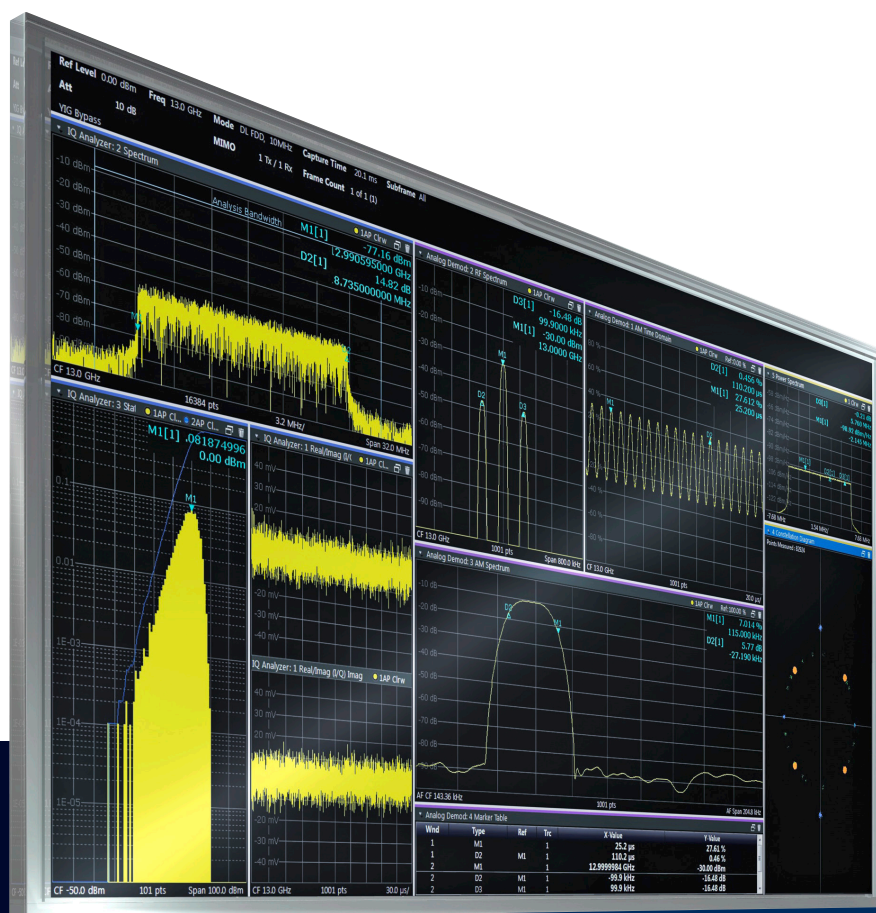


R&S®VSE VECTOR SIGNAL EXPLORER SOFTWARE

Desktop signal analysis



Product Brochure
Version 10.00

ROHDE & SCHWARZ

Make ideas real



AT A GLANCE

The R&S®VSE vector signal explorer software brings the experience and power of Rohde & Schwarz signal analysis to the desktop, offering a wide range of analysis tools for troubleshooting and optimizing designs on your PC. With this software, users analyze and solve problems in analog and digitally modulated signals for a wide range of standards using Rohde & Schwarz signal and spectrum analyzers and oscilloscopes.

The R&S®VSE vector signal explorer software was developed to bring the power of R&S®FSW signal processing to the engineer's PC. It analyzes signals from a wide range of instruments as well as files originating from simulations or recorded measurements.

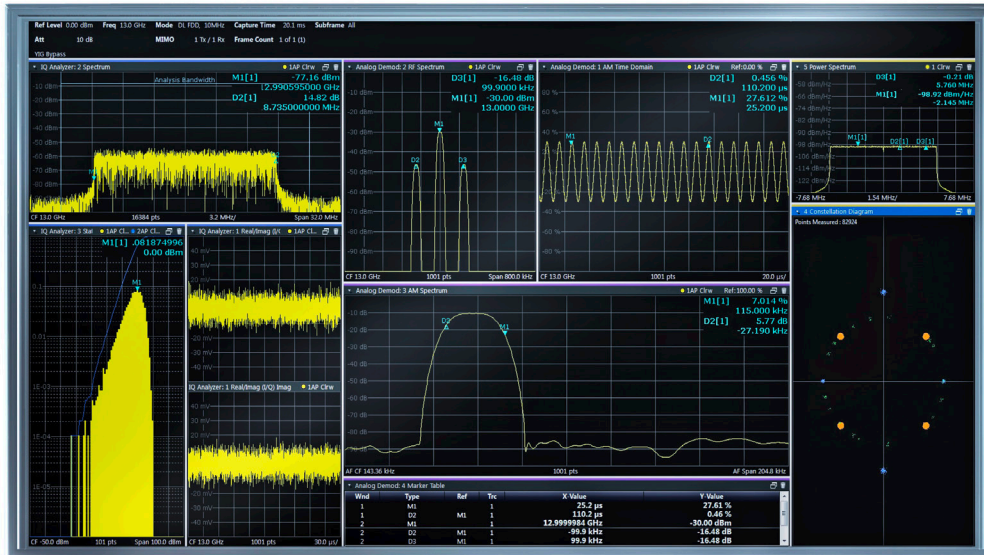
Thanks to the clearly structured menu concept, it is a quick and easy matter to operate the software and control the instruments, and the flexible arrangement of measurement displays provides new ways to visualize measurement results.

With R&S®VSE, users can analyze and investigate a captured signal over and over again, change parameters and settings, examine the signal in depth and troubleshoot a wide range of signals, from simple BPSK to complex wide-band signals such as IEEE 802.11ax and 4096QAM.

The user interface is clearly structured with a flat menu structure. Users arrange results as required, which greatly facilitates result interpretation.

The R&S®VSE is available in two models. The basic edition serves typical R&D work using a desktop PC together with a single instrument. The enterprise edition adds connectivity to multiple instruments as well as increased capabilities for parallel processing of measurement results typically performed on a server.

For increased flexibility, the R&S®VSE enterprise edition can be used together with a network based license server, enabling networked computers to access a license from a central repository. For simultaneous use, multiple licenses must be purchased.

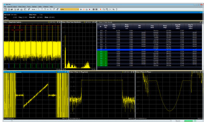


The R&S®VSE signal analysis software enables remote signal analysis and debugging on the desktop. Signals can originate from different instruments that are controlled from one PC. The R&S®VSE easily works with files of recorded data or simulations, saving a trip to the lab. When large amounts of data need to be analyzed, the R&S®VSE can be remotely controlled and is compatible with the R&S®FSW signal and spectrum analyzer.

