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R&S®FSW Signal and Spectrum Analyzer

Setting standards
in RF performance
and usability



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

The high-performance R&S®FSW signal and spectrum analyzer was developed to meet demanding customer requirements. Offering low phase noise, wide analysis bandwidth and straightforward and intuitive operation, the analyzer makes measurements fast and easy.

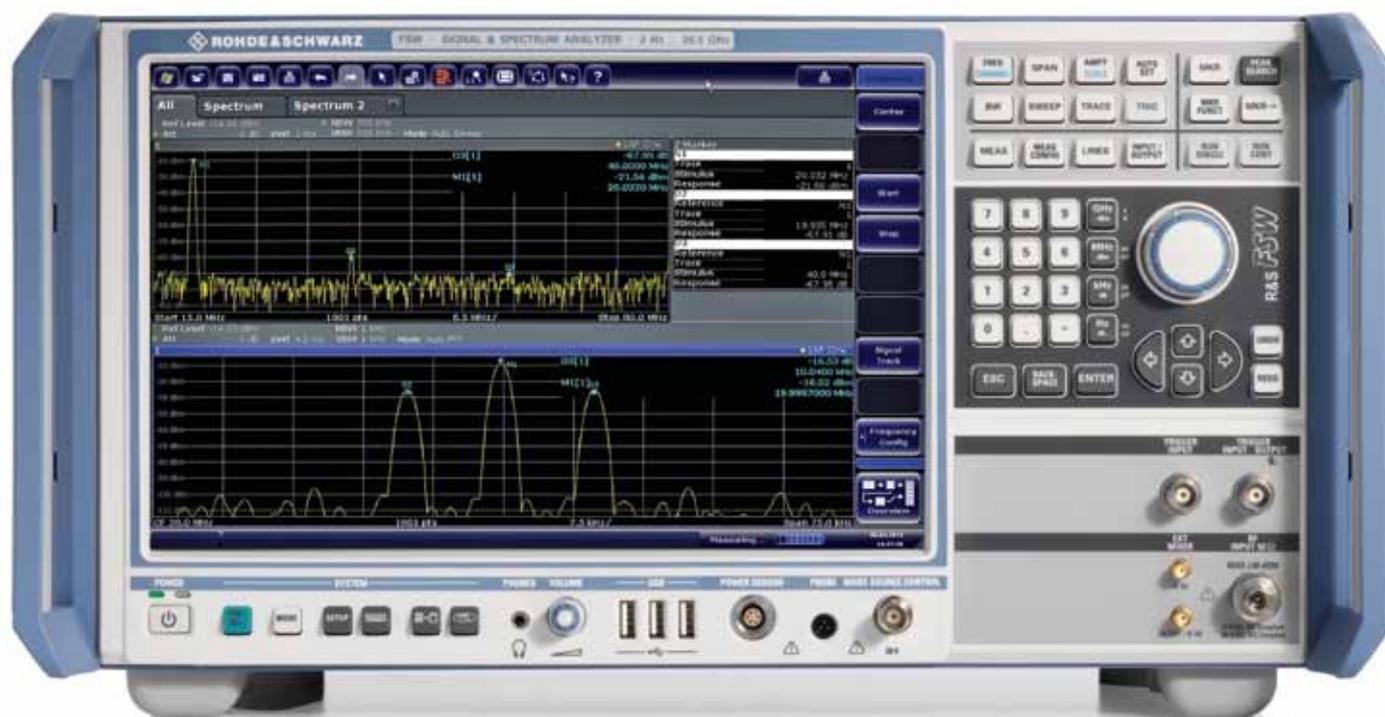
Users in the aerospace and defense (A&D) sector and developers of future, wideband communications systems will find plenty of reasons why the R&S®FSW is the right solution for their T&M requirements. With phase noise unparalleled among signal and spectrum analyzers, the R&S®FSW facilitates the development of oscillators intended for use in radar systems, for example.

The R&S®FSW offers up to 160 MHz analysis bandwidth for measuring wideband-modulated or frequency-agile signals. Currently, signal and spectrum analyzers measure different standards (GSM, CDMA2000®, WCDMA, LTE) separately. The R&S®FSW takes analysis to the next level, providing capability to measure multiple standards simultaneously. Users can quickly and easily detect and eliminate errors caused by interaction between signals.

Featuring a touchscreen user interface, a flat menu structure and straightforward result representation, the R&S®FSW offers exceptional ease of operation. Various measurements can be displayed simultaneously in separate windows on the large 12.1" screen, which greatly facilitates result interpretation. The R&S®FSW also scores top marks when it comes to measurement speed. Providing 1000 sweep/s in remote operation and delay-free switching between instrument setups, the R&S®FSW ranks top among the signal and spectrum analyzers available on the market.

Key facts

- Frequency range from 2 Hz to 8/13.6/26.5 GHz/43.5 GHz
- Low phase noise of -137 dBc (1 Hz) at 10 kHz offset (1 GHz carrier)
- -88 dBc dynamic range (with noise cancellation) for WCDMA ACLR measurements
- Up to 160 MHz analysis bandwidth
- < 0.4 dB total measurement uncertainty up to 8 GHz
- High-resolution 12.1" (31 cm) touchscreen for convenient operation
- Multiple measurement applications can be run and displayed in parallel



R&S®FSW Signal and Spectrum Analyzer

Benefits and key features

RF performance that meets exacting demands

- ▮ Unmatched phase noise – ideal for measuring oscillators for radar and communications applications
- ▮ Excellent dynamic range for spurious measurements thanks to low DANL
- ▮ Harmonic measurements made easy – due to integrated highpass filters
- ▮ High sensitivity even at low frequencies
- ▮ High accuracy
- ▮ Unparalleled dynamic range up to 1 GHz with separate receive path

