

# R&S® FSVA3000 SIGNAL AND SPECTRUM ANALYZER

Master demanding applications



Product Brochure  
Version 11.00

**ROHDE & SCHWARZ**

Make ideas real



# AT A GLANCE

With 1 GHz of analysis bandwidth, outstanding phase noise of  $< -127$  dBc (1 Hz) at 10 kHz offset and a high dynamic range, the R&S®FSVA3000 signal and spectrum analyzer has everything it takes to master demanding measurement applications such as 5G NR measurements. Offering high measurement speed and an advanced operating concept, it is the right instrument for challenging signal analysis tasks both in the lab and in production.

The R&S®FSVA3000 offers a performance level that until recently was only possible with high-end instruments. It is equally suitable for analyzing frequency agile signals and wideband signals as for linearizing power amplifiers. With up to 200 MHz real-time analysis bandwidth, the instrument allows users to monitor the spectrum and to trigger on short-duration signals. The analyzer supports all modern cellular and wireless standards, and its frequency ranges and bandwidth options perfectly match the requirements of 5G NR.

The R&S®FSVA3000 excels with high measurement speed without any compromise in RF performance. It provides high throughput and yield in cellular base station and component production and is also perfectly suited for use in development and verification labs.

The R&S®FSVA3000 offers functions and wizards that make the configuration of complex measurements fast and easy. Setting up RF parameters with touchscreen gestures is as easy as using your smartphone. The auto-set feature automatically sets key parameters such as frequency, level and gating. An SCPI recorder, which translates manual operation into remote control command scripts, considerably speeds up script programming. And event based actions support you when debugging your DUT by capturing and documenting rare events.



Front view of the R&S®FSVA3000.

# KEY FACTS

- ▶ Frequency range from 10 Hz to 4/7.5/13.6/30/44/50/54 GHz
- ▶ Frequency range extension up to 325 GHz with external harmonic mixers from Rohde & Schwarz
- ▶ Frequency range extension up to 50 GHz for high-performance signal analysis with external frontends from Rohde & Schwarz
- ▶ Analysis bandwidth of up to 1 GHz
- ▶ Real-time bandwidth of up to 200 MHz
- ▶ SSB phase noise at 10 kHz offset (1 GHz):  $< -127$  dBc (1 Hz)
- ▶ Third order intercept (TOI) at 1 GHz: +20 dBm (typ.)
- ▶ DANL at 1 GHz:  $-153$  dBm
- ▶ DANL at 1 GHz with optional preamplifier:  $-167$  dBm
- ▶ Ready for cloud based testing
- ▶ 10 Gbit/s LAN interface (option)
- ▶ User interface with multitouch display, SCPI recorder and event based actions
- ▶ Measurement applications for analog and digital signal analysis, including 5G NR

# BENEFITS

- Advanced user interface
  - ▶ page 4
- Clearly structured, intuitive GUI
  - ▶ page 6
- Ready for 5G and other wireless standards
  - ▶ page 8
- Fast measurement speed for production
  - ▶ page 10
- Best-in-class performance and feature set
  - ▶ page 11
- Discover the unseen with real-time spectrum analysis
  - ▶ page 12
- Wide range of measurement applications
  - ▶ page 14



Rear view of the R&S®FSVA3000.

# ADVANCED USER INTERFACE

Depending on the application, certain settings need to be configured on the signal and spectrum analyzer. For simple spectral measurements, this might be just a few parameters. In the case of complex automated conformance tests, lengthy programming may be required. Whatever the objective, the R&S®FSVA3000 can be set up easily and quickly, providing fast access to measurement results.

## Multitouch display

Basic RF measurements typically require the center frequency, span, level and usually the resolution bandwidth to be configured. Finding the ideal settings can be difficult when measuring an unknown signal. The R&S®FSVA3000 features a multitouch display and intuitive menu structure for exceptional ease of operation. A one-finger swipe across the screen adjusts the center frequency or the reference level. Two-finger gestures adjust the displayed span or level range. Settings can be configured in no time.

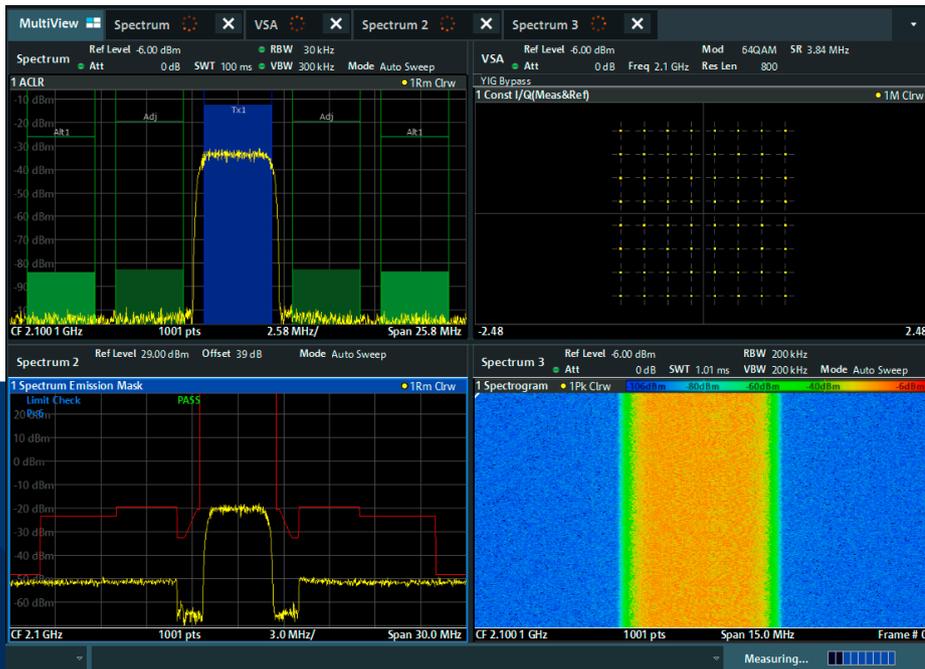
Various measurements can be displayed simultaneously in separate windows on the large 10.1" screen, making it much easier to interpret results. The MultiView function displays all active measurements on one screen. With the sequencer function, all channels are measured one after the other. The user is provided with constantly updated results, and no time-consuming parameter adjustments are necessary.