Supported instruments	
R&S®FSL	R&S®FSW
R&S®FPS	R&S®FSWP
R&S®FPL1000	R&S®NRQ
R&S®FSV3000	R&S®RTP
R&S®FSVA3000	R&S®RTO
R&S®FSV	R&S®ZNL
R&S®FSVA	R&S®ETL

KEY FACTS

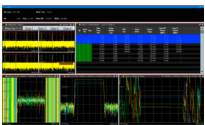
- ▶ Controls multiple instruments from one PC
- ▶ Remote controllable and compatible with R&S®FSW signal and spectrum analyzer
- ▶ Advanced pulse analysis with R&S®RTO oscilloscopes
- ▶ Supports all relevant mobile and wireless communications standards



R&S®VSE-K6
Pulse measurements
▶ [page 4](#)



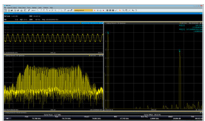
R&S®VSE-K91
WLAN signal analysis
▶ [page 11](#)



R&S®VSE-K6A
Pulse analysis across multiple channels
▶ [page 5](#)



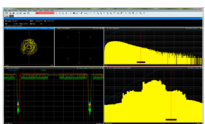
R&S®VSE-K96
OFDM analysis
▶ [page 12](#)



R&S®VSE-K7
Modulation analysis for AM/FM/PM modulated single carriers
▶ [page 6](#)



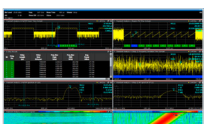
R&S®VSE-K100/-K102/-K104
LTE signal analysis
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R&S®VSE-K10
GSM/EDGE/EDGE Evolution
▶ [page 7](#)



R&S®VSE-K106
LTE narrowband IoT analysis
▶ [page 14](#)



R&S®VSE-K60
Transient analysis
▶ [page 8](#)



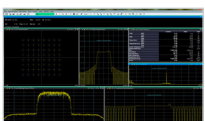
R&S®VSE-K144
5G signal analysis
▶ [page 15](#)



R&S®VSE-K70
Vector signal analysis
▶ [page 9](#)



R&S®VSE-K146
5G MIMO measurements
▶ [page 15](#)



R&S®VSE-K72
WCDMA signal analysis
▶ [page 10](#)

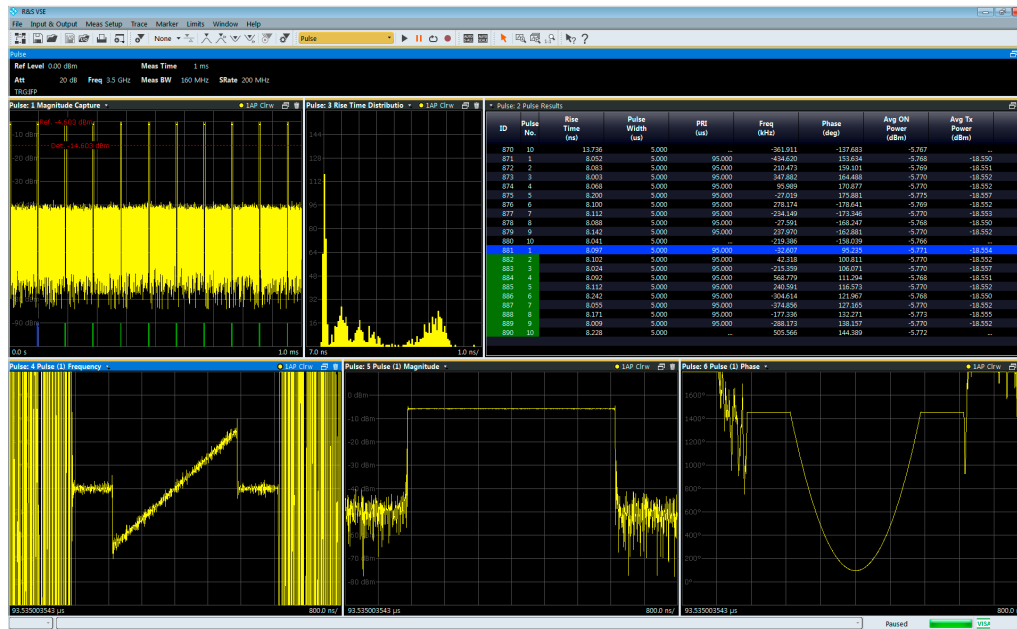
R&S®VSE-K6

Pulse measurements

The R&S®VSE-K6 option measures 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 which results should be displayed simultaneously on the screen. The R&S®VSE delivers a full picture of e.g. a radar system within seconds.

Measurement parameters

- ▶ Pulse parameters: pulse width, pulse repetition rate, pulse repetition interval, duty cycle, rise/fall time, settling time
- ▶ Frequency: carrier frequency, pulse-to-pulse frequency difference, chirp rate, frequency deviation, frequency error
- ▶ Power: peak power, average power, peak-to-average power, pulse-to-pulse power
- ▶ Phase: carrier phase, pulse-to-pulse phase difference, phase deviation, phase error
- ▶ Amplitude droop, ripple, overshoot and settling time
- ▶ Point-in-pulse measurements: frequency, amplitude, phase and I/Q
- ▶ Measurement functions: trends, histograms and spectrum for all parameters
- ▶ Pulse statistics: standard deviation, average, maximum, minimum
- ▶ Pulse tables
- ▶ Intrapulse modulation (frequency, amplitude, phase and I/Q) and pulse spectrum traces
- ▶ Pulse-pulse spectrum
- ▶ User-defined measurement parameters