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Ready for the future

- ▮ Up to 160 MHz analysis bandwidth
- ▮ High spurious-free dynamic range of > 100 dBc
- ▮ Large I/Q memory depth for seamless recording of long signal sequences
- ▮ 500 MHz wide IF path with IF output

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Designed for convenience – with straightforward result display

- ▮ Efficient operation with optimized user guidance
- ▮ MultiView: multiple results available at a glance
- ▮ Optimum configuration and combination of measurement applications

▷ [page 7](#)

Ideal for analyzing radar systems

- ▮ Fast identification and analysis of spurious emissions
- ▮ Low phase noise for oscillator measurements
- ▮ Measuring pulse parameters at the touch of a key
- ▮ Analyzing short pulse rise and fall times

▷ [page 8](#)

Identifying interaction between signals

- ▮ Multistandard radio analyzer (MSRA)

▷ [page 9](#)

When speed counts

- ▮ High measurement rates and fast sweep times with sweep rates of up to 1000 sweep/s
- ▮ Fast switchover between instrument setups
- ▮ Efficient measurement functions speed up operation
- ▮ Integrated support of R&S®NRP-Zxx power sensors

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A safe investment

- ▮ Keeping pace with technological advancement
- ▮ R&S®Legacy Pro – easy replacement of obsolete analyzers
- ▮ Firmware updates – always in step with new developments
- ▮ Keeping test data confidential

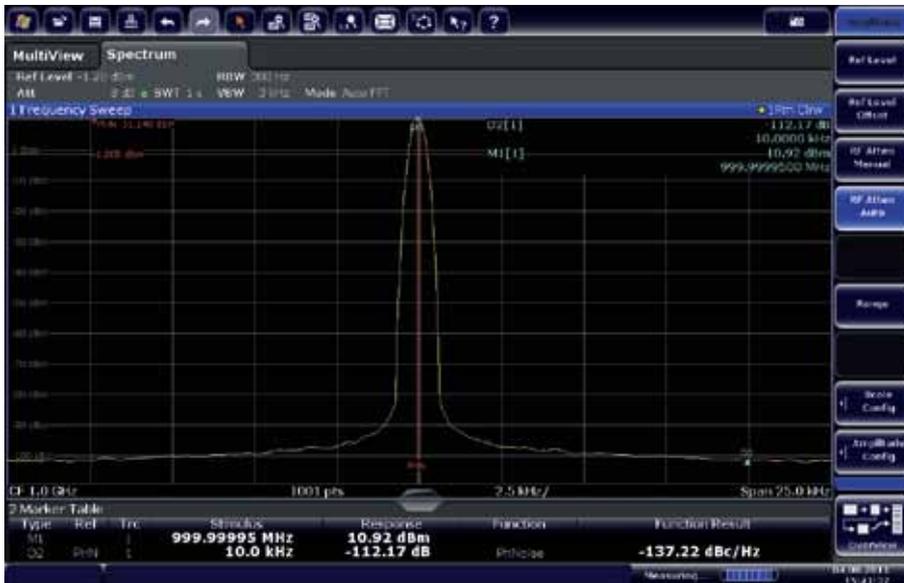
▷ [page 11](#)

RF performance that meets exacting demands

The R&S®FSW redefines the top of the line for signal and spectrum analyzers, offering superior RF performance in terms of phase noise, displayed average noise level (without noise cancellation), intermodulation suppression and dynamic range for ACLR and harmonic measurements.

Unmatched phase noise – ideal for measuring oscillators for radar and communications applications

Developers of oscillators, synthesizers or transmit systems benefit from the R&S®FSW's excellent dynamic range for phase noise measurements. At 10 kHz offset from the carrier, the R&S®FSW achieves phase noise of -137 dBc (1 Hz) for a 1 GHz carrier and -128 dBc (1 Hz) for a 10 GHz carrier. At 100 Hz offset from the carrier, values of -110 dBc (1 Hz) and -90 dBc (1 Hz) are attained. The R&S®FSW therefore outperforms previous analyzers by more than 10 dB.



Phase noise at 10 kHz offset from a 1 GHz carrier: -137 dBc (1 Hz).



Harmonic measurement with highpass filter on (yellow trace) and off (blue trace).

Excellent dynamic range for spurious measurements thanks to low DANL

Featuring a low displayed average noise level (DANL) of typ. -159 dBm (1 Hz) at 2 GHz and -150 dBm (1 Hz) at 25 GHz without using a preamplifier, the R&S®FSW measures spurious emissions quickly and reliably over a wide frequency range. DANL can be further improved by up to 13 dB by means of the analyzer's switch-selected noise cancellation. Users can thus identify even the smallest of spurious that were previously hidden in the noise floor, and effectively optimize transmit systems.

Harmonic measurements made easy – due to integrated highpass filters

The R&S®FSW can optionally be equipped with switchable highpass filters (R&S®FSW-B13) for carrier frequencies up to 1.5 GHz for harmonic measurements on transmit systems, resulting in a clear improvement of dynamic range over conventional spectrum analyzers. External filters are no longer needed. This facilitates test system setup for GSM, CDMA2000®, WCDMA, LTE and TETRA systems, for example.

High sensitivity even at low frequencies

The R&S®FSW's DANL at low frequencies is improved by routing the input signal directly to the A/D converter. This yields high sensitivity of -120 dBm (1 Hz) at 2 Hz even in the audio and baseband frequency range – surpassing comparable analyzers by up to 20 dB.

High accuracy

The R&S®FSW offers high level measurement accuracy up to 8 GHz. This means that the analyzer measures signal levels with < 0.4 dB total measurement uncertainty, for example in the 5.8 GHz ISM band or in satellite communications or radar bands.