## SCPI recorder for fast automation

The R&S®FSVA3000 embedded SCPI recorder accelerates the programming of executable control scripts. All manual user input is translated into SCPI commands that can be exported as plain SCPI or in the syntax of common programming languages and tools such as C++, Python and MATLAB.

If manual code adaptation is required, context-sensitive online help provides comprehensive information, including SCPI commands and parameters.

MultiView displays all active measurements at the same time.



## Event based actions dialog

Troubleshooting in R&D regularly requires the analysis of sporadic events, for instance failure to comply with limit lines or specified EVM values. The R&S®FSVA3000 lets you define rules to perform specific actions in response to such events, for instance storing I/Q data or screenshots. A final report lists all the triggered events over an extended period.

The instrument can be set up with the straightforward GUI, eliminating the need for an external PC for remote control.

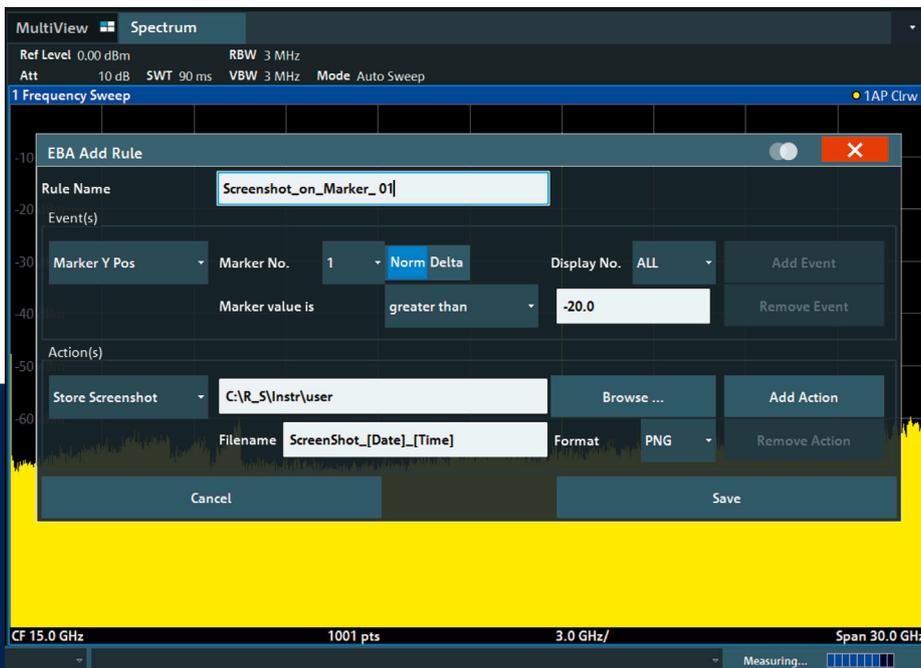
## Autoset

The autoset feature allows you to quickly configure frequently performed measurements such as occupied bandwidth, spectrum, TDP, CCDF, APD and C/N. This feature detects the parameters of an incoming signal and automatically sets the appropriate frequency, level, trigger and gating. For standard-compliant ACLR and SEM measurements, the settings are automatically configured in line with the corresponding standard.

## Smart signal generator control

Many measurements require a signal generator, either to provide a simple CW signal or a modulated carrier. For such applications, the interaction between the R&S®FSVA3000 and a generator such as the R&S®SMBV100B vector signal generator goes far beyond classic signal tracking. With the coupling manager, the analyzer directly controls the generator. A change in frequency or level on the analyzer results in the same change on the generator. The user interface of the generator can be displayed on the analyzer, allowing the user to operate the entire setup from a single screen. The SCPI recorder can also be coupled. Manual settings on either instrument are recorded in a single script. Advanced amplifier measurements with digital predistortion are possible. The analyzer directly provides the predistorted waveform to the generator. The hardware can be coupled via the optional 1 GHz clock reference for better phase synchronization.

In many cases, the event based actions dialog eliminates the need for an external PC. Instead of SCPI programming, IF-THEN commands are set up via the GUI.



# CLEARLY STRUCTURED, INTUITIVE GUI

## 10.1" high-resolution multitouch display

- ▶ 1280 × 800 pixel
- ▶ Multitouch operation

## Toolbar

- ▶ Quickly access frequently used functions
- ▶ Load and save configurations
- ▶ Take screenshots
- ▶ Zoom into graphs
- ▶ Configure displayed items

## Zoom into graphs

- ▶ Zoom into graphs for a detailed view
- ▶ Zoom into multiple areas simultaneously
- ▶ Adapt hardware settings to zoom area

## SCPI recorder

- ▶ Simplified code generation for automatic, remote controlled measurements

## Event based actions

- ▶ Configure and apply IF-THEN tasks directly in the GUI
- ▶ Trigger on sporadic events for quick troubleshooting

## Application starter

- ▶ Quick access to .exe or .com Windows programs

## Three USB 2.0 ports

- ▶ For storage media
- ▶ For connecting accessories
- ▶ For power sensors with a USB connector (additional USB 2.0/USB 3.0 ports on rear panel)



### MultiView and sequencer

- ▶ Display all active measurements on one screen
- ▶ Measure all channels consecutively
- ▶ Receive constantly updated results

### Autoset

- ▶ Automatic setting of frequency, level, trigger and gating based on the incoming signal
- ▶ Automatic selection of ACLR and SEM parameter tables in line with the corresponding standard



### Start commonly used measurements

- ▶ ACLR, OBW, TOI, C/N, SEM

### Removable solid-state disk

- ▶ Option

### Probe power supply

- ▶ +15 V DC, -12.6 V DC and ground

### Settings overview

- ▶ Display and adapt all hardware-related settings on one screen

### Smart port

- ▶ For power sensors
- ▶ For smart noise sources

# READY FOR 5G AND OTHER WIRELESS STANDARDS

The R&S®FSVA3000 signal and spectrum analyzer is ideal for analyzing wireless communications signals in R&D, system testing, verification and production.