Pulse measurements with split-screen display

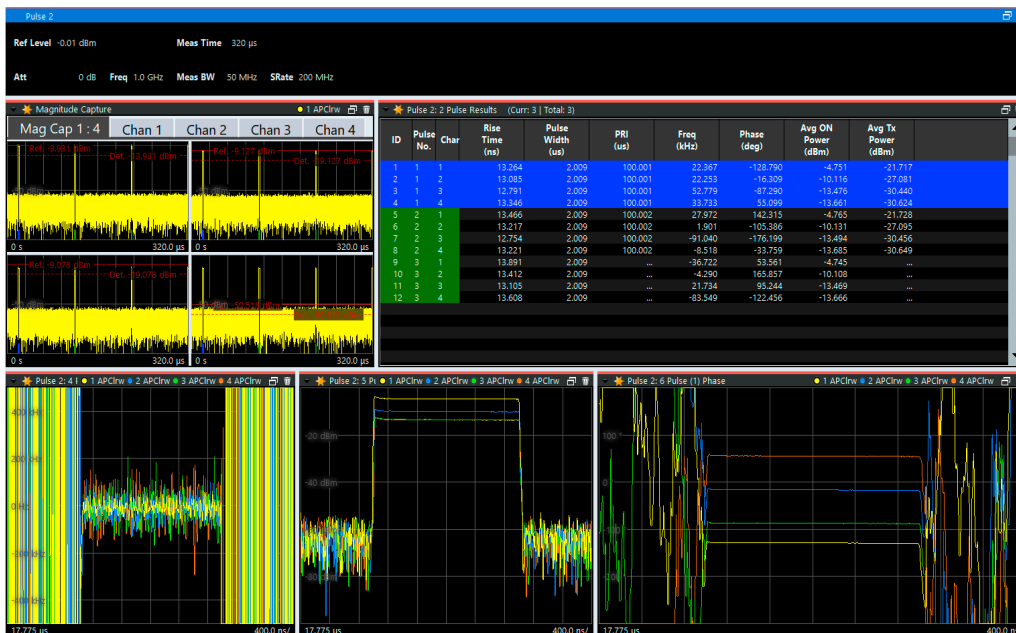
R&S®VSE-K6A

Pulse analysis across multiple channels

The R&S®VSE-K6A option is an extension of the R&S®VSE-K6 pulse analysis option and supports simultaneous capture on up to four channels of a high-end R&S®RTO or R&S®RTP oscilloscope. R&S®VSE-K6A compares all R&S®VSE-K6 pulse parameters and statistics over multiple channels. Analyzing multiple channels simultaneously at an early stage in phased array development, for example, helps improve module design, preventing costly and time-consuming modifications at later stages.

Additional features of the R&S®VSE-K6A

- ▶ Fast comparison of all R&S®VSE-K6 results across multiple channels on the same display
- ▶ Multichannel segmented capture to reduce memory consumption
- ▶ Multichannel I/Q recording and playback via file
- ▶ Multichannel user calibration (R&S®VSE-K544 license needed) with user-defined frequency response correction files (.s2p)



Pulse measurements on multiple channels

R&S®VSE-K7

Modulation analysis for AM/FM/PM modulated single carriers

The R&S®VSE-K7 AM/FM/PM modulation analysis option adds analog modulation analyzer capabilities for amplitude, frequency and phase modulated signals. It measures not only characteristics of the useful modulation, but also factors such as residual FM and synchronous modulation.

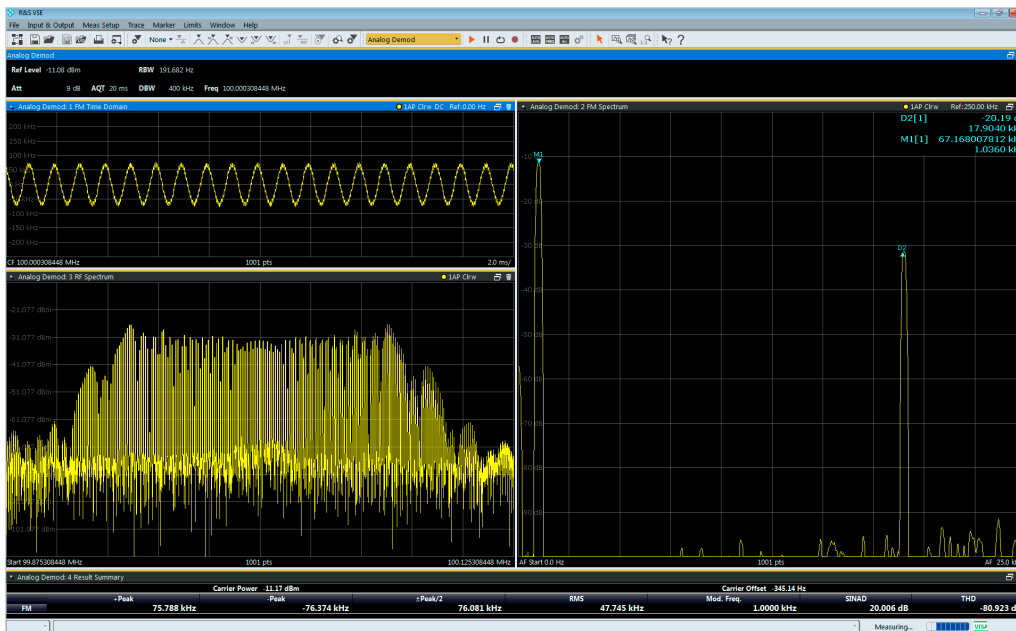
The universal characteristics of the digital measurement demodulator option open up a wide range of applications, for example measuring frequency deviation or the frequency settling time of synthesizers. The FM measurement capability of this option enables the specific modulation measurements needed in development. The R&S®VSE-K7 AM/FM/PM modulation analysis option also performs FFT analysis on the demodulated signal, allowing received signal quality to be determined from the SINAD and THD values. Various filters (highpass, lowpass, deemphasis) are available to simulate real receive signal structures and to accurately characterize analog transmit and receive systems.

Modulation parameters

- ▶ Modulation depth (AM)
- ▶ Frequency deviation (FM)
- ▶ Phase deviation (PM)
- ▶ Modulation frequency
- ▶ THD and SINAD
- ▶ Carrier power

Measurement functions

- ▶ AF spectrum
- ▶ RF spectrum
- ▶ AF scope display
- ▶ AF filters (lowpass and highpass)
- ▶ Weighting filters (CCITT)
- ▶ Squelch



FM signal displayed in time domain, RF spectrum and FM spectrum

R&S®VSE-K10

GSM/EDGE/EDGE Evolution

The R&S®VSE-K10 measures GSM, EDGE, EDGE Evolution and VAMOS signals in line with standards (3GPP TS 45.005, 51.010 and 51.021).

Convenient analysis due to standard-conforming limit checks

The test limits for the spectrum due to modulation and switching transients as well as the test limits for power versus time are automatically configured in line with the standard. After configuring the device type and class (e.g. normal BTS or small MS) as well as the power control level (PCL) used, the application delivers pass/fail results.

Convenient and comprehensive analysis

The modulation accuracy table is derived from the selected slot in the capture buffer and provides a quick overview of the most important numeric parameters.