Unparalleled dynamic range up to 1 GHz with separate receive path

The R&S®FSW has a separate receive path optimized for frequencies < 1 GHz. This yields a dynamic range unattained so far, for example for measurements on professional mobile radio (PMR) systems.



Displayed average noise level (DANL) with preamplifier and noise cancellation switched on.

Ready for the future

Up to 160 MHz analysis bandwidth

The demand for analysis bandwidth is continuously increasing. This becomes apparent when power amplifiers for multicarrier or wideband applications have to be linearized in order to make them more effective, or when the occupied bandwidth of communications systems themselves increases. The R&S®FSW is ready to take on this challenge – offering analysis bandwidths of up to 160 MHz.

Configuration	Maximum analysis bandwidth	Applications
Standard	10 MHz	<ul style="list-style-type: none"> Standard applications and measurements on single carriers, e.g. WCDMA, CDMA2000®, TD-SCDMA, TETRA carriers
R&S®FSW-B28	28 MHz	<ul style="list-style-type: none"> Modulation measurements on WiMAX™, LTE, WLAN 802.11a/b/g signals
R&S®FSW-B40	40 MHz	<ul style="list-style-type: none"> Modulation measurements on 802.11n signals Amplifier characterization and linearization
R&S®FSW-B80	80 MHz	<ul style="list-style-type: none"> Amplifier characterization and linearization Wideband pulse measurements Modulation measurements on 802.11ac signals
R&S®FSW-B160	160 MHz	<ul style="list-style-type: none"> Amplifier characterization and linearization Wideband pulse measurements Modulation measurements on 802.11ac signals

High spurious-free dynamic range of > 100 dBc

In addition to A/D converter resolution, the available spurious-free dynamic range (SFDR) plays an eminent role when analyzing I/Q data. With an SFDR well over 100 dBc, the R&S®FSW offers unprecedented accuracy when it comes to linearizing amplifiers or measuring EVM.

Analysis bandwidth	SFDR
10 MHz	100 dBc
80 MHz	80 dBc
160 MHz	70 dBc

Large I/Q memory depth for seamless recording of long signal sequences

The R&S®FSW has a 400 Msample I/Q memory depth. Signals can be recorded over extended periods of time, even when analyzing large bandwidths. This makes it easier to identify and analyze sporadic errors.

Analysis bandwidth	Sampling rate	Maximum recording time
10 MHz	12.5 Msample/s	36.9 s
20 MHz	25 Msample/s	18.4 s
40 MHz	50 Msample/s	9.2 s
80 MHz	100 Msample/s	4.6 s
160 MHz	200 Msample/s	2.3 s



Spurious-free dynamic range (SFDR) at 80 MHz I/Q bandwidth.

Designed for convenience – with straightforward result display

The R&S®FSW turns into a reality what many users desire: configuration, measurement and analysis that are truly intuitive.

Efficient operation with optimized user guidance

From block diagrams reflecting the signal flow on the R&S®FSW touchscreen, the user can select a desired element and access all functions via straightforward dialogs. The R&S®FSW uses flat menu structures throughout, making it easy to navigate to a desired function or setting. For example, up to eight traces can be configured in a single dialog. Dialog windows are transparent, so that the signal of interest is always visible.

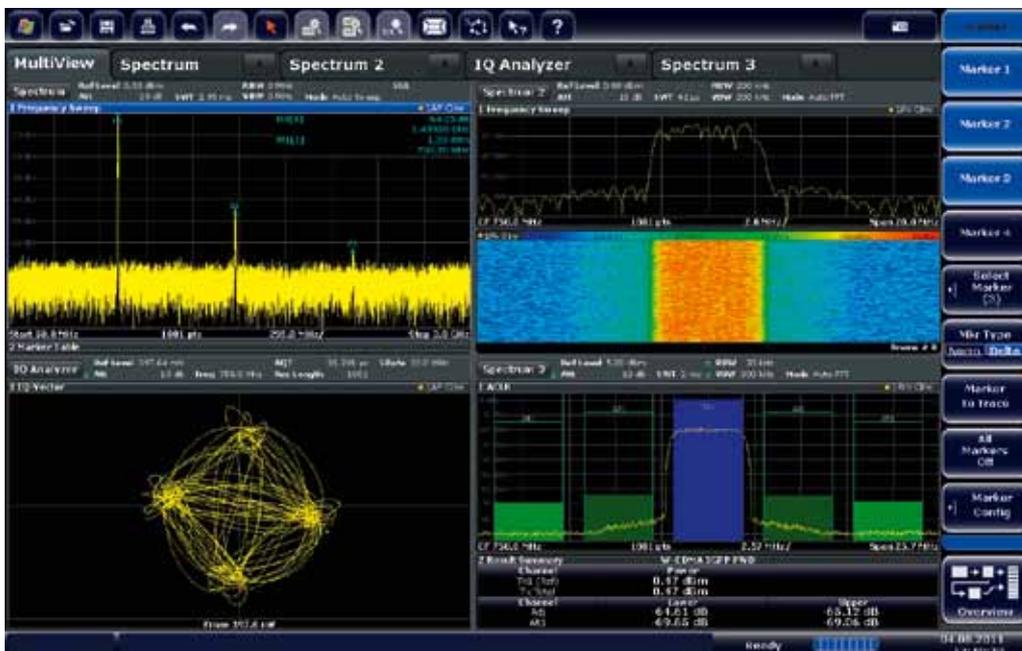
Frequently used control functions are assigned to hard-keys. Via a toolbar, users can quickly access global functions, such as the zoom function or the storage function for saving measurement data and screen content.

MultiView: multiple results available at a glance

With the MultiView function, the user can display multiple results simultaneously on the R&S®FSW's 12.1" touchscreen.

