

R&S®FS-K96/ R&S®FS-K96PC OFDM Vector Signal Analysis With Rohde & Schwarz analyzers



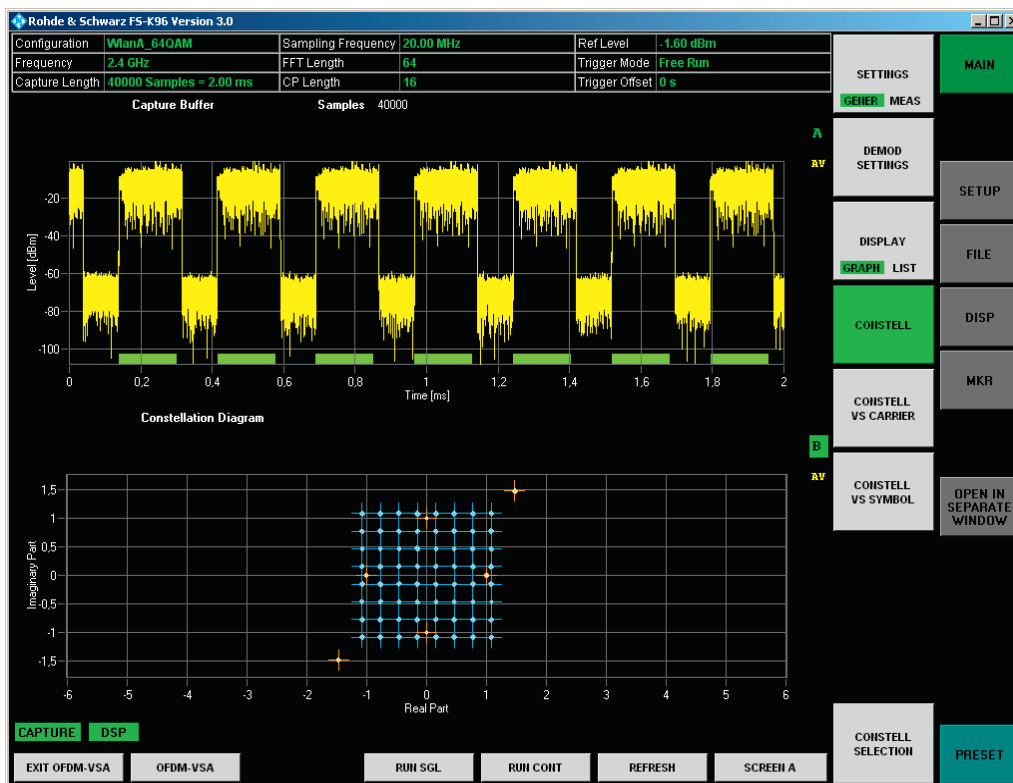
R&S®FS-K96/ R&S®FS-K96PC OFDM Vector Signal Analysis At a glance

The R&S®FS-K96/R&S®FS-K96PC OFDM analysis software extends the capability of the R&S®FSQ/FSG/FSV/FSVR/FSW signal and spectrum analyzers and the R&S®FSUP signal source analyzer to include modulation measurements on general OFDM signals. The OFDM demodulator is user-configurable and standard-independent.

The software analyzes OFDM signals that are either user-defined or compliant with standards such as IEEE802.16 (WiMAX™), IEEE 802.11a/g/n/ac (WLAN) and DVB-T. Moreover, it supports development engineers in the analysis of proprietary signals in the initial phases of forthcoming OFDM standards.

- Extension of the capability of the R&S®FSQ/FSG/FSV/FSVR/FSW signal and spectrum analyzers and the R&S®FSUP signal source analyzer to include transmitter measurements on general OFDM signals
- User-definable and standard-independent OFDM demodulator
- 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)
- Frequency range from 20 MHz to 3/8/26.5/40 GHz, depending on the analyzer model
- Very low residual EVM < -51 dB for DVB-T, 2k mode (R&S®FSQ)
- RF measurement or optional I/Q baseband measurement
- Generation of an ideal reference signal based on the configuration file

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The upper part of the display shows the recorded signal in the time domain. The lower part shows the constellation diagram. Color coding makes identification of the different modulation formats easy.