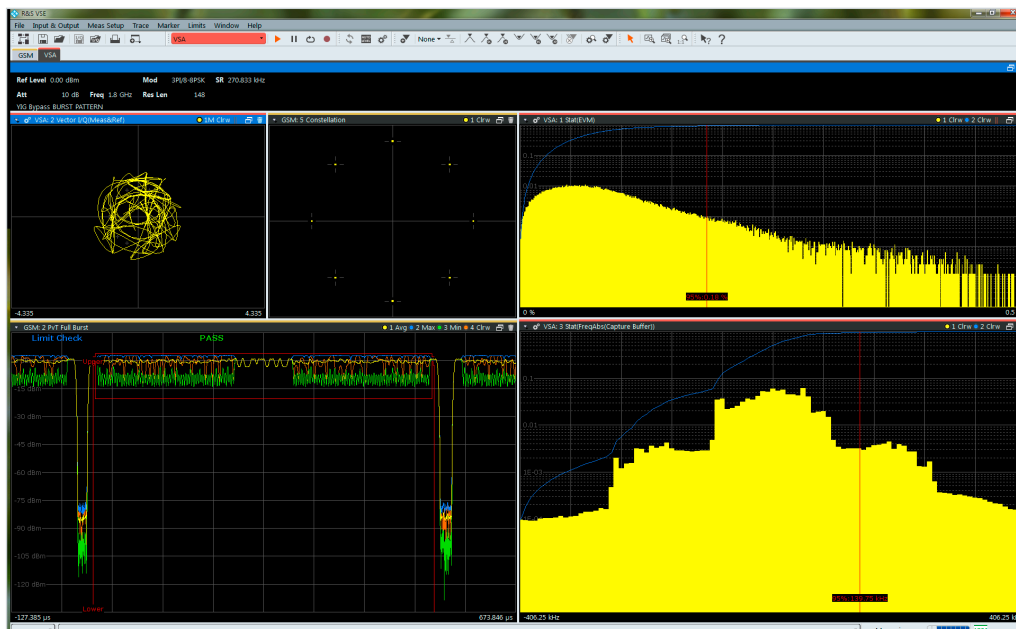
Additional measurements such as phase or magnitude error versus time or EVM versus time and the constellation diagram provide enhanced analysis capabilities.

Numerous modulation parameters

- ▶ Supports GSM, EDGE, EDGE Evolution and VAMOS
- ▶ Supports GSMK, QPSK, A-QPSK, 8PSK, 16QAM and 32QAM modulation
- ▶ Supports normal and high symbol rates
- ▶ Supports normal, micro and pico BTS classes
- ▶ Supports normal and small MS classes
- ▶ Supports frequency bands from T-GSM380 up to PCS1900
- ▶ Autodetection of modulation, burst type and training sequence
- ▶ No trigger required

Measurement results

- ▶ Error vector magnitude (EVM)
- ▶ Phase, frequency and magnitude error
- ▶ Power versus time (PvT)
- ▶ Spectrum due to modulation
- ▶ Spectrum due to switching transients
- ▶ Constellation diagram



Demodulation of an EDGE signal with power versus time display and EVM versus symbol display together with numerical results and a constellation diagram

R&S®VSE-K60

Transient analysis

The R&S®VSE-K60 transient analysis option is ideal for radar system manufacturers and developers who need to characterize frequency agile signals, including analysis of hopping sequences (R&S®VSE-K60H) and chirps or FMCW signals (R&S®VSE-K60C).

The R&S®VSE-K60C option displays the frequency response and calculates the deviation from the ideal linear phase, even for the non-pulsed FMCW radar signals commonly used in automotive radars.

The R&S®VSE-K60H automatically analyzes the hopping sequence of fast frequency hopping pulsed signals used in automotive or aerospace and defense applications.

Measurement parameters

- ▶ Frequency hopping signals: dwell time, settling time, switching time, frequency deviation, power, phase deviation, power ripple
- ▶ Chirp signals: frequency deviation, chirp begin, chirp length, chirp rate, chirp state deviation, phase deviation, power, power ripple
- ▶ Spectrogram and section of spectrogram, tabular display, frequency, frequency error, phase and amplitude versus time, FFT spectrum
- ▶ Pan and zoom functions to select analysis region using touch gestures in spectrogram, spectrum and time domain trace displays
- ▶ Trends and histograms for all parameters
- ▶ Hop/chirp statistics: standard deviation, average, maximum, minimum
- ▶ User-defined measurement parameters



Analysis of a chirp signal with different measurement windows

R&S®VSE-K70

Vector signal analysis

The R&S®VSE-K70 option flexibly analyzes 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 4096QAM

Modulation formats

- ▶ 2FSK, 4FSK, 8FSK
- ▶ 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, 2048QAM, 4096QAM
- ▶ 16APSK (DVB-S2), 32APSK (DVB-S2), 2ASK, 4ASK, $\pi/4$ -16QAM (EDGE), $-\pi/4$ -16QAM (EDGE)

Numerous standard-specific presets

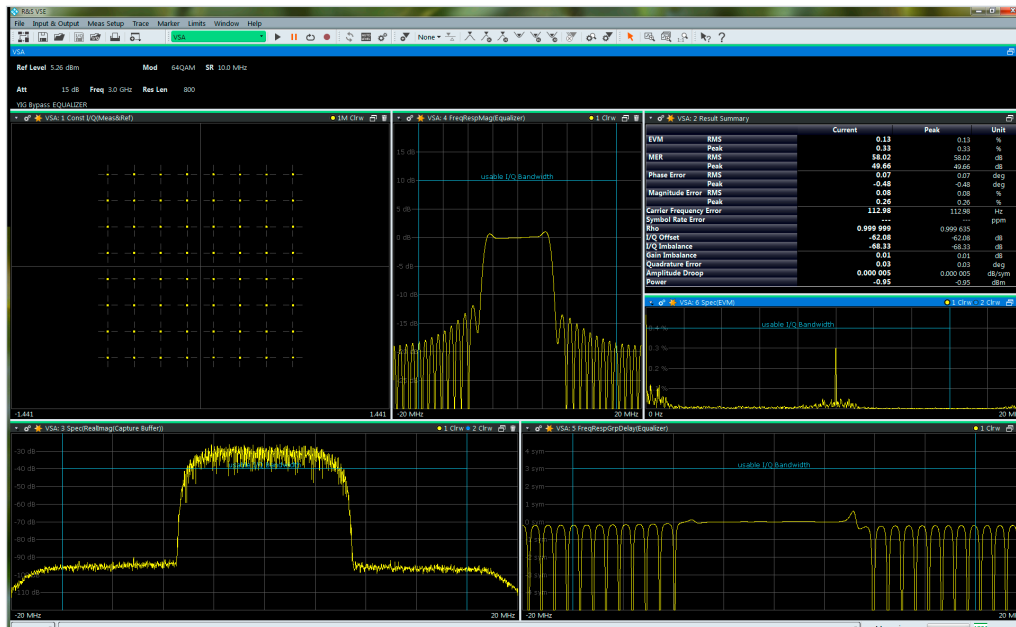
- ▶ User-definable constellations and mappings
- ▶ GSM, GSM/EDGE
- ▶ 3GPP WCDMA, CDMA2000®
- ▶ TETRA, APCO25
- ▶ Bluetooth®, Zigbee
- ▶ DECT, DVB-S2