For example, in one measurement diagram, the user can analyze the wanted spectrum of a radar signal. In a second diagram with separate settings, the signal harmonics can be measured. A third diagram can be activated to measure and statistically evaluate the pulse rise and fall times as well as phase shift keying within a pulse (intrapulse PSK) using the R&S®FSW-K6 application. The desired diagram (measurement application) can be activated by clicking the associated tab. Clicking the MultiView tab will simultaneously display all active measurements.

The multichannel sequencer makes it possible to run multiple measurement applications virtually in parallel. Measuring signals at different frequencies and according to different parameters previously called for a step-by-step approach, i.e. measurements had to be performed one after the other, which was a time-consuming procedure. The new functionality now makes it possible to run different measurement applications virtually simultaneously and view all results at a glance. This provides an enormous speed advantage for signal measurements during development and verification.



MultiView function.

Ideal for analyzing radar systems

Rapid spurious identification, low phase noise, extensive pulse analysis functions and wide analysis bandwidth make the R&S®FSW signal and spectrum analyzer an essential tool in the development and production of radar systems.

Fast identification and analysis of spurious emissions

To identify spurious emissions from a transmitter or oscillator, measurements are often carried out over large frequency ranges at narrow analysis bandwidths. Due to its short sweep times, the R&S®FSW delivers results very quickly even for this demanding application.

At 1 kHz resolution bandwidth and a frequency range up to 8 GHz, the R&S®FSW outputs a spectrum with levels down to -100 dBm within 10 s. Using the zoom or the MultiView function, users can investigate detected spurious emissions in greater detail while keeping an eye on the overall spectrum.

Low phase noise for oscillator measurements

Radar systems are equipped with highly stable oscillators in order to achieve high resolution. They can accurately determine the speed of moving objects, for example. With its outstanding RF performance, the R&S®FSW is the ideal tool for measuring these oscillators (see page 4).

Measuring pulse parameters at the touch of a key

Characterizing radar systems requires numerous pulse parameters to be measured. The R&S®FSW-K6 option measures – at the touch of a key – all relevant parameters such as pulse duration, pulse period, pulse rise and fall times, power drop across a pulse, and intrapulse phase modulation, and produces a trend analysis over many pulses. The user selects the results to be displayed simultaneously on the screen. The R&S®FSW thus delivers a full picture of a radar system within seconds.

Analyzing short pulse rise and fall times

Analyzing short pulses requires a wide dynamic range and a large analysis bandwidth. The R&S®FSW has both (see page 6).



Equipped with the R&S®FSW-K6 pulse measurements option, the R&S®FSW delivers pulse parameters at the touch of a key.

Identifying interaction between signals

Multistandard radio analyzer (MSRA)

The constantly growing demand for wireless transmission capacity results in ever more complex signal scenarios. Multistandard transmitters transmit signals to various standards over a common RF path. Measuring RF signal quality and RF signal interaction poses new challenges for signal and spectrum analyzers, both in terms of speed and the ability to measure different signals in parallel.

The R&S®FSW meets this challenge with its new multistandard radio analyzer function. The MSRA simultaneously measures signals of different standards (GSM, WCDMA, LTE, etc.) at different frequencies within its 160 MHz analysis bandwidth.

Interaction between signals is visualized by jointly displaying the results of all measurements.

This technique is also beneficial when it comes to optimizing transmission and communications systems, for example to determine the interaction between WLAN and radar systems.



Multistandard radio analyzer (MSRA): Signals are captured once, then analyzed according to different standards and at different frequencies in parallel.

When speed counts

A wide variety of measurements are needed in order to validate and verify the characteristics of RF ICs, modules and systems under various conditions, for example at different frequencies, temperatures or with different supply voltages.

The R&S®FSW effectively supports these measurements by offering high speed, efficient measurement functions and fast switchover between instrument setups. This speeds up test sequences and reduces the time to the final product.

High measurement rates and fast sweep times with sweep rates of up to 1000 sweep/s

With a sweep rate of up to 800 sweep/s in manual operation and 1000 sweep/s in remote control, the R&S®FSW offers performance superior to that of comparable signal and spectrum analyzers. The R&S®FSW speeds up measurements that require a high averaging factor, as are frequently stipulated in test specifications for communications standards.

Fast switchover between instrument setups

With the R&S®FSW, different instrument setups can be kept in RAM simultaneously to accommodate measurements requiring different settings. This minimizes the time to switch between instrument setups and operating modes. For example, test routines that involve switchover between spectrum and modulation measurements are performed faster.

Efficient measurement functions speed up operation

- Frequency list mode: fast measurement on up to 300 frequencies with different analyzer settings triggered by just a single remote control command
- Measurement of different power levels in the time domain in just a single sweep (multisummary marker)
- Frequency counter with 0.1 Hz resolution at < 50 ms measurement time
- Fast ACP measurement in the time domain using channel filters or in the frequency domain using FFT sweep

Integrated support of R&S®NRP-Zxx power sensors

The R&S®FSW supports the operation of up to four R&S®NRP-Zxx power sensors. This simplifies test system architecture. No extra, separately controlled instruments are needed to connect the sensors, which also speeds up test system control.

Measurement speed of the R&S®FSW		
Local measurement and display update rate	1001 sweep points	1.25 ms (800/s) (measured)
Remote measurement, average over 1000 sweeps	1001 sweep points	1.0 ms (1000/s) (measured)
Remote measurement including data transfer via LAN		5 ms (200/s) (measured)
Marker peak search		1.7 ms (measured)
Setting of center frequency including data transfer	$f \leq 8$ GHz	15 ms (measured)
	$f > 8$ GHz	65 ms (measured)

A safe investment

Keeping pace with technological advancement

Fast innovation cycles, new transmission methods, growing data volumes and ever higher bandwidths mean that analyzers have to constantly cope with new T&M requirements during their useful life. The R&S®FSW has a modular design, i.e. subassemblies such as the controller, the power supply and the digital backend are inserted into slots on the rear. Optional modules, such as for extending I/Q demodulation bandwidth, are likewise accommodated on the rear. Measurement applications can be activated with a key code.