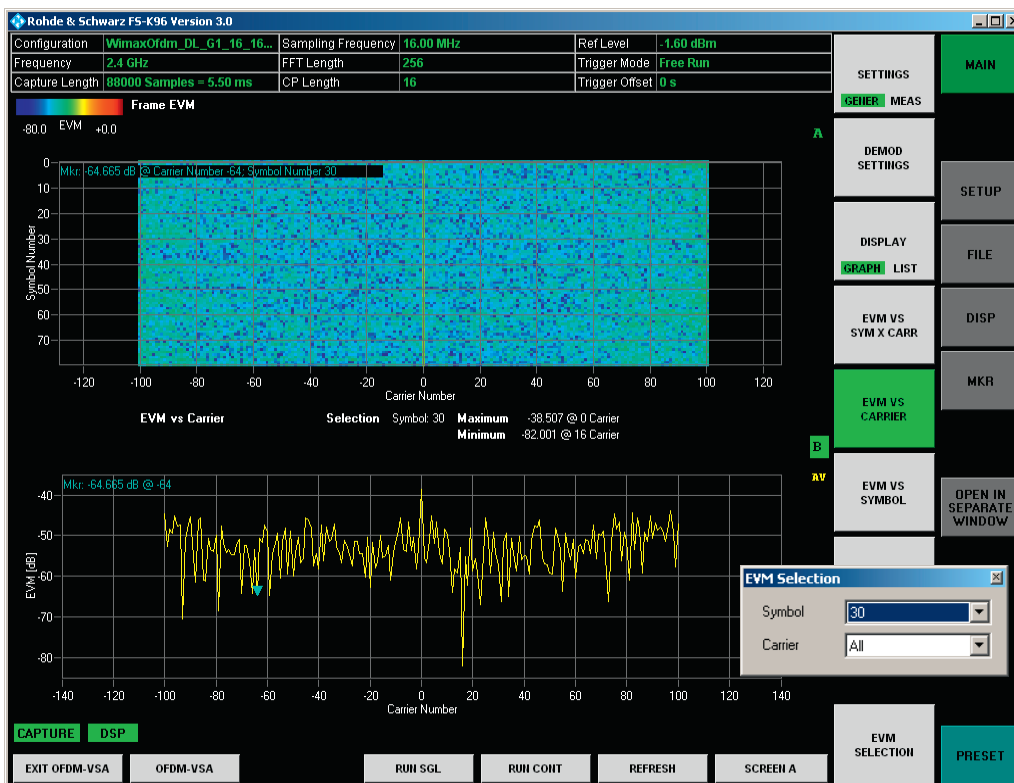
User-configurable and standard-independent

The software offers a high degree of freedom when it comes to measurement parameters. In addition to the user-definable OFDM demodulator, general parameters such as trigger, synchronization and tracking can be set manually.

Numerous measurements for analyzing OFDM signals

In addition to a numeric table that lists EVM results or the I/Q offset, the R&S®FS-K96/R&S®FS-K96PC software provides numerous graphical results that make error analysis easy.

Multiple windows can be configured easily to show the most important and most often used graphical results.



The error vector magnitude (EVM) can be evaluated in multiple ways. The EVM frame shows the EVM values per OFDM symbol in a color-coded format, providing a fast overview. “EVM versus Carrier” and “EVM versus Symbol” (not shown here) provide a cross section for a specific OFDM symbol of a specific carrier.

OFDM demodulator settings and configuration

The R&S®FS-K96/R&S®FS-K96PC OFDM analysis software offers maximum flexibility for adapting the analyzer to signal requirements. Thanks to this flexibility, users can define frequency, bandwidths, sample rate and guard interval length for the relevant OFDM signal. Many other parameters can be modified as needed, e.g. memory depth or trigger settings.

