise in a reference trace and performing noise correction

Measurement of residual FM/PM and jitter
❙ Integration across the entire selected carrier offset frequency range or across a separately selectable frequency range
❙ Tabular display of residual FM, residual PM and RMS jitter in addition to measurement trace

Evaluation aids
❙ Limit lines with PASS/FAIL indication
❙ Spot phase noise at up to four selectable frequency offsets
❙ Maximum of four additional markers

Phase noise measurement at 1 kHz to 100 MHz from the carrier: The dynamic range that is limited by the thermal inherent noise at large carrier offsets can be improved by noise correction. Trace 1 (yellow) shows the noise-corrected measurement while trace 2 (blue) shows the measurement without noise correction.
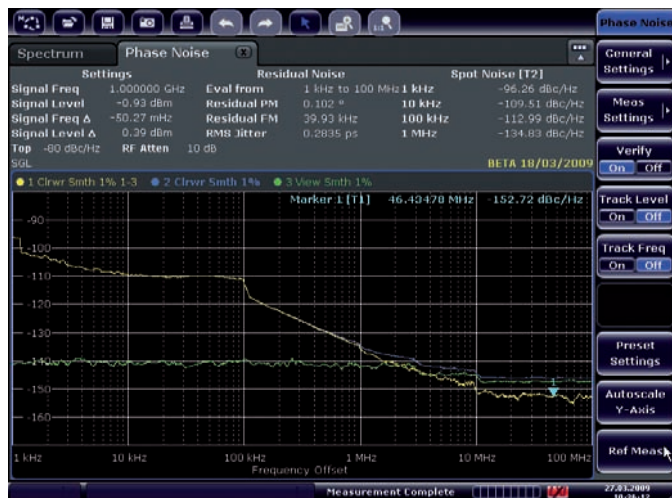
An overview of all important parameters is displayed in a clearly structured table.
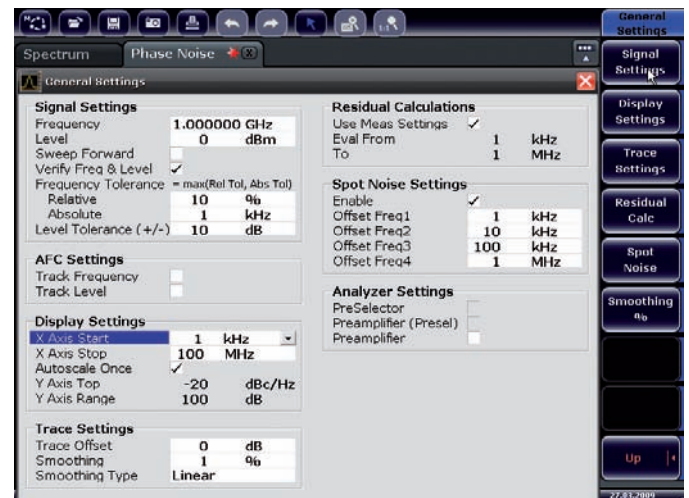
R&S®FSV-K70 option
Vector signal analysis application

The R&S®FSV-K70 option enables users to flexibly set the analysis of digitally modulated single carriers down to the bit level. The clearly structured operating concept simplifies measurements, despite the wide range of analysis tools.

Clearly structured block diagram display.

16QAM with four screens.

Flexible modulation analysis from MSK to 64QAM
▎ Modulation formats:
  · 2FSK, 4FSK
  · MSK, GMSK, DMSK
  · BPSK, QPSK, Offset-QPSK, DQPSK, 8PSK, D8PSK, π/4-DQPSK, 3π/8-8PSK, π/8-D8PSK
  · 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 16APSK (DVB-S2), 32APSK (DVB-S2), π/4-16QAM (EDGE), –π/4-16QAM (EDGE)
▎ Symbol rate up to 32 MHz
▎ Analysis length up to 50 000 symbols
▎ Signal analysis bandwidth 28 MHz; 40 MHz and 160 MHz optional