R&S®Legacy Pro – easy replacement of obsolete analyzers

In a test system, core elements such as spectrum analyzers may have to be replaced, for example because an analyzer becomes inoperative and repair is not possible, or because the user wants to benefit from the higher measurement speed of a more state-of-the-art instrument. Replacement may be required despite test system software having been validated at substantial cost and effort. The R&S®FSW supports the remote control command sets of other Rohde&Schwarz signal and spectrum analyzers, such as those of the R&S®FSU and R&S®FSQ, as well as those of other manufacturers' instruments (R&S®Legacy Pro). Replacing an obsolete analyzer with an R&S®FSW therefore poses no problems. In most cases it is sufficient to verify the R&S®FSW's response during a measurement sequence. Numerous successful reference projects with the R&S®FSV or R&S®FSU replacing obsolete analyzers prove the efficiency of this approach.

Firmware updates – always in step with new developments

R&S®FSW firmware updates can be downloaded from a USB stick or via LAN. They are available free of charge at www.rohde-schwarz.de

Keeping test data confidential

To keep their test data confidential, users can exchange the R&S®FSW's internal solid state disk (SSD) for another, neutral SSD (R&S®FSW-B18 option). The instrument can then be sent in for calibration or any other purpose without any confidential test data leaving the lab. Device-specific alignment data remains in the analyzer, where it is stored separately and independently of user data.

R&S®FSW-K70

option

Vector signal analysis application

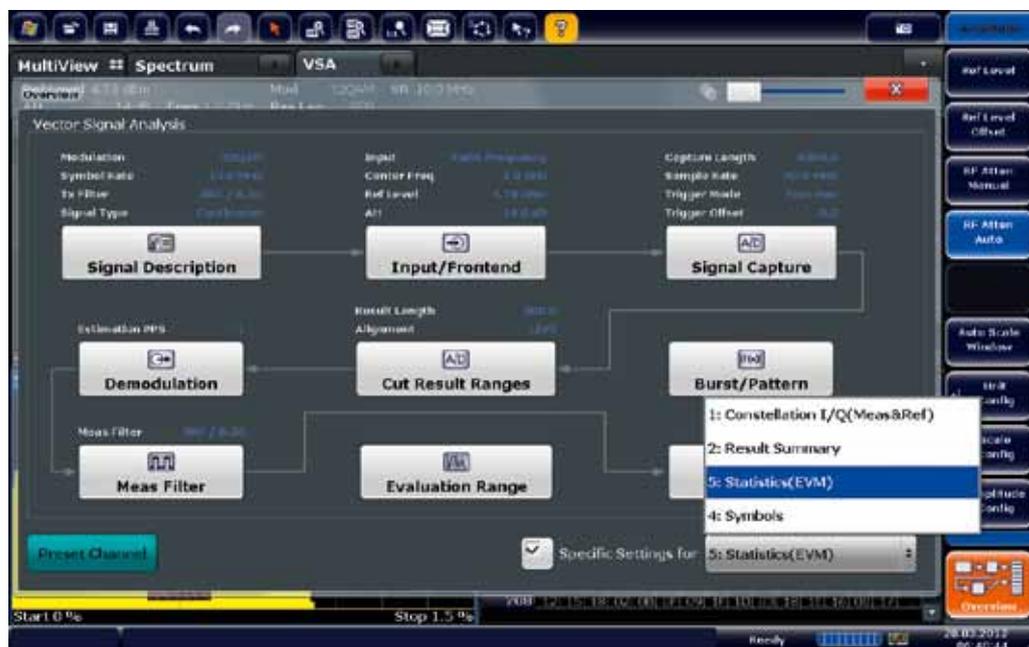
The R&S®FSW-K70 option enables users to flexibly analyze digitally modulated single carriers down to the bit level. The clearly structured operating concept simplifies measurements, despite the wide range of analysis tools.

Flexible modulation analysis from MSK to 64QAM

- Modulation formats:
 - 2FSK, 4FSK
 - MSK, GMSK, DMSK
 - BPSK, QPSK, Offset-QPSK, DQPSK, 8PSK, D8PSK, $\pi/4$ -DQPSK, $3\pi/8$ -8PSK, $\pi/8$ -D8PSK
 - 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 512QAM, 1024QAM
 - 16APSK (DVB-S2), 32APSK (DVB-S2), 2ASK, 4ASK, $\pi/4$ -16QAM (EDGE), $-\pi/4$ -16QAM (EDGE)
- Analysis length up to 50 000 symbols
- Signal analysis bandwidth 28 MHz (40 MHz, 80 MHz and 160 MHz optional)

Numerous standard-specific default settings

- GSM, GSM/EDGE
- 3GPP WCDMA, EUTRA/LTE, CDMA2000®
- TETRA, APCO25
- Bluetooth®, ZigBee
- DECT, DVB-S2



Clearly structured block diagram display.

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®FSW-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 95th 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
- ▮ Bit error calculation on known data sequences
- ▮ Equalizer helps in finding the optimum filter design
- ▮ Multicarrier filter for measuring under conditions where several signals are present



32QAM with four screens.