## More bandwidth

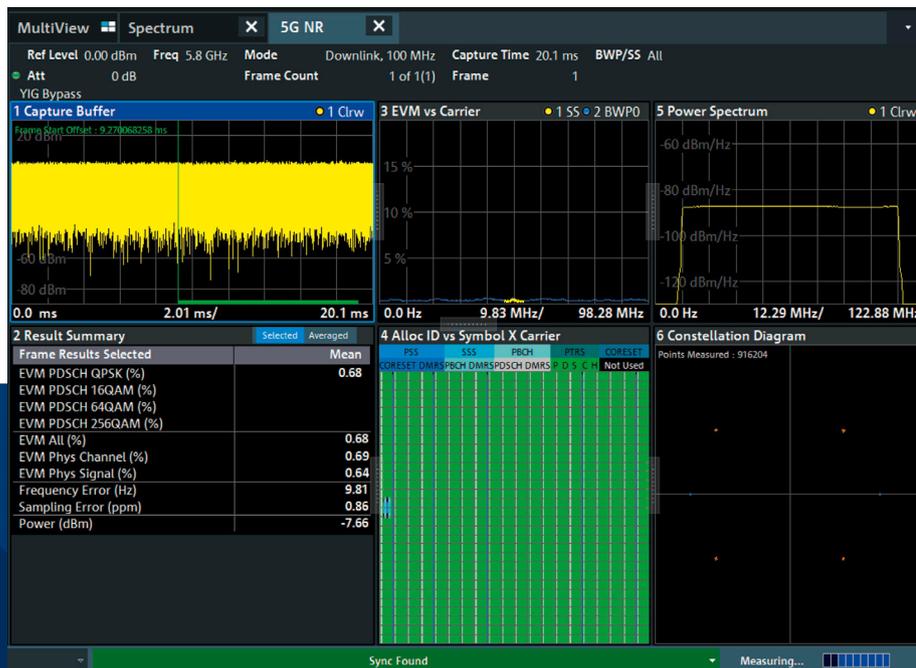
Modern communications signals require ever more bandwidth. With 1 GHz of analysis bandwidth, the R&S®FSVA3000 sets a new standard in its class. The instrument can capture 10 contiguous 5G NR component carriers simultaneously. This saves measurement time and enables analysis of interactions and timing between the carriers. The 1 GHz bandwidth is available up to the maximum frequency of each analyzer model, e.g. 44 GHz. The R&S®FSVA3000 features an excellent dynamic range, which is beneficial not only for spectral measurements but also for analyzing and demodulating signals with a high crest factor, such as OFDM signals or signals with a high modulation order. Excellent EVM values of over 1% can be achieved for 320 MHz wide WLAN signals at 2.4 GHz and 5.8 GHz and also for 5G NR signals at 28 GHz. This increases the margin for the DUT, since it minimizes the error introduced by the measuring instrument.

## Support of all modern wireless standards

The R&S®FSVA3000 provides signal analysis options for all modern wireless and cellular communications standards, i.e.:

- ▶ 3GPP 5G NR
- ▶ EUTRA/LTE/LTE-Advanced
- ▶ NB-IoT downlink
- ▶ WCDMA
- ▶ GSM/EDGE/EDGE Evolution
- ▶ WLAN IEEE 802.11a/b/g/n/p/ac/ax/be
- ▶ Bluetooth® Basic Rate/Enhanced Data Rate/Low Energy

Analysis of a 5G NR signal with the R&S®FSVA3-K144 (downlink) and R&S®FSVA3-K145 (uplink) options.



## Best signal analysis performance with external frontends

5G NR signal analysis at microwave frequencies usually takes place in anechoic chambers where space is scarce. The R&S®FE50DTR and R&S®FE44S external frontends solve this challenge. Thanks to the separation of frequency upconversion and downconversion from the signal analyzer and generator, the small radio head can be mounted close to the antenna in order to reduce cable losses. Additionally, lower frequency base units can be used, enabling an upgrade of existing FR1 setups. The excellent radio quality of the R&S®FE50DTR and R&S®FE44S enables all relevant in-band measurements to be performed in line with 3GPP and provides EVM performance up to 0.35% for 100 MHz wide 5G NR signals at 28 GHz.

R&S®FE50DTR external frontend with R&S®SMM100A vector signal generator and R&S®FSVA3000 signal and spectrum analyzer.



# FAST MEASUREMENT SPEED FOR PRODUCTION

Automated production of components, modules and devices requires spectral measurements as well as signal demodulation. The R&S®FSVA3000 signal and spectrum analyzer performs even complex measurements very quickly.

The R&S®FSVA3000 has been designed for high-speed operation in automated test systems. It performs spectral measurements, signal demodulation and switching between different measuring modes very quickly. The instrument's synthesizer technology enables fast frequency switching. FFT based ACLR and SEM measurements provide the same dynamic range as swept spectrum measurements, but are faster.

The R&S®FSV3-K147 option enables combined and automated ACLR, SEM and EVM measurements on 5G NR downlink signals. This feature provides significant speed advantages thanks to parallelized calculations and adaptable trigger settings. It is especially advantageous for over-the-air (OTA) characterization of devices, which involves a large number of measurements.

The enhanced computing power option provides a quad core CPU and a PCIe 3.0 bus system to deliver faster clock speed, higher data transfer rates and more RAM capacity to accelerate digital signal demodulation.

The R&S®FSVA3000 maintains its excellent dynamic range during FFT based ACLR measurements, which are significantly faster than swept measurements.