Numerous standard-specific default settings
▎ GSM, GSM/EDGE
▎ 3GPP WCDMA, CDMA2000®
▎ TETRA, APCO25
▎ Bluetooth®, ZigBee
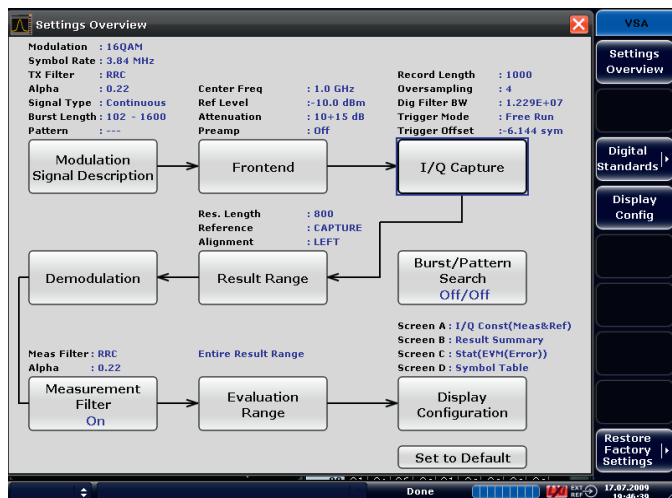▎ DECT

Easy operation with graphical support
The visualization of the demodulation stages and the associated settings is so clear that even beginners and infrequent users can find the correct settings. The combination of touchscreen and block diagram simplifies operation and representation.

Based on the description of the signal to be analyzed (e.g. modulation format, continuous or with bursts, symbol rate, transmit filtering), the R&S®FSV-K70 option supports users in automatically finding useful settings.

Flexible analysis tools for detailed signal analysis make troubleshooting really easy
▎ Display choices for amplitude, frequency, phase, I/Q, eye diagram; amplitude, phase, or frequency error; constellation or vector diagram
▎ Statistical evaluations
  · Histogram representation
  · Standard deviation and 95:th percentile in the result summary
▎ Spectrum analyses of the measurement and error signal considerably support users in finding signal errors such as incorrect filtering or spurious
▎ Flexible burst search for the analysis of complex signal combinations, short bursts or signal mix – capabilities that go beyond the scope of many signal analyzers
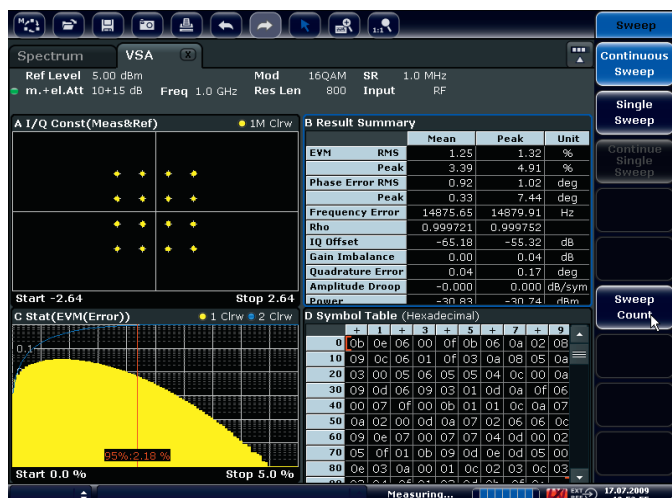
Specifications in brief

