



## WLAN 802.11a Application Firmware R&S<sup>®</sup> FSQ-K90

Transmitter measurements on WLAN 802.11a OFDM signals with the Signal Analyzer R&S FSQ

- ◆ Enhances the signal analyzers of the R&S FSQ family by transmitter measurements in accordance with the IEEE 802.11a standard
- ◆ Frequency range from 20 MHz to 3/8/26 GHz, depending on base unit
- ◆ Very low residual EVM of below -44 dB/-46 dB
- ◆ Automatic or manual setting of modulation format
- ◆ Analysis at the RF or in the baseband (optional)
- ◆ All measurement functions remote-controllable via IEC/IEEE bus or LAN
- ◆ High measurement rate of >2 measurements/s (54 Mbps, 16 payload symbols)
- ◆ Supports 802.11g OFDM

Version  
01.00

July  
2003



**ROHDE & SCHWARZ**

## General

Application Firmware R&S FSQ-K90 expands the application range of the Signal Analyzers R&S FSQ by spectrum and modulation measurements on OFDM signals in accordance with the WLAN standard IEEE 802.11a. The measurements specified by this standard can thus be performed at a keystroke, for example:

- ◆ Output power (burst power)
- ◆ Spectrum mask with limit lines and PASS/FAIL display (FIG 1a +b)

- ◆ Spectrum flatness (including display of group delay, FIG 4)
- ◆ Constellation error (FIG 2)
- ◆ RF carrier leakage (FIG 2)
- ◆ Carrier frequency and symbol clock error
- ◆ Adjacent channel power

Further analysis and evaluation facilities are often required in the development and verification phase:

- ◆ Constellation diagram for all carriers or a single carrier
- ◆ Constellation overview of all carriers (FIG 6)
- ◆ EVM of single carriers
- ◆ EVM versus symbols or time
- ◆ Group delay
- ◆ Time-gated spectrum (FFT)
- ◆ Time-gated CCDF and crest factor
- ◆ Bit stream
- ◆ Analysis at the RF, IF, inverted IF or in the baseband (option R&S FSQ-B71)
- ◆ Selectable tracking (phase, timing, level)

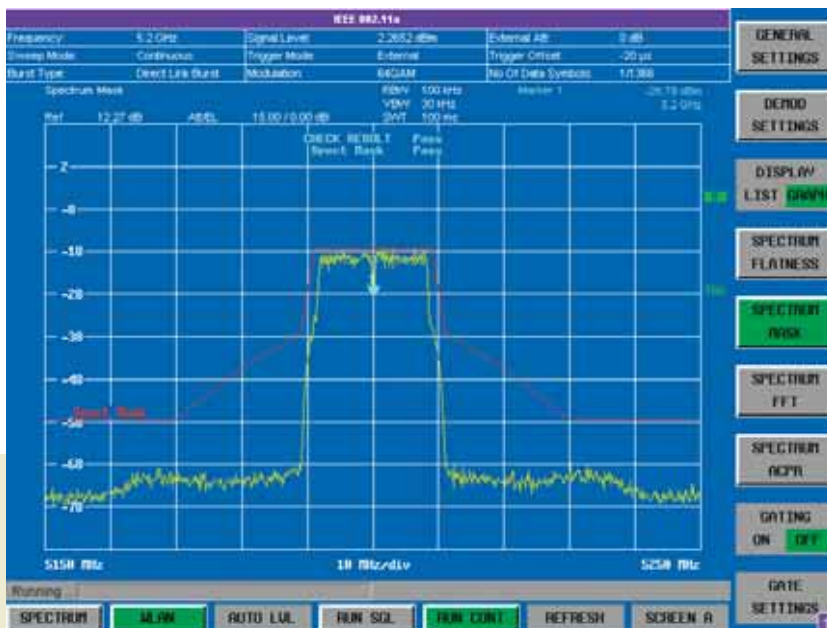


FIG 1a: Spectrum mask with standard-compliant limit lines

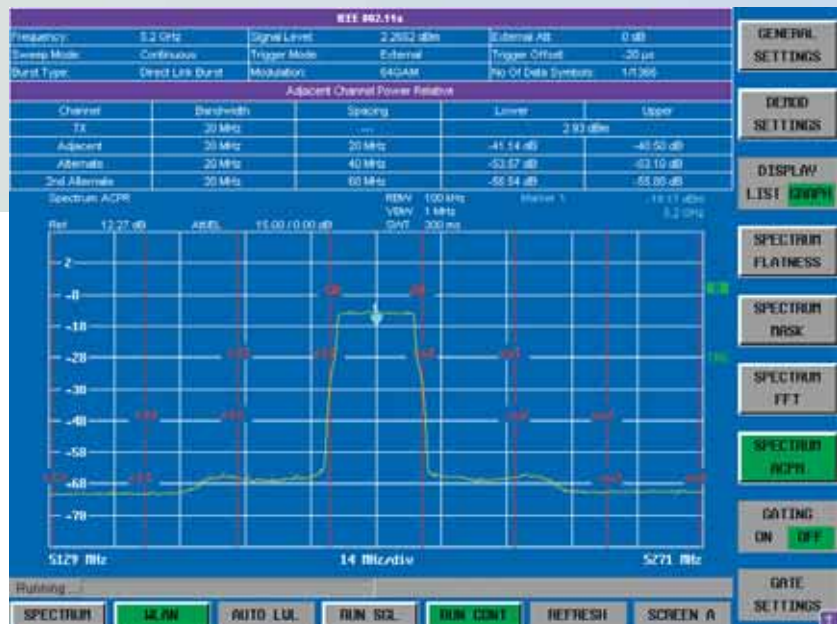


FIG 1b: ACP measurement

The usual spectrum analysis functions of the base unit further expand measurement functionality, making the instrument even more versatile.