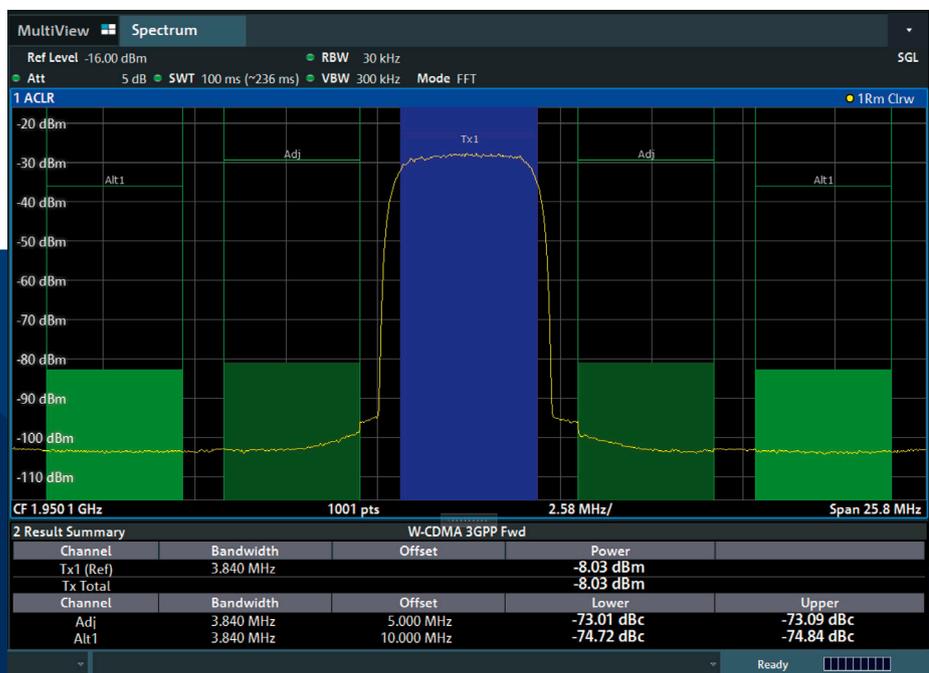
## Ready for cloud based testing

In cloud based test systems, signal analysis is performed on external CPUs. This requires the transfer of huge amounts of I/Q data. The R&S®FSVA3000 interacts perfectly with cloud based processing. The instrument's architecture enables the ultra-fast transfer of I/Q measurement data. The optional 10 Gbit/s LAN interface allows I/Q data transfer even at the high sample rates required for 1 GHz analysis bandwidth.

## Emulation modes for legacy instruments

Replacing legacy equipment in automated test systems can be a laborious task if all control code has to be rewritten.

The R&S®FSVA3000 simplifies the replacement of obsolete instruments. Emulation modes for many legacy analyzers, including R&S®FSP, R&S®FSU/R&S®FSQ, R&S®FSV, Keysight PSA, Keysight PXA and HP 856x/HP 8560E, enable users to keep existing code. Now there is no reason not to upgrade your legacy equipment to an R&S®FSVA3000.



# BEST-IN-CLASS PERFORMANCE AND FEATURE SET

Many measurement applications in the wireless, A&D and component industries require low phase noise, wide analysis bandwidth and high dynamic range. The R&S®FSVA3000 signal and spectrum analyzer is the perfect tool during the production and verification of wireless communications systems and components and for service and maintenance applications in the A&D market.

## Best-in-class RF performance

The R&S®FSVA3000 achieves RF performance that was previously only offered by high-end instruments. With SSB phase noise as low as  $< -127$  dBc (1 Hz) at 10 kHz offset, narrowband measurements very close to the carrier become possible. With the optional R&S®FSV3-K40 phase noise measurement application, the instrument's low inherent phase noise leaves enough margin for phase noise measurements on the most commonly used oscillators in the wireless and A&D industries.

The maximum analysis bandwidth of 1 GHz is unrivaled in this instrument class. This bandwidth is important for analyzing wideband signals, characterizing frequency agile signals and capturing extremely short events. Characterizing the nonlinear behavior of power amplifiers also requires a wide analysis bandwidth.

The dynamic range is typically limited at the upper end by the third order intercept (TOI). The R&S®FSVA3000 has a typical TOI of +20 dBm at 1 GHz. This allows accurate measurements of harmonics and spurs even in the presence of strong signals, and provides an excellent dynamic range for adjacent channel power measurements. It also leaves sufficient margin for demodulation and EVM measurements on signals with a very wide bandwidth and a high crest factor.

## Measurement applications

The R&S®FSVA3000 supports a vast number of measurement applications, including:

- ▶ AM/FM/PM modulation analysis
- ▶ Vector signal analysis of single-carrier digitally modulated signals, including calculation of EVM and equalization
- ▶ Amplifier noise figure and gain measurements
- ▶ Phase noise measurements
- ▶ In-depth pulse analysis and analysis of pulse behavior over time
- ▶ Amplifier measurements including AM/AM, AM/PM and digital predistortion
- ▶ Measurement options for all modern wireless and cellular standards

# DISCOVER THE UNSEEN WITH REAL-TIME SPECTRUM ANALYSIS

Equipped with the R&S®FSV3-K200R 200 MHz real-time spectrum measurements option, the R&S®FSVA3000 signal and spectrum analyzer displays RF spectra seamlessly and in real time. Short events with a duration of only 3.44  $\mu$ s can be captured with 100% probability and full level accuracy.

## Unlocking comprehensive analysis capabilities

The R&S®FSV3-K200R option turns the R&S®FSVA3000 into a fully fledged real-time spectrum analyzer with up to 200 MHz real-time bandwidth, depending on the installed analysis bandwidth option.

## Never miss anything thanks to seamless capture

While classic swept spectrum analyzers have blind times, the R&S®FSV3-K200R real-time option displays the spectrum seamlessly with up to 200 MHz span. The supported displays are the real-time spectrum, the persistence spectrum and the spectrogram.

The spectrogram displays multiple consecutive spectra over time, with time on the vertical axis and frequency on the horizontal axis. The power level is represented by a

specific color for the respective frequency/time value. This seamless spectrum display enables users, for example, to analyze existing frequency hopping algorithms or create alternative ones to prevent collisions between signals of different standards operating in the same frequency band, e.g. WLAN and Bluetooth®.

In the persistence spectrum, the color depends on the number of occurrences of a level at a specific frequency in a certain past period. Events that occurred further back are slowly grayed out with an afterglow effect.

By coupling the markers between spectrogram and real-time spectrum, the spectrum of past events can be displayed.