Easy operation with graphical support

With the clearly visualized demodulation stages and associated settings, even beginners and infrequent users find the correct settings. Based on the description of the signal to be analyzed (e.g. modulation format, continuous or with bursts, symbol rate, transmit filtering), users also quickly find 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
- ▶ Analysis of RF signals or analog and digital baseband signals
- ▶ Statistical evaluations
- ▶ Histogram representation
- ▶ Standard deviation and 95th percentile in the result summary
- ▶ Spectrum analysis of the measurement and error signal considerably help users find signal errors such as incorrect filtering and interferers
- ▶ Flexible burst search for analyzing 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 for finding the optimum filter design



Demodulation of a 64QAM signal with frequency and group delay display of the equalizer together with numerical modulation accuracy results

R&S®VSE-K72

WCDMA signal analysis

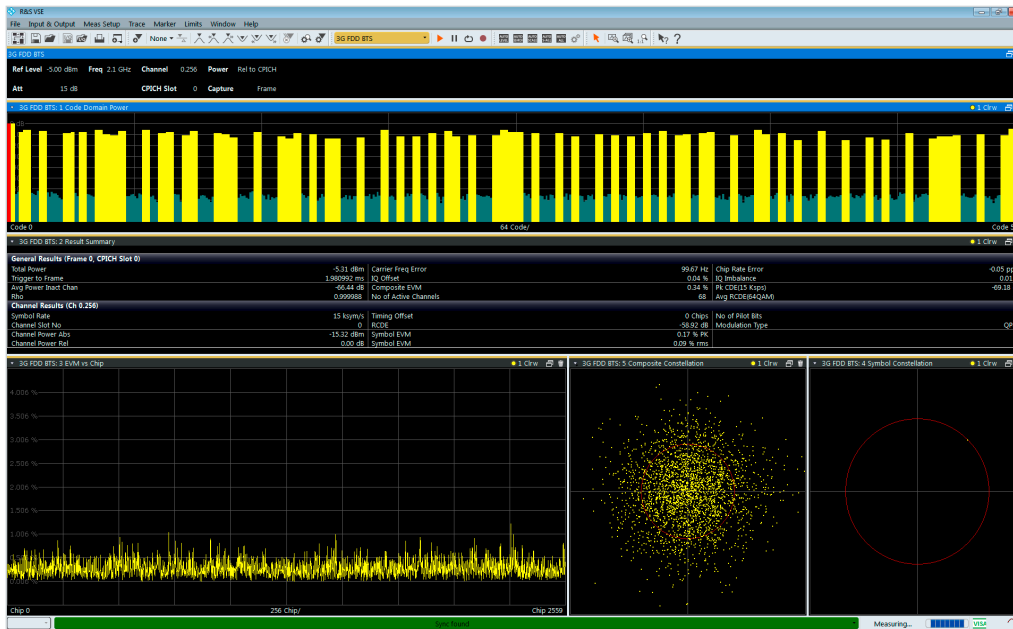
The R&S®VSE-K72 covers the in-band measurements of the 3GPP WCDMA uplinks and downlinks, including HSDPA, HSUPA and HSPA+.

The main function of the R&S®VSE-K72 option is to determine the power of the individual code channels, referred to as code domain power measurement. The power ratios between the individual channels, for instance, can be checked for compliance with the nominal values. This measurement is an efficient way of detecting impairments such as clipping or intermodulation that are not obvious from the spectrum alone. The power of the different codes is shown versus the code number.

Code domain power measurements

The code domain power measurement offers in-depth analysis for a WCDMA signal with several active channels. The composite EVM measurement returns a modulation error value for the total signal. The symbol EVM function yields the individual vector errors of the active channels.

- ▶ Code domain power versus time
- ▶ CCDF
- ▶ Constellation diagram
- ▶ Modulation quality
- ▶ EVM
- ▶ Peak code domain error
- ▶ Residual code domain error constellation diagram
- ▶ I/Q offset
- ▶ I/Q imbalance
- ▶ Gain imbalance
- ▶ Center frequency
- ▶ Automatic detection of
 - Active channels and decoding of useful information
 - Scrambling code
 - HSDPA modulation format
- ▶ Supports
 - Compressed mode signals
 - HSPA and HSPA+ (HSDPA+ and HSUPA+)



Demodulation of a downlink signal with numerical results as well as EVM versus symbols and constellation diagram of the composite signal and also the symbol constellation diagram of the CPICH

R&S®VSE-K91

WLAN signal analysis

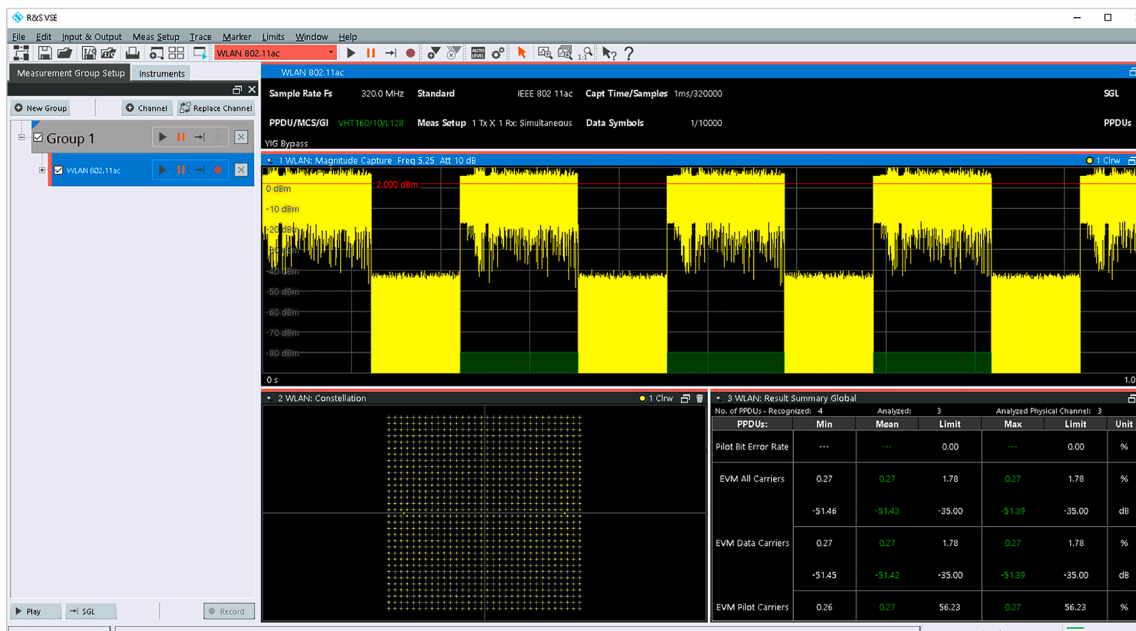
The R&S®VSE-K91 options demodulate all types of WLAN signals. For MIMO measurements, they support simultaneous capture of up to eight channels with supported analyzers, and up to four channels with the high-end R&S®RTO and R&S®RTP oscilloscopes. The R&S®VSE-K91 application software covers standard tests and further evaluations for in-depth analysis in development for signals in line with the WLAN IEEE 802.11a/b/g/j/p/n/ac/ax standard.