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)

The general parameters can be entered directly in the R&S®FS-K96/R&S®FS-K96PC application. A configuration file is available for additional OFDM parameters. This file allows users to define the OFDM demodulator in detail.

Basic settings

Basic OFDM parameters such as bandwidth, sample rate, FFT length and cycle prefix length can be directly defined allowing users to verify these parameters without a configuration file. Moreover, they can obtain measurement results for CCDF and various power measurements (power spectrum, power versus symbol, power versus carrier, power versus symbol and carrier).



The upper diagram shows the power of each carrier and symbol of the received frames in dBm. The values are color-coded in accordance with a table of colors that is displayed in the upper area of the measurement window. The lower diagram shows the allocation of pilot and data symbols as defined by the configuration file.

Expanded settings by means of a configuration file

The configuration file defines all parameters of an OFDM signal in detail, thereby allowing the software to perform demodulation and further analysis of OFDM signals configured in almost any manner. This file lets users enter all parameters that the software requires in order to carry out frame synchronization and demodulation. Available results include the various EVM and channel measurements such as EVM for each carrier, group delay, or impulse response.

Configuration file features

- ▮ The following user-defined information can be entered:
 - Position and value of the pilot carriers
 - Position and modulation format of the data carriers
 - Preamble structure
- ▮ Easy-to-create file using the wizard or special MATLAB® class
- ▮ Graphical display of the configuration file with allocation of pilot and data symbols
- ▮ Sample system configuration files provided for following
 - WLAN 802.11a, 802.11g OFDM
 - WLAN 802.11ac
 - WiMAX™ 802.16 OFDM
 - DVB-T, DVB-H

Configuration file wizard to quickly extract all necessary parameters from a signal

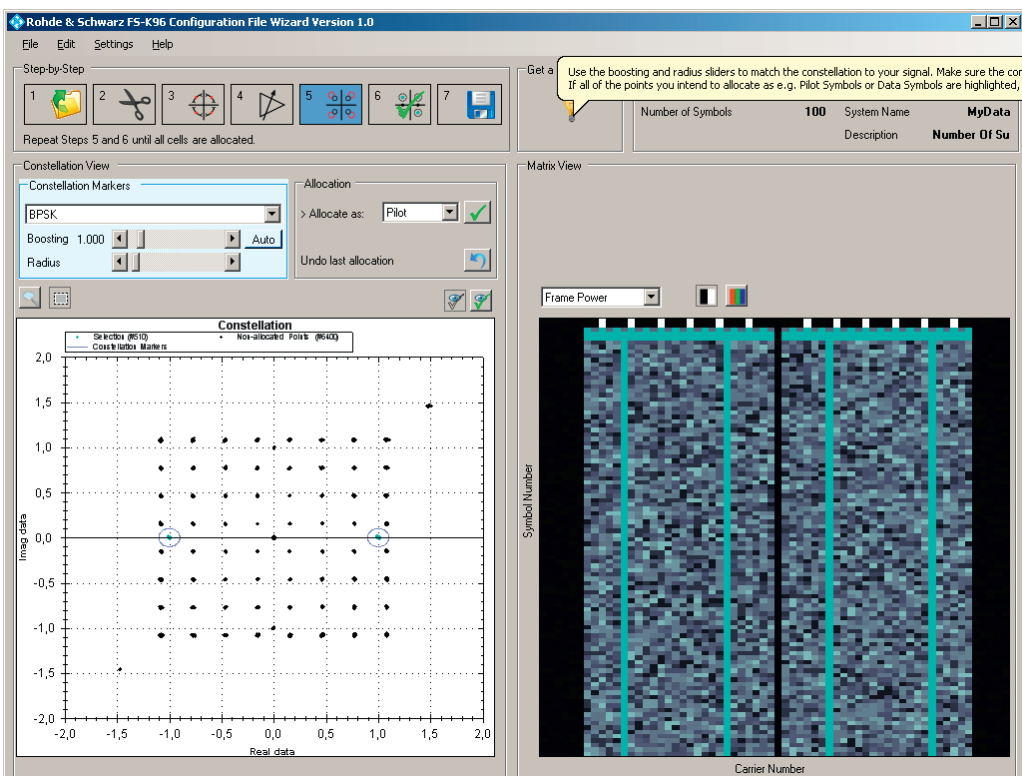
The integrated wizard guides users through the process of creating a configuration file that describes the OFDM system. It allows users to extract the necessary parameters directly from a signal recorded by the R&S®FS-K96 and creates a matching configuration file. At the same time it visualizes the structure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