Base unit		
Frequency		
Frequency range	R&S®FSV4	10 Hz to 4 GHz
	R&S®FSV7	10 Hz to 7 GHz
	R&S®FSV13	10 Hz to 13.6 GHz
	R&S®FSV30	10 Hz to 30 GHz
	R&S®FSV40	10 Hz to 40 GHz
Aging of frequency reference		1×10^{-6}
	with R&S®FSV-B4 option	1×10^{-7}
Resolution/bandwidths		
Resolution bandwidths	standard sweep	1 Hz to 10 MHz
	standard sweep, zero span	1 Hz to 10 MHz, 20 MHz, 28 MHz [1] 40 MHz optional
	FFT sweep	1 Hz to 300 kHz
	channel filter	100 Hz to 5 MHz
	EMI filter	200 Hz, 9 kHz, 120 kHz, 1 MHz
Video filter		1 Hz to 10 MHz, 20 MHz, 28 MHz, 40 MHz [1]
Signal analysis bandwidth		28 MHz [1]
	R&S®FSV-B70 option	40 MHz [2]
	with R&S®FSV-B160 options	160 MHz [3]
Displayed average noise level (DANL)		
DANL (1 Hz bandwidth)	1 GHz	–152 dBm, typ. –155 dBm
	3 GHz	–150 dBm, typ. –153 dBm
	7 GHz	–146 dBm, typ. –149 dBm
	13 GHz	–148 dBm, typ. –151 dBm
	30 GHz	–144 dBm, typ. –147 dBm
	40 GHz	–136 dBm, typ. –139 dBm
DANL with preamplifier, R&S®FSV-B22 option	1 GHz	–162 dBm, typ. –165 dBm
	3 GHz	–160 dBm, typ. –163 dBm
	7 GHz	–156 dBm, typ. –159 dBm
DANL with preamplifier, R&S®FSV-B24 option	10 GHz	–164 dBm, typ. –167 dBm
	30 GHz	–159 dBm, typ. –162 dBm
	40 GHz	–154 dBm, typ. –156 dBm
Intermodulation		
Third order intercept (TOI)	f < 3.6 GHz	+13 dBm, typ. +16 dBm
	3.6 GHz to 30 GHz	+15 dBm, typ. +18 dBm
Dynamic range WCDMA ACLR	without noise compensation	70 dB
	with noise compensation	73 dB
Phase noise		
1 GHz carrier frequency	10 kHz offset from carrier	–106 dBc (1 Hz), typ. –110 dBc (1 Hz)
	100 kHz offset from carrier	–115 dBc (1 Hz)
	1 MHz offset from carrier	–134 dBc (1 Hz)
Total measurement uncertainty	3.6 GHz	0.29 dB
	7 GHz	0.39 dB
R&S®FSV-B9 tracking generator		
Frequency range	R&S®FSV4	100 kHz to 4 GHz
	R&S®FSV7, R&S®FSV13, R&S®FSV30, R&S®FSV40	100 kHz to 7 GHz
Frequency offset		up to 1 GHz
Level range		–60 dBm to 0 dBm

[1] R&S®FSV40, 1307.9002K39: max bandwidth 10 MHz.
[2] Not for the R&S®FSV40, 1307.9002K39.
[3] The R&S®FSV30 and R&S®FSV40 support the R&S®FSV-B160 option only up to 7 GHz.

Software options

Separate data sheets are available for the following software options. You can order these data sheets under the numbers specified below.