Supported WLAN standards

- ▶ R&S®VSE-K91 supports IEEE 802.11a/b/g
- ▶ R&S®VSE-K91p supports IEEE 802.11p
- ▶ R&S®VSE-K91n supports IEEE 802.11n
- ▶ R&S®VSE-K91ac supports IEEE 802.11ac
- ▶ R&S®VSE-K91ax supports IEEE 802.11ax

Supported WLAN measurements

- ▶ 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
- ▶ Bitstream
- ▶ Signal field
- ▶ Constellation versus carrier
- ▶ Automatic detection of
 - Burst type
 - MCS index
 - Bandwidth
 - Guard interval
- ▶ Estimation of payload length from burst



Demodulation of an IEEE 802.11ac signal with 1024QAM

R&S®VSE-K96

OFDM analysis

The R&S®VSE-K96 OFDM analysis software makes it possible to perform modulation measurements on general OFDM signals. The OFDM demodulator is user-configurable and not dependent on any standards.

The software analyzes OFDM signals that are either user-defined or compliant with standards such as IEEE802.11a/g/n/ac (WLAN) and DVB-T. It also supports development engineers in analyzing proprietary signals in the initial phases of upcoming OFDM standards. This includes the following:

- ▶ Wizard with a step-by-step guide for easy setup of the configuration file from a captured signal
- ▶ Support of OFDM and OFDMA
- ▶ Support of any PSK or QAM modulation format (up to 4096QAM)

User-configurable and independent of standards

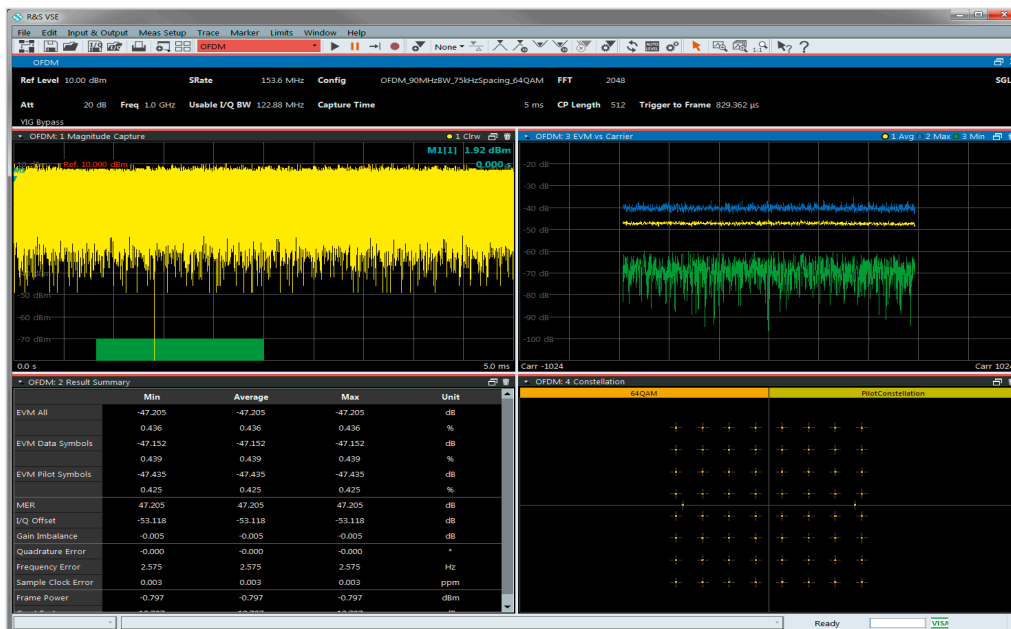
The software offers a high degree of freedom regarding measurement parameters.

User-definable OFDM parameters:

- ▶ General OFDM parameters such as signal bandwidth, sample rate, FFT length, cyclic prefix length
- ▶ Preamble structure
- ▶ Position of the pilots and data carriers
- ▶ Modulation format of the data carriers
- ▶ Flexible assignment of cyclic prefix length (e.g. for LTE)

Configuration file wizard for quick extraction of all necessary parameters from a signal

The integrated wizard guides users through the process of creating a configuration file that describes the OFDM system. It allows users to extract the necessary parameters directly from a signal recorded by the R&S®VSE-K96 software and creates a matching configuration file. At the same time, it visualizes the structure of the signal.



Demodulation of a 90 MHz wide OFDM signal with 64QAM, using an FFT of 2048

R&S®VSE-K100/-K102/-K104

LTE signal analysis

The R&S®VSE-K10x options cover 3GPP LTE and LTE-Advanced in-band measurements. The R&S®VSE-K100/-K102/-K104 options provide convenient analysis due to automatic detection of modulation formats. Each signal subframe is analyzed, and the QPSK, 16QAM and 64QAM modulation formats plus the length of the cyclic prefix are automatically detected and used in the analysis. The cell identity can also be automatically detected. This minimizes the number of user settings.

Supported LTE capabilities

- ▶ R&S®VSE-K100:
 - Uplink and downlink capabilities for LTE FDD
- ▶ R&S®VSE-K104:
 - Uplink and downlink capabilities for LTE TDD
- ▶ R&S®VSE-K102:
 - MIMO and LTE-Advanced capabilities added to the R&S®VSE-K100/-K104 options

Extensive TDD support

R&S®VSE-K104 provides many TDD-specific features such as power versus time measurement, special subframe configurations and measurements on downlink dual layer beamforming signals using UE-specific reference signals. Users can verify all important aspects of a TDD transmitter.