## KEY USE CASES

### Aerospace and defense (A&D)

- ▶ Seamless analysis of frequency agile radar signals
- ▶ Detection of unwanted spurious emissions
- ▶ Validation of frequency agile tactical communications systems

### Regulatory authorities

- ▶ Continuous monitoring of frequency bands
- ▶ Reliable detection of unwanted or unlicensed signals

### EMC precompliance

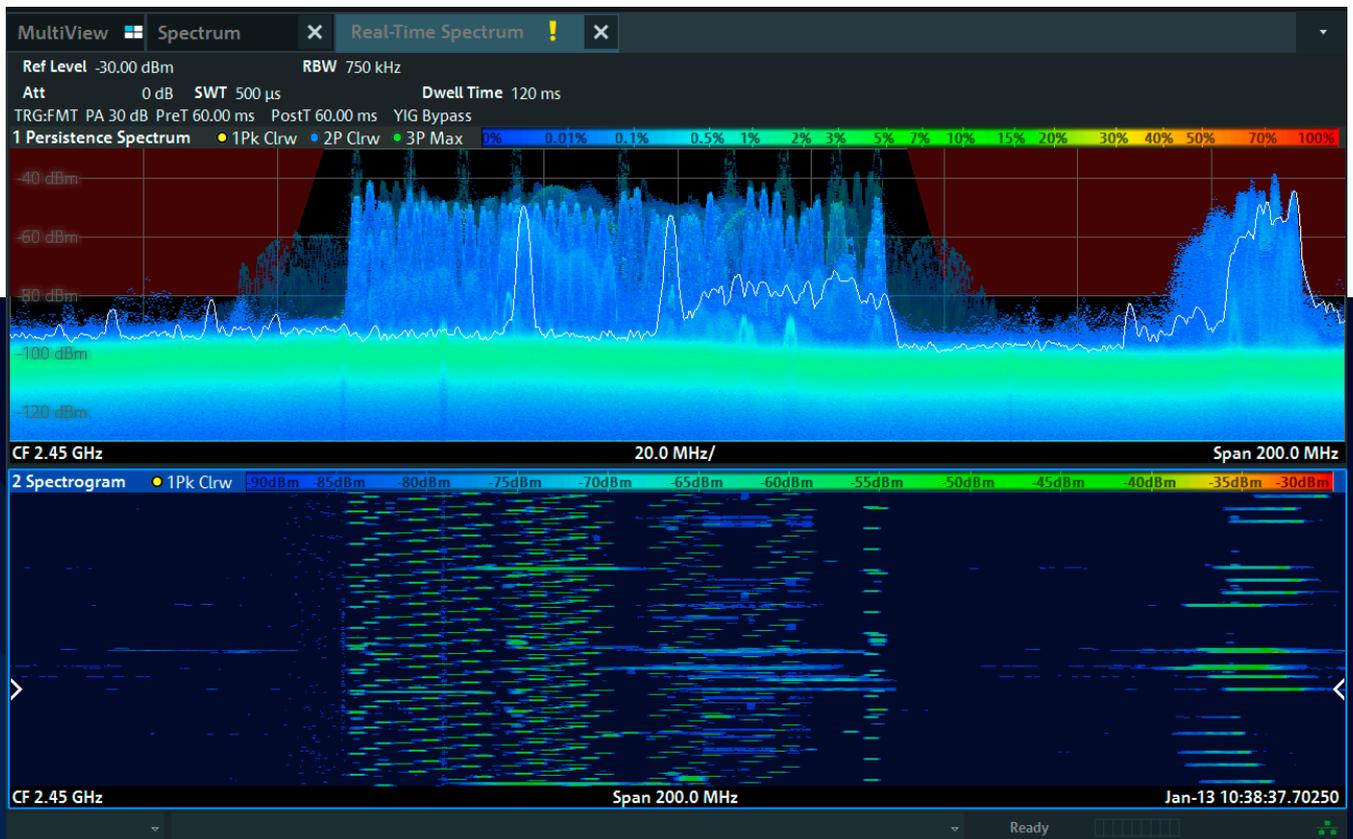
- ▶ Instantaneous identification of emission sources
- ▶ Spectral mask triggering on transmission events
- ▶ Detection of spurious emissions in real time

## Detection and triggering on extremely short or frequency agile signals

The R&S®FSVA3000 can also use frequency-dependent masks to trigger on extremely short transient events that classic spectrum analyzers cannot detect. The duration of the shortest events that can be captured with 100% probability and less than 3 dB level uncertainty is called the probability of intercept (POI). The R&S®FSV3-K200R features a POI of less than 3.44  $\mu$ s.

A user-definable frequency-dependent mask can be used to trigger on such short spectral events. This enables signals that occur sporadically in the spectrum to be detected reliably and investigated effectively.

Real-time spectrum of the ISM band at 2.45 GHz.



# WIDE RANGE OF MEASUREMENT APPLICATIONS

## GENERAL PURPOSE MEASUREMENT APPLICATIONS

Measurement application	Measurement parameters	Measurement functions
<b>R&amp;S®FSV3-K6</b> Pulse measurements	Pulse parameters: ▶ Timing: pulse width, pulse repetition interval, duty cycle, rise/fall time, settling time, timestamp, off time ▶ Frequency: carrier frequency, pulse-to-pulse frequency difference, chirp rate, frequency deviation, frequency error ▶ Power: peak power, average power, peak-to-average power ratio, pulse-to-pulse power ratio ▶ Phase: carrier phase, pulse-to-pulse phase difference, phase deviation, phase error ▶ Amplitude: droop, ripple, overshoot width, top/base power, average on power, average transmitted power, minimum/peak power, peak-to-average/peak-to-min power ratio, pulse-to-pulse power ratio	▶ Point-in-pulse measurements: frequency, amplitude, phase versus pulse, trend charts and histograms for all parameters ▶ Pulse statistics: standard deviation, average, maximum, minimum ▶ Pulse tables ▶ User-defined measurement parameters
<b>R&amp;S®FSV3-K7</b> Modulation analysis for AM/FM/PM modulated single carriers	▶ Modulation depth (AM) ▶ Frequency deviation (FM) ▶ Phase deviation (PM) ▶ Modulation frequency ▶ THD and SINAD ▶ Carrier power	▶ AF spectrum ▶ RF spectrum ▶ AF scope display ▶ AF filters (lowpass and highpass) ▶ Weighting filters (CCITT) ▶ Squelch
<b>R&amp;S®FSV3-K8</b> Bluetooth® Basic Rate/Enhanced Data Rate/Low Energy measurements	▶ Packet type ▶ Packet length ▶ Output power ▶ Delta frequency ( $\Delta f$ ) ▶ Frequency drift ▶ ICFT	▶ RF spectrum ▶ RF envelope ▶ Constellation ▶ Demod waveform ▶ Symbols
<b>R&amp;S®FSV3-K18</b> Amplifier measurements <b>R&amp;S®FSV3-K18D</b> Direct DPD measurements <b>R&amp;S®FSV3-K18F</b> Frequency response and group delay <b>R&amp;S®FSV3-K18M</b> Memory-polynomial DPD	▶ AM/AM, AM/PM, EVM ▶ Width of AM/AM and AM/PM curves ▶ Magnitude, phase and group delay versus frequency (R&S®FSV3-K18F) ▶ Polynomial coefficients (R&S®FSV3-K18) ▶ Memory-polynomial coefficients (R&S®FSV3-K18M)	▶ General amplifier measurements ▶ Polynomial based digital predistortion (R&S®FSV3-K18) ▶ Direct digital predistortion (R&S®FSV3-K18D) ▶ Memory-polynomial predistortion (R&S®FSV3-K18M) ▶ Control and synchronization of an external signal generator, e.g. the R&S®SMBV100B vector signal generator ▶ Characterization of dynamic behavior of two-port devices ▶ Real-time memory DPD (with Hammerstein model) (R&S®FSV3-K18M)
<b>R&amp;S®FSV3-K30</b> Noise figure and gain measurements based on Y-factor method	▶ Noise figure ▶ Noise temperature ▶ Gain ▶ Y-factor	▶ Analyzer noise correction (second stage correction) ▶ Measurements on frequency-converting DUTs ▶ Control of a generator as an LO in frequency-converting measurements ▶ SSB and DSB
<b>R&amp;S®FSV3-K40</b> Phase noise measurements	▶ SSB phase noise ▶ Residual FM and residual PM ▶ Jitter	▶ 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/PM ▶ Signal tracking ▶ Optional suppression of spurious emissions