Designation	Type	Data Sheet Order No.
Analog Modulation Analysis (AM/FM/φM)	R&S®FSV-K7	PD 5214.0530.22
Bluetooth®/EDR Measurements	R&S®FSV-K8	PD 5214.3823.22
GSM/EDGE/EDGE Evolution Analysis	R&S®FSV-K10	PD 5214.0447.22
Noise Figure and Gain Measurements	R&S®FSV-K30	PD 5214.1837.22
Phase Noise Measurements	R&S®FSV-K40	PD 5214.1843.22
Vector Signal Analysis	R&S®FSV-K70	PD 5214.0599.22
3GPP BS (DL) Analysis, incl. HSDPA	R&S®FSV-K72	PD 5214.1743.22
3GPP UE (UL) Analysis, incl. HSUPA	R&S®FSV-K73	PD 5214.0976.22
TD-SCDMA BS (DL) Analysis	R&S®FSV-K76	PD 5214.1572.22
TD-SCDMA UE (UL) Analysis	R&S®FSV-K77	PD 5214.1614.22
CDMA2000® BS (DL) Analysis	R&S®FSV-K82	PD 5214.1714.22
CDMA2000® MS (UL) Analysis	R&S®FSV-K83	PD 5214.4136.22
1xEV-DO BS (DL) Analysis	R&S®FSV-K84	PD 5214.1850.22
1xEV-DO MS (UL) Analysis	R&S®FSV-K85	PD 5214.4859.22
WLAN IEEE 802.11a/b/g/j Analysis	R&S®FSV-K91	PD 5214.1450.22
WLAN IEEE 802.11n Analysis	R&S®FSV-K91n	PD 5214.1450.22
WLAN IEEE 802.11ac Analysis	R&S®FSV-K91ac	PD 5214.1450.22
WiMAX™ IEEE 802.16e OFDM/OFDMA Analysis	R&S®FSV-K93	PD 5214.1466.22
OFDM Vector Signal Analysis	R&S®FS-K96	PD 5214.4820.22
OFDM Vector Signal Analysis	R&S®FS-K96PC	PD 5214.4820.22
EUTRA/LTE Downlink PC Software	R&S®FSV/FSQ-K100/-K102/-K104	PD 5213.8521.22
EUTRA/LTE Uplink PC Software	R&S®FSV/FSQ-K101/-K105	PD 5213.9186.22
Distortion Analysis Software	R&S®FS-K130PC	PD 5214.4113.22

Ordering information

Designation	Type	Order No.
Base unit (including supplied accessories such as power cable and manual)		
Signal and Spectrum Analyzer, 10 Hz to 4 GHz	R&S®FSV4	1321.3008.04
Signal and Spectrum Analyzer, 10 Hz to 7 GHz	R&S®FSV7	1321.3008.07
Signal and Spectrum Analyzer, 10 Hz to 13.6 GHz	R&S®FSV13	1321.3008.13
Signal and Spectrum Analyzer, 10 Hz to 30 GHz	R&S®FSV30	1321.3008.30
Signal and Spectrum Analyzer, 10 Hz to 40 GHz	R&S®FSV40	1321.3008.40
Signal and Spectrum Analyzer, 10 Hz to 40 GHz	R&S®FSV40	1321.3008.39 [1]
Hardware options		
Ruggedized Housing	R&S®FSV-B1	1310.9500.02
AM/FM Audio Demodulator	R&S®FSV-B3	1310.9516.02
OCXO, Precision Reference Frequency	R&S®FSV-B4	1310.9522.02
OCXO, Precision Reference Frequency Stability	R&S®FSV-B4	1310.9522.03
Additional Interfaces (IF/video/AM/FM output, AUX port, trigger output, two additional USB ports)	R&S®FSV-B5	1310.9539.02
Tracking Generator, 100 kHz to 3.6 GHz/7 GHz	R&S®FSV-B9	1310.9545.02
External Generator Control	R&S®FSV-B10	1310.9551.02
Digital Baseband Interface	R&S®FSV-B17	1310.9568.02
Spare Solid State Disk (SSD, removable hard disk)	R&S®FSV-B18	1310.9697.05
Spare Hard Disk Drive (HDD, removable hard disk)	R&S®FSV-B19	1310.9574.05