General purpose measurement applications

Measurement application	Measurement parameters	Measurement functions	Remarks
R&S®FSW-K7 Modulation analysis for AM/FM/φM modulated single carriers	<ul style="list-style-type: none"> ▮ Modulation depth (AM) ▮ Frequency deviation (FM) ▮ Phase deviation (φM) ▮ Modulation frequency ▮ THD and SINAD ▮ Carrier power 	<ul style="list-style-type: none"> ▮ AF spectrum ▮ RF spectrum ▮ AF scope display ▮ AF filters (lowpass and highpass) ▮ Weighting filters (CCITT) ▮ Squelch 	
R&S®FSW-K17 Multicarrier group delay measurements	<ul style="list-style-type: none"> ▮ Group delay (abs. and rel.) ▮ Magnitude ▮ Phase 	<ul style="list-style-type: none"> ▮ Up to 160 MHz signal capture bandwidth ▮ Calibration (load and save calibration data) for measurement of components and frequency converters ▮ Configurable multicarrier scenarios 	
R&S®FSW-K30 Noise figure and gain measurements based on Y-factor method	<ul style="list-style-type: none"> ▮ Noise figure ▮ Noise temperature ▮ Gain ▮ Y factor 	<ul style="list-style-type: none"> ▮ Analyzer noise correction (2nd stage correction) ▮ Measurements on frequency-converting DUTs ▮ Control of a generator as an LO in frequency-converting measurements ▮ SSB and DSB 	Requires external noise source, e.g. Noisecom NC346
R&S®FSW-K40 Phase noise measurements	<ul style="list-style-type: none"> ▮ SSB phase noise ▮ Residual FM and residual φM ▮ Jitter 	<ul style="list-style-type: none"> ▮ 1 Hz to 10 GHz offset range ▮ Selection of resolution bandwidth and number of averages for each offset range ▮ Definable evaluation ranges for residual FM/φM ▮ Signal tracking ▮ Optional suppression of spurious emissions 	

Measurement applications for wireless communications systems

Measurement application/ technology	Power	Modulation quality	Spectrum measurements	Miscellaneous	Special features
R&S®FSW-K10 GSM/EDGE/ EDGE Evolution	<ul style="list-style-type: none"> Power measurement in time domain including carrier power 	<ul style="list-style-type: none"> EVM Phase/frequency error Origin offset suppression Constellation diagram 	<ul style="list-style-type: none"> Modulation spectrum Transient spectrum 	–	<ul style="list-style-type: none"> Single burst and multi burst Automatic detection of modulation
R&S®FSW-K72/-K73 3GPP FDD (WCDMA)	<ul style="list-style-type: none"> Code domain power Code domain power versus time CCDF 	<ul style="list-style-type: none"> EVM Peak code domain error Constellation diagram I/Q offset Residual code domain error I/Q imbalance Gain imbalance Center frequency error (chip rate error) 	<ul style="list-style-type: none"> Spectrum mask ACLR Power measurement 	<ul style="list-style-type: none"> Channel table with channels used on base station Timing offset Power versus time 	<ul style="list-style-type: none"> Automatic detection of active channels and decoding of useful information Automatic detection of encryption code Automatic detection of HSDPA modulation format Support of compressed mode signals Support of HSPA and HSPA+ (HSDPA+ and HSUPA+)
R&S®FSW-K76/-K77 TD-SCDMA	<ul style="list-style-type: none"> Code domain power Code domain power versus time CCDF 	<ul style="list-style-type: none"> EVM Peak code domain error Constellation diagram I/Q offset Residual code domain error Gain imbalance Center frequency error (chip rate error) 	<ul style="list-style-type: none"> Spectrum mask ACLR Power measurement 	<ul style="list-style-type: none"> Channel table with channels used on base station Timing offset Power versus time 	<ul style="list-style-type: none"> Automatic detection of active channels and decoding of useful information Automatic detection of HSDPA modulation format Support of HSPA+ (HSDPA+ and HSUPA+)
R&S®FSW-K82/-K83 CDMA2000®	<ul style="list-style-type: none"> Carrier power Code domain power Code domain power versus time CCDF 	<ul style="list-style-type: none"> RHO EVM Constellation diagram I/Q offset I/Q imbalance Center frequency error 	<ul style="list-style-type: none"> Spectrum mask ACLR Power measurement 	<ul style="list-style-type: none"> Channel table with summary of channels used on base station Timing offset 	<ul style="list-style-type: none"> Automatic detection of active channels and decoding of user information Robust demodulation algorithms for reliable measurement of multicarrier signals
R&S®FSW-K84/-K85 1xEV-DO	<ul style="list-style-type: none"> Carrier power Code domain power Code domain power versus time CCDF 	<ul style="list-style-type: none"> RHO_{Pilot} (R&S®FSW-K84) RHO_{Data} (R&S®FSW-K84) RHO_{MAC} (R&S®FSW-K84) RHO_{Overall} EVM Constellation diagram I/Q offset I/Q imbalance Center frequency error 	<ul style="list-style-type: none"> Spectrum mask ACLR Power measurement 	<ul style="list-style-type: none"> Channel table with summary of channels used on base station Timing offset 	<ul style="list-style-type: none"> Automatic detection of active channels and decoding of user information Robust demodulation algorithms for reliable measurement of multicarrier signals