Measurement application	Measurement parameters	Measurement functions
<b>R&amp;S®FSV3-K54</b> EMI measurements	EMI diagnostics and precompliance measurements in line with commercial and military standards: <ul style="list-style-type: none"> <li>▶ Disturbance voltage</li> <li>▶ Disturbance power</li> <li>▶ Radiated disturbance</li> </ul>	<ul style="list-style-type: none"> <li>▶ EMI detectors and resolution bandwidths in line with CISPR 16-1-1, MIL-STD-461 and DO-160</li> <li>▶ Limit line library as specified in the latest EMI standards</li> <li>▶ Test automation and reporting for fast and repeatable measurements</li> <li>▶ Transducer factors for antennas, cables, LISNs, etc.</li> <li>▶ Support of R&amp;S®ELEKTRA EMC test software</li> </ul>
<b>R&amp;S®FSV3-K60</b> Transient measurements <b>R&amp;S®FSV3-K60C</b> Transient chirp measurements <b>R&amp;S®FSV3-K60H</b> Transient hop measurements <b>R&amp;S®FSV3-K60P</b> Transient phase noise measurements	<ul style="list-style-type: none"> <li>▶ Frequency hopping signals: dwell time, settling time, switching time, frequency deviation, power, phase deviation, power ripple</li> <li>▶ Chirp signals: frequency deviation, chirp begin, chirp length, chirp rate, chirp state deviation, phase deviation, power, power ripple</li> </ul>	<ul style="list-style-type: none"> <li>▶ Spectrogram and spectrogram sections, tabular display, frequency, frequency error, phase and amplitude versus time, FFT spectrum</li> <li>▶ Pan and zoom functions to select analysis region using touch gestures; supported in spectrogram, frequency and time domain trace displays</li> <li>▶ Phase noise</li> <li>▶ Frequency and phase deviation spectrograms</li> <li>▶ Trend charts and histograms for all parameters</li> <li>▶ Chirp and hop statistics: standard deviation, average, maximum and minimum</li> <li>▶ User-defined measurement parameters</li> </ul>
<b>R&amp;S®FSV3-K70</b> Vector signal analysis <b>R&amp;S®FSV3-K70M</b> Multi-modulation analysis <b>R&amp;S®FSV3-K70P</b> BER PRBS measurements	Analysis of digitally modulated single carriers down to bit level: <ul style="list-style-type: none"> <li>▶ EVM</li> <li>▶ MER</li> <li>▶ Phase error</li> <li>▶ Magnitude error</li> <li>▶ Carrier frequency error</li> <li>▶ Symbol rate error</li> <li>▶ I/Q skew</li> <li>▶ Rho</li> <li>▶ I/Q offset, I/Q imbalance, quadrature error</li> <li>▶ Amplitude droop</li> <li>▶ Power</li> <li>▶ Bit error rate of known data streams</li> <li>▶ Bit error rate of bit streams generated with PRBS shift registers (R&amp;S®FSV3-K70P)</li> <li>▶ Analysis of vector modulated signals with multiple modulations, e.g. DVB-S2(X) (R&amp;S®FSV3-K70M)</li> </ul>	<ul style="list-style-type: none"> <li>▶ Eye diagram</li> <li>▶ Constellation diagram</li> <li>▶ Vector diagram</li> <li>▶ Histogram</li> <li>▶ Equalizer</li> <li>▶ Multiple modulation formats, e.g.: <ul style="list-style-type: none"> <li>- 2FSK to 64FSK</li> <li>- MSK, GMSK, DMSK</li> <li>- Multiple PSKs (e.g. BPSK, QPSK, 8PSK, 3π/8-8PSK)</li> <li>- 16QAM to 1024QAM</li> <li>- 16APSK (DVB-S2), 32APSK (DVB-S2), 2ASK, 4ASK</li> <li>- User-definable constellations</li> </ul> </li> </ul>
<b>R&amp;S®FSV3-K96</b> OFDM signal analysis	Analysis of custom OFDM signals: <ul style="list-style-type: none"> <li>▶ EVM (pilots, data, pilots and data)</li> <li>▶ EVM versus carrier versus symbol</li> <li>▶ Frequency error</li> <li>▶ Sampling clock error</li> <li>▶ I/Q offset</li> <li>▶ Gain imbalance</li> <li>▶ Quadrature error</li> <li>▶ Power versus time</li> <li>▶ Power spectrum</li> <li>▶ Power versus carrier versus symbol</li> <li>▶ Channel flatness</li> <li>▶ Group delay</li> <li>▶ Impulse response</li> <li>▶ Bitstream</li> </ul>	<ul style="list-style-type: none"> <li>▶ Constellation diagram</li> <li>▶ CCDF</li> <li>▶ Channel estimation and compensation using phase, timing and level tracking</li> <li>▶ Configuration file wizard</li> <li>▶ Free configuration of pilot and data carriers and modulation schemes</li> </ul>