Supported LTE measurements

- ▶ EVM
- ▶ Constellation diagram
- ▶ I/Q offset
- ▶ Gain imbalance
- ▶ Quadrature error
- ▶ Center frequency error (symbol clock error)
- ▶ Bitstream
- ▶ Allocation summary list
- ▶ Averaging over multiple measurements

With R&S®VSE-K102 option, additionally

- ▶ MIMO demodulation
- ▶ MIMO time alignment for R&S®FSW-K100/-K104
- ▶ Interband carrier aggregation time alignment



An LTE downlink signal with modulation results and in-band results such as bitstreams and information gained from decoding control channels

R&S®VSE-K106

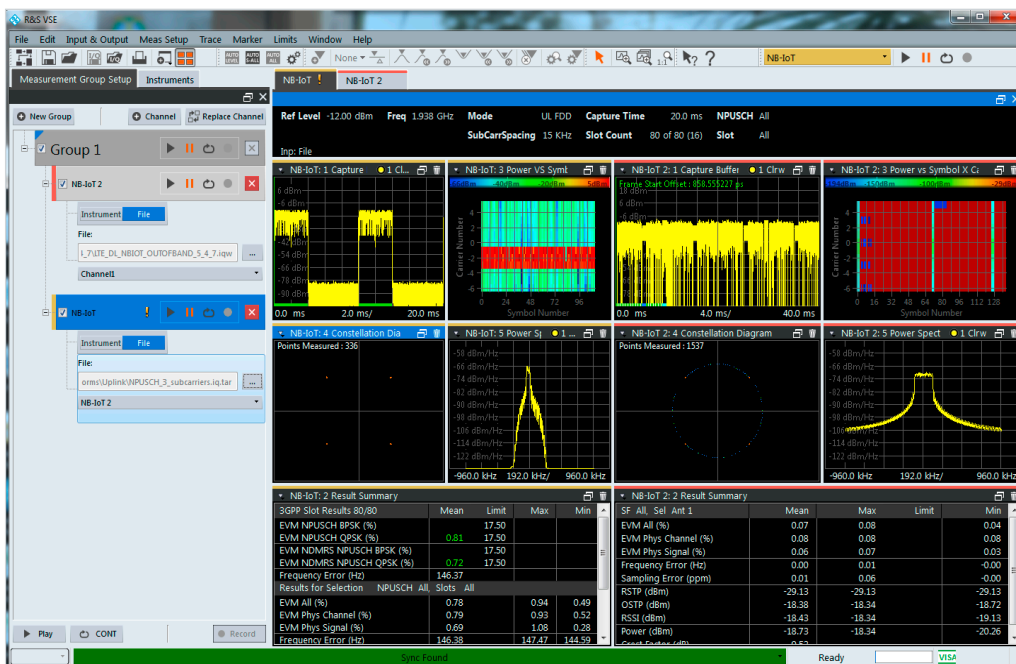
LTE narrowband IoT analysis

The R&S®VSE-K106 option covers the modulation measurements for narrowband IoT (NB-IoT) specified by 3GPP for base stations and user equipment.

NB-IoT focuses specifically on indoor coverage, low cost and long-life battery devices. The NB-IoT technology can be deployed “in-band” in a spectrum allocated to LTE within a normal LTE carrier or standalone for deployments in a dedicated spectrum specifically targeting GSM refarming.

Supported LTE measurements

- ▶ EVM
- ▶ Constellation diagram
- ▶ I/Q offset
- ▶ Gain imbalance
- ▶ Quadrature error
- ▶ Center frequency error (symbol clock error)
- ▶ Bitstream
- ▶ Allocation summary list



R&S®VSE-K106 uplink and downlink

R&S®VSE-K144/-K146

5G signal analysis

The R&S®VSE-K144 option covers in-band measurements of 3GPP 5G NR in the uplink and downlink. Each signal subframe is analyzed, and a wide range of measurement results is provided, including EVM, frequency and power of different channels and signals. The R&S®VSE-K146 enables true 5G MIMO measurements.

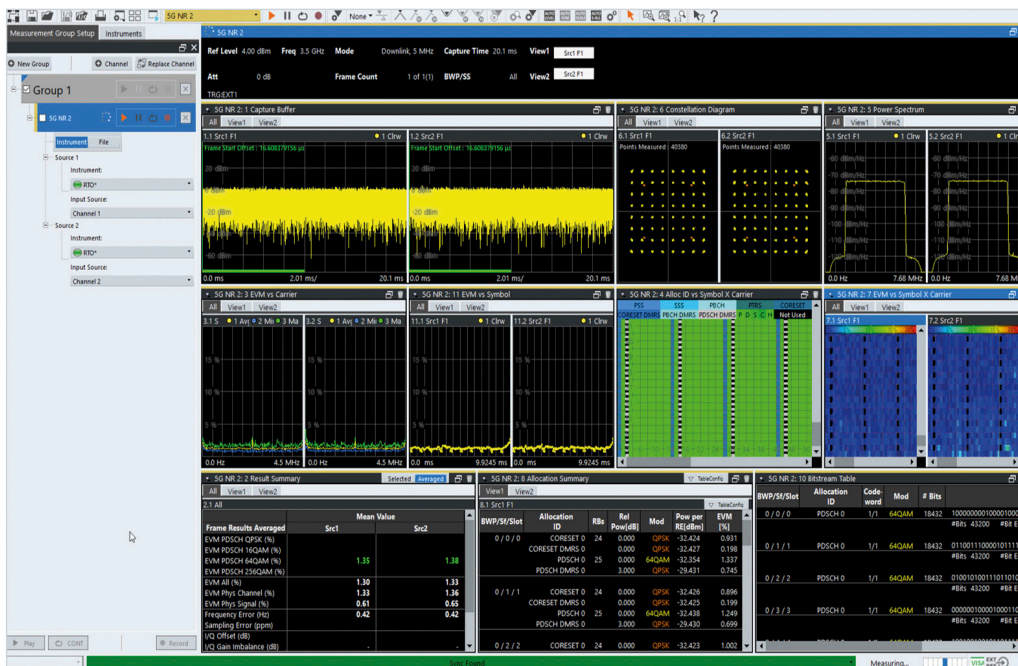
The R&S®VSE-K144 supports all specified 5G signal bandwidths from 5 MHz to 400 MHz with multiple numerologies, multiple bandwidth parts and modulation formats from QPSK to 256QAM.

Supported 5G measurements

- ▶ EVM
- ▶ Constellation diagram
- ▶ I/Q offset
- ▶ Gain imbalance
- ▶ Quadrature error
- ▶ Center frequency error (symbol clock error)
- ▶ Allocation summary list
- ▶ Channel decoder results
- ▶ Averaging over multiple measurements

5G MIMO measurements

Among others, the demodulation and decoding of a MIMO signal and phase differences between antennas can be measured. Via antenna mapping, crosstalk can be compensated and OTA measurements are possible. For the capture of up to four MIMO streams with one instrument, the R&S®RTP high-performance oscilloscope is recommended.