Additional software settings

In addition to the parameters in the configuration file, parameters such as synchronization and tracking can also be set manually. These setting capabilities make error analysis easy. Plus, it is possible, for example, to compensate for the frequency error of the measurement signal in the measurement results by using the phase tracking feature.

The software also offers the following functions:

- ▮ Frequency synchronization (based on pilots or data)
- ▮ Time synchronization (to cyclic prefix or preamble)
- ▮ Automatic modulation detection
- ▮ Burst search support (accelerates the detection of burst signals)
- ▮ Tracking of phase, timing and level



The integrated wizard makes it easy to create a configuration file: Simply record the signal in R&S®FS-K96 and start the wizard, which provides step by step guidance.

Measurements

The R&S®FS-K96/R&S®FS-K96PC OFDM analysis software offers numerous measurements for the analysis of OFDM signals.

Main parameters and results of the measurements

A numeric table lists the main parameters and results of the measurements:

- EVM results (averaged)
 - EVM of all carriers
 - EVM of data carriers only
 - EVM of pilot carriers only
- I/Q constellation
 - Frequency error
 - Symbol clock error
- I/Q offset
 - Gain imbalance
 - Quadrature offset
- Power measurement
 - Frame power
 - Crest factor

Graphical measurement results

The software displays the following measurement results as graphs:

- Power measurement
 - Power versus symbol and carrier
 - Power versus carrier
 - Power versus symbol
 - Capture buffer
 - Power spectrum
- Error vector magnitude (EVM measurements)
 - EVM versus symbol and carrier
 - EVM versus carrier
 - EVM versus symbol
 - Frequency and phase error
- Channel measurements
 - Spectrum flatness
 - Group delay
 - Impulse response
- Constellation measurements
 - Constellation diagram (color-coded by modulation mode)
 - Constellation versus carrier
 - Constellation versus symbols
- Other measurements
 - CCDF
 - Signal flow diagram
(detailed description of the current measurement status)
 - Report (detailed list of demodulation steps)

The screenshot shows the Rohde & Schwarz OFDM - VSA Version 1.0 software interface. The top section displays configuration parameters:

Configuration	WLANA_64QAM	Sampling Frequency	20.00 MHz	Ref Level	-0.70 dBm
Frequency	2.4 GHz	FFT Length	64	Trigger Mode	Free Run
Capture Length	110000 Samples - 5.50 ms	CP Length	16	Trigger Offset	0 s

Below the configuration is a 'Result Summary' table:

Item	Min	Mean	Mean Limit	Max	Max Limit	Unit
EVM All	-49.674	-49.524	---	-49.330	---	dB
EVM Data	-49.480	-49.346	---	-49.155	---	dB
EVM Pilot	-51.976	-51.580	---	-51.321	---	dB
IQ Offset	-64.724	-64.192	---	-63.286	---	dB
IQ Gain Imbalance	-0.013	-0.013	---	-0.012	---	dB
IQ Quadrature Error	-0.025	-0.021	---	-0.018	---	°
Frequency Offset	-0.905	-0.147	---	0.766	---	Hz
Clock Offset	0.038	0.061	---	0.075	---	ppm
Frame Power	-9.652	-9.647	---	-9.641	---	dBm
Crest Factor	9.953	9.957	---	9.961	---	dB