# WIDE RANGE OF MEASUREMENT APPLICATIONS

## MEASUREMENT APPLICATIONS FOR WIRELESS COMMUNICATIONS SYSTEMS

Measurement application	Power	Modulation quality	Spectrum measurements	Miscellaneous	Special features
<b>R&amp;S®FSV3-K10</b> GSM/EDGE/ EDGE Evolution	<ul style="list-style-type: none"> <li>▶ Power measurement in time domain, including carrier power</li> </ul>	<ul style="list-style-type: none"> <li>▶ EVM</li> <li>▶ Phase/frequency error</li> <li>▶ Origin offset suppression</li> <li>▶ Constellation diagram</li> </ul>	<ul style="list-style-type: none"> <li>▶ Modulation spectrum</li> <li>▶ Transient spectrum</li> </ul>		<ul style="list-style-type: none"> <li>▶ Single burst and multiburst</li> <li>▶ Automatic detection of modulation format</li> </ul>
<b>R&amp;S®FSV3-K72/-K73</b> 3GPP FDD (WCDMA)	<ul style="list-style-type: none"> <li>▶ Code domain power</li> <li>▶ Code domain power versus time</li> <li>▶ CCDF</li> </ul>	<ul style="list-style-type: none"> <li>▶ EVM</li> <li>▶ Peak code domain error</li> <li>▶ Constellation diagram</li> <li>▶ I/Q offset</li> <li>▶ Residual code domain error</li> <li>▶ I/Q imbalance</li> <li>▶ Gain imbalance</li> <li>▶ Center frequency error (chip rate error)</li> </ul>	<ul style="list-style-type: none"> <li>▶ Spectrum mask</li> <li>▶ ACLR</li> <li>▶ Power measurement</li> </ul>	<ul style="list-style-type: none"> <li>▶ Channel table with channels used on base station</li> <li>▶ Timing offset</li> <li>▶ Power versus time</li> </ul>	<ul style="list-style-type: none"> <li>▶ Automatic detection of active channels and decoding of useful information</li> <li>▶ Automatic detection of encryption code</li> <li>▶ Automatic detection of HSDPA modulation format</li> <li>▶ Support of compressed mode signals</li> <li>▶ Support of HSPA and HSPA+ (HSDPA+ and HSUPA+)</li> </ul>
<b>R&amp;S®FSV3-K91</b> WLAN IEEE 802.11a/b/g <b>R&amp;S®FSV3-K91P</b> WLAN IEEE 802.11p <b>R&amp;S®FSV3-K91N</b> WLAN IEEE 802.11n <b>R&amp;S®FSV3-K91AC</b> WLAN IEEE 802.11ac <b>R&amp;S®FSV3-K91AX</b> WLAN IEEE 802.11ax <b>R&amp;S®FSV3-K91BE</b> WLAN IEEE 802.11be	<ul style="list-style-type: none"> <li>▶ Power versus time</li> <li>▶ Burst power</li> <li>▶ Crest factor</li> </ul>	<ul style="list-style-type: none"> <li>▶ EVM (pilot, data)</li> <li>▶ EVM versus carrier</li> <li>▶ EVM versus symbol</li> <li>▶ Constellation diagram</li> <li>▶ I/Q offset</li> <li>▶ I/Q imbalance</li> <li>▶ Gain imbalance</li> <li>▶ Center frequency error</li> <li>▶ Symbol clock error</li> <li>▶ Group delay</li> </ul>	<ul style="list-style-type: none"> <li>▶ Spectrum mask</li> <li>▶ ACLR</li> <li>▶ Power measurement</li> <li>▶ Spectrum flatness</li> </ul>	<ul style="list-style-type: none"> <li>▶ Bit stream</li> <li>▶ Signal field</li> <li>▶ Constellation versus carrier</li> </ul>	<ul style="list-style-type: none"> <li>▶ Automatic detection of burst type</li> <li>▶ Automatic detection of MCS index</li> <li>▶ Automatic detection of bandwidth</li> <li>▶ Automatic detection of guard interval</li> <li>▶ Estimation of payload length from burst</li> <li>▶ IEEE 802.11ax PPDU formats: HE SU PPDU, HE MU PPDU, HE trigger based PPDU, HE extended range SU PPDU</li> <li>▶ IEEE 802.11be PPDU formats: EHT MU PPDU (compressed, non-compressed), EHT trigger based PPDU</li> </ul>
<b>R&amp;S®FSV3-K100/-K101/-K104/-K105</b> EUTRA/LTE TDD and FDD, uplink and downlink measurements	<ul style="list-style-type: none"> <li>▶ Power measurement in time and frequency domains</li> <li>▶ CCDF</li> </ul>	<ul style="list-style-type: none"> <li>▶ EVM</li> <li>▶ Constellation diagram</li> <li>▶ I/Q offset</li> <li>▶ Gain imbalance</li> <li>▶ Quadrature error</li> <li>▶ Center frequency error (symbol clock error)</li> </ul>	<ul style="list-style-type: none"> <li>▶ Spectrum mask</li> <li>▶ ACLR</li> <li>▶ Power measurement</li> <li>▶ Spectrum flatness</li> </ul>	<ul style="list-style-type: none"> <li>▶ Bit stream</li> <li>▶ Allocation summary list</li> <li>▶ Averaging over multiple measurements</li> </ul>	<ul style="list-style-type: none"> <li>▶ Automatic detection of modulation format, cyclic prefix length and cell ID</li> </ul>