Measurement application/ technology	Power	Modulation quality	Spectrum measurements	Miscellaneous	Special features
R&S®FSW-K91 WLAN IEEE 802.11a R&S®FSW-K91N WLAN IEEE 802.11n R&S®FSW-K91AC WLAN IEEE 802.11ac	<ul style="list-style-type: none"> ▮ Power versus time ▮ Burst power ▮ Crest factor 	<ul style="list-style-type: none"> ▮ EVM (pilot, data) ▮ EVM versus carrier ▮ EVM versus symbol ▮ Constellation diagram ▮ I/Q offset ▮ I/Q imbalance ▮ Gain imbalance ▮ Center frequency error ▮ Symbol clock error ▮ Group delay 	<ul style="list-style-type: none"> ▮ Spectrum mask ▮ ACLR ▮ Power measurement ▮ Spectrum flatness 	<ul style="list-style-type: none"> ▮ Bitstream ▮ Signal field ▮ Constellation versus carrier 	<ul style="list-style-type: none"> ▮ Automatic detection of burst type ▮ Automatic detection of MCS index ▮ Automatic detection of bandwidth ▮ Automatic detection of guard interval ▮ Estimation of payload length from burst
R&S®FSW-K100/-K101/-K104/K-105 EUTRA/LTE TDD and FDD UL and DL	<ul style="list-style-type: none"> ▮ Power measurement in time and frequency domains ▮ CCDF 	<ul style="list-style-type: none"> ▮ EVM ▮ Constellation diagram ▮ I/Q offset ▮ Gain imbalance ▮ Quadrature error ▮ Center frequency error (symbol clock error) 	<ul style="list-style-type: none"> ▮ Spectrum mask ▮ ACLR ▮ Power measurement ▮ Spectrum flatness 	<ul style="list-style-type: none"> ▮ Bit stream ▮ Allocation summary list ▮ Averaging over multiple measurements 	<ul style="list-style-type: none"> ▮ Automatic detection of modulation, cyclic prefix length and cell ID
R&S®FSW-K102 EUTRA/LTE MIMO					Time alignment for R&S®FSW-K100/-K104; full MIMO support planned
R&S®FS-K100PC/-K101PC/-K102PC/-K103PC/-K104PC/-K105PC LTE FDD, TDD and MIMO	<ul style="list-style-type: none"> ▮ Power measurement in time and frequency domain ▮ CCDF 	<ul style="list-style-type: none"> ▮ EVM ▮ Constellation diagram ▮ I/Q offset ▮ Gain imbalance ▮ Quadrature error ▮ Center frequency error (symbol clock error) 	<ul style="list-style-type: none"> ▮ Power spectrum ▮ ACLR ▮ Spectrum mask ▮ Spectrum flatness 	<ul style="list-style-type: none"> ▮ Bit stream ▮ Allocation summary list ▮ Signal flow diagram ▮ Averaging over multiple measurements 	<ul style="list-style-type: none"> ▮ Automatic detection of modulation, cyclic prefix length and cell ID ▮ MIMO measurements (R&S®FS-K102PC/-K103PC) ▮ Windows based analysis software, to be installed on the R&S®FSW or a separate PC

Specifications in brief

Specifications in brief			
Frequency			
Frequency range	R&S®FSW8	2 Hz to 8 GHz	
	R&S®FSW13	2 Hz to 13.6 GHz	
	R&S®FSW26	2 Hz to 26.5 GHz	
	R&S®FSW43	2 Hz to 43.5 GHz	
Aging of frequency reference		1 × 10 ⁻⁷ /year	
	with R&S®FSW-B4 option	3 × 10 ⁻⁸ /year	
Bandwidths			
Resolution bandwidths	standard filter	1 Hz to 10 MHz, 80 MHz (with R&S®FSW-B8 option)	
	RRC filter	18 kHz (NADC), 24.3 kHz (TETRA), 3.84 MHz (3GPP)	
	channel filter	100 Hz to 5 MHz	
	video filter	1 Hz to 10 MHz	
I/Q demodulation bandwidth		10 MHz	
	with R&S®FSW-B28 option	28 MHz	
	with R&S®FSW-B40 option	40 MHz	
	with R&S®FSW-B80 option	80 MHz	
	with R&S®FSW-B160 option	160 MHz	
Displayed average noise level (DANL)	2 GHz	typ. -156 dBm (1 Hz)	
	with R&S®FSW-B13 option	typ. -159 dBm (1 Hz)	
	8 GHz	typ. -156 dBm (1 Hz)	
	20 GHz	typ. -150 dBm (1 Hz)	
	40 GHz	typ. -144 dBm (1 Hz)	
	DANL with preamplifier (R&S®FSW-B24 option)	8 GHz	typ. -169 dBm (1 Hz)
		20 GHz	typ. -166 dBm (1 Hz)
40 GHz		typ. -165 dBm (1 Hz)	
DANL with noise cancellation, preamplifier off, 2 GHz		typ. -169 dBm (1 Hz)	
Intermodulation			
Third-order intercept (TOI)	f < 1 GHz	typ. +30 dBm	
	f < 3 GHz	typ. +25 dBm	
	8 GHz to 26 GHz	typ. +17 dBm	
	13.6 GHz to 40 GHz	typ. +15 dBm	
WCDMA ACLR dynamic range	with noise cancellation	88 dB	
Phase noise			
10 kHz offset from carrier	500 MHz carrier	typ. -140 dBc (1 Hz)	
	1 GHz carrier	typ. -137 dBc (1 Hz)	
	10 GHz carrier	typ. -128 dBc (1 Hz)	
Total measurement uncertainty	8 GHz	< 0.4 dB	