Designation	Type	Order No.
LO/IF Ports for External Mixers	R&S®FSV-B21	1310.9597.02
Preamplifier, 9 kHz to 4 GHz/7 GHz	R&S®FSV-B22	1310.9600.02
Preamplifier, 9 kHz to 13.6 GHz	R&S®FSV-B24	1310.9616.13
Preamplifier, 9 kHz to 30 GHz	R&S®FSV-B24	1310.9616.30
Preamplifier, 9 kHz to 40 GHz	R&S®FSV-B24	1310.9616.40
Electronic Attenuator (1 dB steps)	R&S®FSV-B25	1310.9622.02
40 MHz Analysis Bandwidth	R&S®FSV-B71	1310.9645.02 [2]
160 MHz Analysis Bandwidth (for R&S®FSV4 and R&S®FSV7)	R&S®FSV-B160	1311.2015.02 [3]
160 MHz Analysis Bandwidth (for R&S®FSV13)	R&S®FSV-B160	1311.2015.13 [3]
160 MHz Analysis Bandwidth (for R&S®FSV30 und R&S®FSV40)	R&S®FSV-B160	1311.2015.40 [2] [3]
N-Type Adapter for R&S®RT-Zxx probes	R&S®RT-ZA9	1417.0909.02
Software options		
Analog Modulation Analysis (AM/FM/φM)	R&S®FSV-K7	1310.8103.02
FM Stereo Measurements (for R&S®FSV-K7)	R&S®FSV-K7S	1310.8126.02
Bluetooth®/EDR Measurement Application	R&S®FSV-K8	1301.8155.02
Power Sensor Support (power measurement with the R&S®NRP-Zxx power sensors)	R&S®FSV-K9	1310.8203.02
GSM/EDGE/EDGE Evolution Analysis	R&S®FSV-K10	1310.8055.02
Spectrogram Measurements	R&S®FSV-K14	1310.8255.02
Noise Figure and Gain Measurements	R&S®FSV-K30	1310.8355.02
Phase Noise Measurements	R&S®FSV-K40	1310.8403.02
Vector Signal Analysis	R&S®FSV-K70	1310.8455.02
3GPP BS (DL) Analysis, incl. HSDPA and HSDPA+	R&S®FSV-K72	1310.8503.02
3GPP UE (UL) Analysis, incl. HSUPA	R&S®FSV-K73	1310.8555.02
TD-SCDMA BS Measurements	R&S®FSV-K76	1310.8603.02
TD-SCDMA UE Measurements	R&S®FSV-K77	1310.8655.02
CDMA2000® BS (DL) Analysis	R&S®FSV-K82	1310.8703.02
CDMA2000® MS (UL) Measurements	R&S®FSV-K83	1310.8755.02
1xEV-DO BS (DL) Analysis	R&S®FSV-K84	1310.8803.02
1xEV-DO MS (UL) Measurements	R&S®FSV-K85	1310.8773.02
WLAN IEEE 802.11a/b/g/j Analysis	R&S®FSV-K91	1310.8903.02 [2]
WLAN IEEE 802.11n Analysis	R&S®FSV-K91n	1310.9468.02 [2]
WLAN IEEE 802.11ac Analysis	R&S®FSV-K91ac	1310.8629.02 [2]
WiMAX™ IEEE 802.16e OFDM/OFDMA Analysis	R&S®FSV-K93	1310.8955.02 [2]
EUTRA/LTE FDD Downlink Analysis	R&S®FSV-K100	1310.9051.02 [2]
EUTRA/LTE FDD Uplink Analysis	R&S®FSV-K101	1310.9100.02 [2]
EUTRA/LTE Downlink MIMO Analysis	R&S®FSV-K102	1310.9151.02 [2]
EUTRA/LTE TDD Downlink Analysis	R&S®FSV-K104	1309.9774.02 [2]
EUTRA/LTE TDD Uplink Analysis	R&S®FSV-K105	1309.9780.02 [2]
Signal analysis software		
OFDM Vector Signal Analysis Software	R&S®FS-K96	1310.0202.06
Distortion Analysis Software	R&S®FS-K130PC	1310.0090.06

[1] Maximum bandwidth 10 MHz.
[2] Not for the R&S®FSV40, 1307.9002K39.
[3] Cannot be used together with R&S®FSV-B10, 1310.9551.02. The R&S®FSV13, R&S®FSV30 and R&S®FSV40 support this option only up to 7 GHz.

For data sheet, see PD 3606.7982.22 and www.rohde-schwarz.com.

About Rohde & Schwarz

Rohde & Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established more than 75 years ago, Rohde & Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

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◗ Continuous improvement in environmental sustainability
◗ ISO 14001-certified environmental management system

Certified Quality System
ISO 9001

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