Measurement application	Power	Modulation quality	Spectrum measurements	Miscellaneous	Special features
<b>R&amp;S®FSV3-K102</b> EUTRA/LTE MIMO		<ul style="list-style-type: none"> <li>▶ R&amp;S®FSV3-K100 and -K104 modulation quality measurements for each individual MIMO path</li> </ul>			<ul style="list-style-type: none"> <li>▶ MIMO time alignment for R&amp;S®FSV3-K100/-K104</li> <li>▶ Interband carrier aggregation time alignment</li> </ul>
<b>R&amp;S®FSV3-K103</b> EUTRA/LTE-Advanced uplink measurements			<ul style="list-style-type: none"> <li>▶ Multicarrier ACLR for FDD and TDD</li> <li>▶ SEM for contiguously aggregated component carriers</li> </ul>		
<b>R&amp;S®FSV3-K106</b> EUTRA/LTE NB-IoT downlink measurements	<ul style="list-style-type: none"> <li>▶ Power measurement in time and frequency domains</li> </ul>	<ul style="list-style-type: none"> <li>▶ EVM</li> <li>▶ Constellation diagram</li> <li>▶ Frequency error</li> <li>▶ Sampling error</li> </ul>	<ul style="list-style-type: none"> <li>▶ Spectrum flatness, ACLR, SEM</li> </ul>	<ul style="list-style-type: none"> <li>▶ Allocation summary list</li> </ul>	<ul style="list-style-type: none"> <li>▶ Standalone, guard band and in-band operation</li> <li>▶ Automatic detection of cell ID</li> </ul>
<b>R&amp;S®FSV3-K144</b> 5G NR Rel. 15 downlink measurements					
<b>R&amp;S®FSV3-K145</b> 5G NR Rel. 15 uplink measurements					
<b>R&amp;S®FSV3-K147</b> 5G NR combined ACLR/SEM/EVM measurements		<ul style="list-style-type: none"> <li>▶ EVM</li> <li>▶ EVM xPDSCCH</li> <li>▶ Constellation diagram</li> <li>▶ I/Q offset</li> <li>▶ I/Q imbalance</li> <li>▶ Gain imbalance</li> <li>▶ Center frequency error</li> </ul>			
<b>R&amp;S®FSV3-K148</b> 5G NR Rel. 16 extension for uplink/downlink measurements	<ul style="list-style-type: none"> <li>▶ Power versus time</li> </ul>		<ul style="list-style-type: none"> <li>▶ Multicarrier ACLR, SEM</li> </ul>	<ul style="list-style-type: none"> <li>▶ Allocation summary list</li> <li>▶ Channel table with channels used on base station</li> </ul>	<ul style="list-style-type: none"> <li>▶ Automatic detection of cell ID</li> <li>▶ Support of multiple bandwidth parts</li> </ul>
<b>R&amp;S®FSV3-K171</b> 5G NR Rel. 17 extension for uplink/downlink measurements					
<b>R&amp;S®FSV3-K175</b> Extension for O-RAN measurements					
<b>R&amp;S®FSV3-K544</b> Frequency response correction				<ul style="list-style-type: none"> <li>▶ SnP file in Touchstone file format</li> </ul>	<ul style="list-style-type: none"> <li>▶ Corrects frequency response (amplitude and phase) of the measurement setup</li> </ul>

# SPECIFICATIONS IN BRIEF

Specifications in brief		
<b>Frequency</b>		
Frequency range	R&S®FSVA3004	10 Hz <sup>1)</sup> to 4 GHz
	R&S®FSVA3007	10 Hz <sup>1)</sup> to 7.5 GHz
	R&S®FSVA3013	10 Hz <sup>1)</sup> to 13.6 GHz
	R&S®FSVA3030	10 Hz <sup>1)</sup> to 30 GHz
	R&S®FSVA3044	10 Hz <sup>1)</sup> to 44 GHz
	R&S®FSVA3050	10 Hz <sup>1)</sup> to 50 GHz
	with R&S®FSV3-B54G option	10 Hz <sup>1)</sup> to 54 GHz
Aging of frequency reference		1 × 10 <sup>-6</sup> per year
	with R&S®FSV3-B4 option	1 × 10 <sup>-7</sup> per year
<b>Bandwidth</b>		
	standard filter	1 Hz to 10 MHz
Resolution bandwidth	RRC filter	18 kHz (NADC), 24.3 kHz (TETRA), 3.84 MHz (3GPP), 4.096 MHz
	channel filter	100 Hz to 5 MHz
	video filter	1 Hz to 10 MHz
I/Q demodulation bandwidth	standard	28 MHz
	with R&S®FSV3-B40 option	40 MHz
	with R&S®FSV3-B200 option	200 MHz
	with R&S®FSV3-B400 option	400 MHz
	with R&S®FSV3-B601 option	600 MHz
	with R&S®FSV3-B1001 option	1 GHz
I/Q demodulation bandwidth via analog baseband inputs	with R&S®FSV3-B271 option	I only, Q only: DC to 200 MHz; I + jQ: -200 MHz to +200 MHz
<b>Phase noise (with R&amp;S®FSV3-B710 option)</b>		
	1 GHz carrier	
	1 kHz offset	< -122 dBc (1 Hz)
	10 kHz offset	< -127 dBc (1 Hz)
	100 kHz offset	< -127 dBc (1 Hz)
	1 MHz offset	< -140 dBc (1 Hz)
<b>Displayed average noise level (DANL)</b>		
	1 GHz	-153 dBm (typ.)
DANL with preamplifier (R&S®FSV3-B24 option)	50 MHz ≤ f < 7.5 GHz	-167 dBm (typ.)
<b>Intermodulation</b>		
Third order intercept (TOI)	1 GHz	> 17 dBm, 20 dBm (typ.)
<b>Total measurement uncertainty</b>		
	2 GHz	0.29 dB

<sup>1)</sup> The R&S®FSV3-B710 option extends the low end of the frequency range to 2 Hz.

## RELATED DOCUMENTS

Title of document	PD No.
R&S®FSVA3000 Signal and Spectrum Analyzer – Specifications	5216.1211.22
R&S®VSE Vector Signal Explorer Software – Product Brochure	3607.1371.12
R&S®FS-SNS Smart Noise Sources – Product Brochure	5216.2718.12
EMI Measurement Application for Signal and Spectrum Analyzers – R&S®FSW-K54, R&S®FSV3-K54, R&S®FPL1-K54, R&S®FSV-K54 – Product Brochure	3608.3949.12
R&S®FE50DTR External Frontend 36 GHz to 50 GHz – Product Brochure	3609.5551.12
R&S®FE44S External Frontend 24 GHz to 44 GHz – Product Brochure	3609.5545.12

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