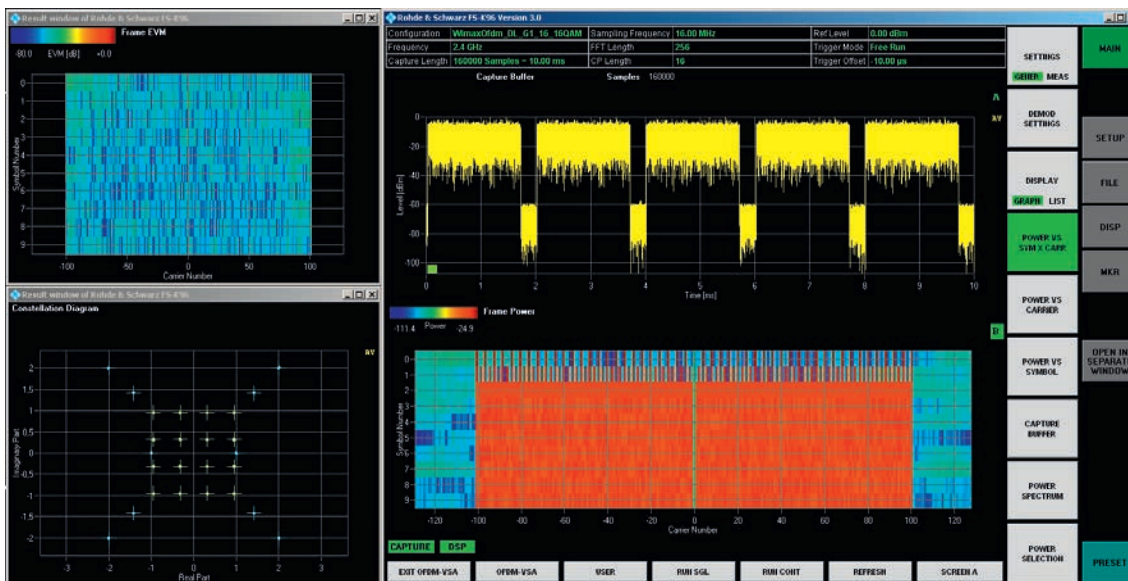
The interface also features a control panel on the right with buttons for SETTINGS, MAIN, DEMOD SETTINGS, SETUP, DISPLAY, GRAPH LIST, FILE, CONSTELL, DISP, and PRESET. At the bottom, there are buttons for CAPTURE, DSP, EXIT OFDM-VSA, OFDM-VSA, RUN SGL, RUN CONT, REFRESH, SCREEN A, and CONSTELL SELECTION.

The summary of results offers a quick overview of the most important numeric measurement results. The calculation includes all analyzed frames in the capture buffer.

Ordering information

Designation	Type	Order No.
OFDM Vector Signal Analysis Software, PC and analyzer required (requires R&S®FSPC)	R&S®FS-K96	1310.0202.06
OFDM Vector Signal Analysis Software, usable with and without analyzer (requires R&S®FSPC)	R&S®FS-K96PC	1310.0219.06
Upgrade from R&S®FS-K96 to R&S®FS-K96PC (requires R&S®FSPC)	R&S®FS-K96U	1310.0225.06
Licence Dongle	R&S®FSPC	1310.0002.03
R&S®FS-K96 runs only when a LAN or GPIB connection to a R&S®FSQ/FSG/FSV/FSVR/FSW or R&S®FSUP is established. R&S®FS-K96 PC runs with and without connection to an analyzer.		
System requirements		
Windows XP with service pack 2, 1 Gbyte free HD space, 1 Gbyte free RAM, graphic resolution 800 × 600 pixel or higher, LAN or GPIB connection with installed VISA driver for instrument control		
Supported instruments		
Signal Analyzer	R&S®FSQ	1155.5001.xx
Signal and Spectrum Analyzer	R&S®FSV	1307.9002.xx
Spectrum Analyzer	R&S®FSG	1303.0002.xx
Signal Source Analyzer	R&S®FSUP	1166.3505.xx
Real-Time Spectrum Analyzer	R&S®FSVR	1311.0006.xx
Signal and Spectrum Analyzer	R&S®FSW	1312.8000.xx

For data sheet, see PD 5214.4820.22 and www.rohde-schwarz.com



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ISO 9001

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