For data sheet, see PD 5214.5984.22 and www.rohde-schwarz.com

Ordering information

Designation	Type	Order No.
Base unit		
Signal and Spectrum Analyzer, 2 Hz to 8 GHz	R&S®FSW8	1312.8000K08
Signal and Spectrum Analyzer, 2 Hz to 13.6 GHz	R&S®FSW13	1312.8000K13
Signal and Spectrum Analyzer, 2 Hz to 26.5 GHz	R&S®FSW26	1312.8000K26
Signal and Spectrum Analyzer, 2 Hz to 43.5 GHz	R&S®FSW43	1312.8000K43
Hardware options		
OCXO Precision Reference Frequency	R&S®FSW-B4	1313.0703.02
Resolution Bandwidths > 10 MHz (for R&S®FSW8, R&S®FSW13 and R&S®FSW26)	R&S®FSW-B8	1313.2464.26
Resolution Bandwidths > 10 MHz (for R&S®FSW43)	R&S®FSW-B8	1313.2464.02
Highpass Filters for Harmonic Measurements	R&S®FSW-B13	1313.0761.02
Digital Baseband Interface	R&S®FSW-B17	1313.0784.02
Spare Solid State Disk (removable hard drive)	R&S®FSW-B18	1313.0790.02
LO/IF Ports for External Mixers (for R&S®FSW26)	R&S®FSW-B21	1313.1100.26
LO/IF Ports for External Mixers (for R&S®FSW43)	R&S®FSW-B21	1313.1100.43
Preamplifier, 100 kHz to 8 GHz/13 GHz (for the R&S®FSW8 and R&S®FSW13)	R&S®FSW-B24	1313.0832.13
Preamplifier, 100 kHz to 26 GHz (for the R&S®FSW26)	R&S®FSW-B24	1313.0832.26
Preamplifier, 100 kHz to 43 GHz (for the R&S®FSW43)	R&S®FSW-B24	1313.0832.43
Electronic Attenuator, 1 dB steps	R&S®FSW-B25	1313.0990.02
USB Mass Memory Write Protection	R&S®FSW-B33	1313.3602.02
28 MHz Analysis Bandwidth	R&S®FSW-B28	1313.1645.02
40 MHz Analysis Bandwidth	R&S®FSW-B40	1313.0861.02
80 MHz Analysis Bandwidth	R&S®FSW-B80	1313.0878.02
160 MHz Analysis Bandwidth	R&S®FSW-B160	1313.1668.02
Firmware/software		
Pulse Measurements	R&S®FSW-K6	1313.1322.02
Analog Modulation Analysis AM/FM/ϕM	R&S®FSW-K7	1313.1339.02
GSM, EDGE, EDGE Evolution and VAMOS measurements	R&S®FSW-K10	1313.1368.02
Multicarrier Group Delay Measurements	R&S®FSW-K17	1313.4150.02
Noise Figure Measurements	R&S®FSW-K30	1313.1380.02
Phase Noise Measurements	R&S®FSW-K40	1313.1397.02
Vector Signal Analysis	R&S®FSW-K70	1313.1416.02
3GPP FDD (WCDMA) BS Measurements (incl. HSDPA and HSDPA+)	R&S®FSW-K72	1313.1422.02
3GPP FDD (WCDMA) MS Measurements (incl. HSUPA and HSUPA+)	R&S®FSW-K73	1313.1439.02
3GPP TDD (TD-SCDMA) BS Measurements	R&S®FSW-K76	1313.1445.02
3GPP TDD (TD-SCDMA) UE Measurements	R&S®FSW-K77	1313.1451.02
CDMA2000® BS Measurements	R&S®FSW-K82	1313.1468.02
CDMA2000® MS Measurements	R&S®FSW-K83	1313.1474.02
1xEV-DO BS BS Measurements	R&S®FSW-K84	1313.1480.02
1xEV-DO MS BS Measurements	R&S®FSW-K85	1313.1497.02
802.11a/b/g Measurements	R&S®FSW-K91	1313.1500.02
802.11n Measurements	R&S®FSW-K91N	1313.1516.02
802.11ac Measurements	R&S®FSW-K91AC	1313.4209.02
EUTRA/LTE FDD BS Measurements	R&S®FSW-K100	1313.1545.02
EUTRA/LTE FDD UE Measurements	R&S®FSW-K101	1313.1551.02
EUTRA/LTE BS MIMO Measurements ¹⁾	R&S®FSW-K102	1313.1568.02
EUTRA/LTE TDD BS Measurements	R&S®FSW-K104	1313.1574.02
EUTRA/LTE TDD UE Measurements	R&S®FSW-K105	1313.1580.02
OFDM Vector Signal Analysis Software	R&S®FS-K96	1310.0202.06
OFDM Vector Signal Analysis Software	R&S®FS-K96PC	1310.0219.06
EUTRA/LTE FDD Downlink PC Software	R&S®FS-K100PC	1309.9916.06

Designation	Type	Order No.
EUTRA/LTE Uplink FDD PC Software	R&S®FS-K101PC	1309.9922.06
EUTRA/LTE Downlink MIMO PC Software (incl. LTE-Advanced)	R&S®FS-K102PC	1309.9939.06
EUTRA/LTE Uplink MIMO PC Software (incl. LTE-Advanced)	R&S®FS-K103PC	1309.9945.06
EUTRA/LTE TDD Downlink PC Software	R&S®FS-K104PC	1309.9951.06
EUTRA/LTE TDD Uplink PC Software	R&S®FS-K105PC	1309.9968.06
Distortion Analysis PC Software	R&S®FS-K130PC	1310.0090.06
Analysis Bandwidth Upgrade from 28 MHz to 40 MHz	R&S®FSW-U40	1313.5205.02
Analysis Bandwidth Upgrade from 40 MHz to 80 MHz	R&S®FSW-U80	1313.5211.02
Analysis Bandwidth Upgrade from 80 MHz to 160 MHz	R&S®FSW-U160	1313.3754.02

¹⁾ Time alignment for R&S®FSW-K100/-K104; full MIMO support planned.

Service options		
Extended Warranty, one year	R&S®WE1FSW	Please contact your local Rohde & Schwarz sales office.
Extended Warranty, two years	R&S®WE2FSW	
Extended Warranty, three years	R&S®WE3FSW	
Extended Warranty, four years	R&S®WE4FSW	
Extended Warranty with Calibration Coverage, one year	R&S®CW1FSW	
Extended Warranty with Calibration Coverage, two years	R&S®CW2FSW	
Extended Warranty with Calibration Coverage, three years	R&S®CW3FSW	
Extended Warranty with Calibration Coverage, four years	R&S®CW4FSW	

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