5G MIMO measurement application

ORDERING INFORMATION

Designation	Type	Order No.
Vector signal explorer base software, basic edition	R&S®VSE	1345.1011.06
Vector signal explorer base software, enterprise edition	R&S®VSE	1345.1105.06
Software options		
Pulse measurement application	R&S®VSE-K6	1320.7516.06
Phased array measurements	R&S®VSE-K6A	1345.1286.06
AM/FM/PM modulation analysis	R&S®VSE-K7	1320.7539.06
GSM measurements	R&S®VSE-K10	1313.1368.06
Transient measurements	R&S®VSE-K60	1320.7868.06
Transient chirp measurements (requires R&S®VSE-K60)	R&S®VSE-K60C	1320.7874.06
Transient hop measurements (requires R&S®VSE-K60)	R&S®VSE-K60H	1320.7880.06
Vector signal analysis	R&S®VSE-K70	1320.7522.06
Multi-modulation analysis	R&S®VSE-K70M	1345.1211.06
PRBS bit error rate measurements	R&S®VSE-K70P	1345.1228.06
3GPP FDD measurements	R&S®VSE-K72	1320.7580.06
IEEE802.11a/b/g measurements	R&S®VSE-K91	1320.7597.06
IEEE802.11p measurements	R&S®VSE-K91p	1320.7680.06
IEEE802.11n measurements	R&S®VSE-K91n	1320.7600.06
IEEE802.11ac measurements	R&S®VSE-K91ac	1320.7616.06
IEEE802.11ax measurements	R&S®VSE-K91ax	1345.1411.06
OFDM signal analysis	R&S®VSE-K96	1320.7922.06
EUTRA/LTE FDD uplink and downlink measurement application	R&S®VSE-K100	1320.7545.06
EUTRA/LTE-Advanced and MIMO (downlink)	R&S®VSE-K102	1320.7551.06
EUTRA/LTE TDD uplink and downlink measurement application	R&S®VSE-K104	1320.7568.06
EUTRA/LTE narrowband IoT analysis	R&S®VSE-K106	1320.7900.06
5G uplink and downlink measurement application	R&S®VSE-K144	1309.9574.06
5G MIMO measurements	R&S®VSE-K146	1345.1305.06
Frequency response correction	R&S®VSE-K544	1309.9580.06
License dongle	R&S®FSPC	1310.0002.03
License dongle for floating licenses	R&S®FSPC-FL	1310.0002.04
Service option		
Software maintenance	R&S®VSE-SWM	1320.7622.81

Free trial

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Download your trial today!

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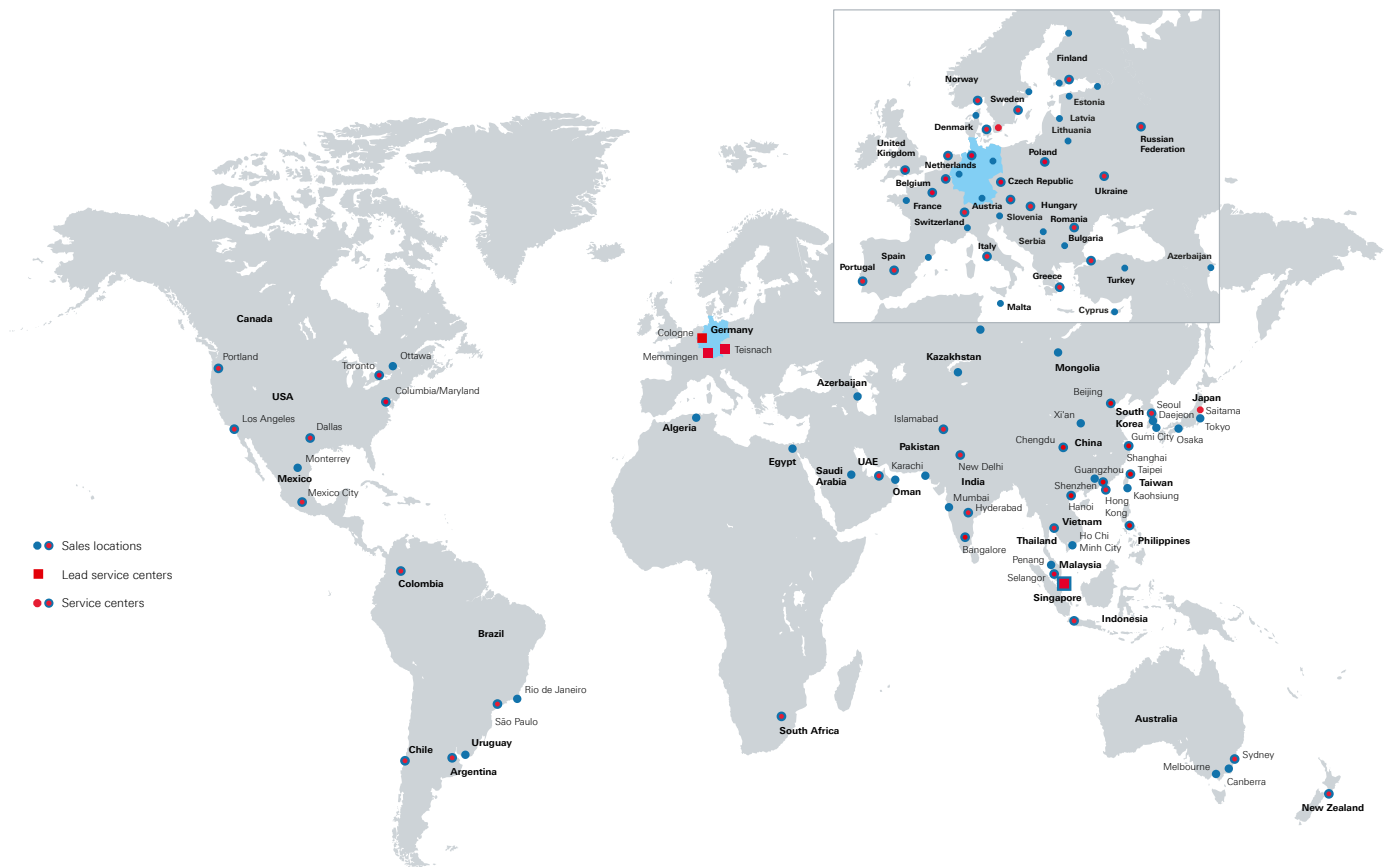
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