Other typical development tasks can be performed with the following measurement functions:

- ◆ Channel and user-configurable adjacent channel power measurement
- ◆ Multicarrier adjacent channel power measurement
- ◆ TOI marker for automatic determination of third-order intercept
- ◆ Noise measurements (with R&S FS-K3) or phase noise measurement (with R&S FS-K4)

The Signal Analyzer R&S FSQ26 covers the entire frequency range to be measured for spurious emissions.



FIG 2: Display of the main modulation parameters in the Result Summary: The measurement covering 20 bursts shows an EVM of  $-46.7$  dB for the best burst (min. peak) and  $-45.09$  dB for the worst burst (max. peak) as well as an average EVM of  $-46.09$  dB for all bursts. Output power (with regard to burst) and crest factor are also displayed. Quick and easy determination, for example, of the EVM dependence on the output power of an amplifier is thus possible. Owing to its auto level function, the analyzer follows these level changes without requiring any manual settings.



FIG 3: Constellation diagram of all or (selectable) single carriers

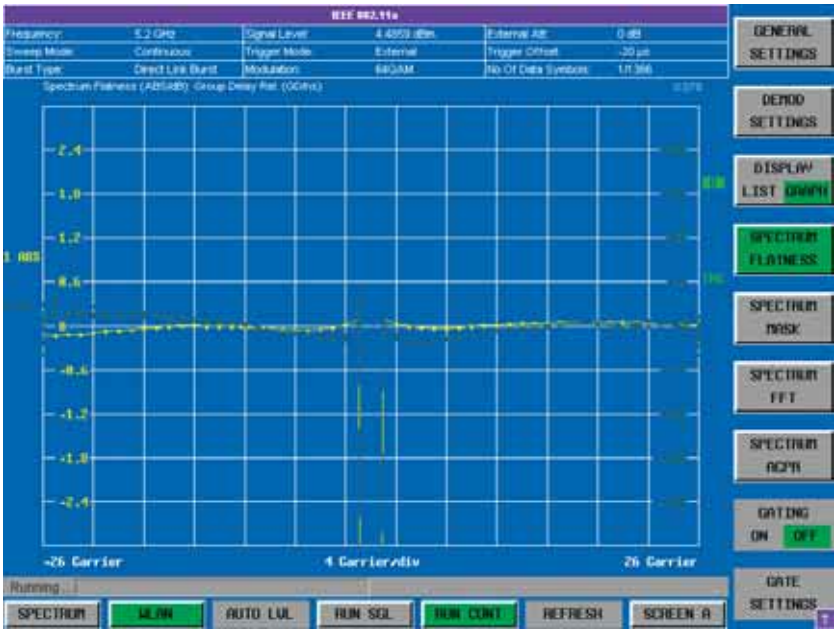


FIG 4: Group delay and spectrum flatness are determined via the channel estimation of the preamble or (user-selectable) for the entire burst including payload. Frequency responses of filters, distortions due to time offsets or different I and Q signal delays (skew) are clearly visible.

### General Settings

**Signal Characteristics**

Standard	IEEE 802.11a
Frequency	5.2 GHz
Channel No	40
Auto Level	<input checked="" type="checkbox"/>
Ext Att	0 dB
Signal Level (RF)	-30 dBm
Signal Level (Baseband)	1 V

**Data Capture Settings**

Capture Time	1 ms
Overall Burst Count	<input type="checkbox"/>
No of Bursts to Analyze	1

**Trigger Settings**

Trigger Mode	Free Run
Trigger Offset	Free Run
Power Level (RF)	External
Power Level (Baseband)	Power
Auto Power Trigger Level	<input type="checkbox"/>

**IQ Settings**

Swap IQ	<input type="checkbox"/>
---------	--------------------------

**Input Settings**

Baseband Input	<input type="checkbox"/>
IQ Input	50 Ohm
Balanced	<input checked="" type="checkbox"/>
Low Pass	<input checked="" type="checkbox"/>
Dither	<input type="checkbox"/>

### Demod Settings

**Burst To Analyze**

Use Signal Field Content	<input type="checkbox"/>
Burst Type	Direct Link Burst
Demodulator	64QAM
Equal Burst Length	BPSK
Min No of Data Symbols	QPSK
Max No of Data Symbols	16QAM
Improved Channel Estimation	64QAM
Improved Channel Estimation	<input type="checkbox"/>

**Tracking**

Phase	<input checked="" type="checkbox"/>
Timing	<input type="checkbox"/>
Level	<input type="checkbox"/>

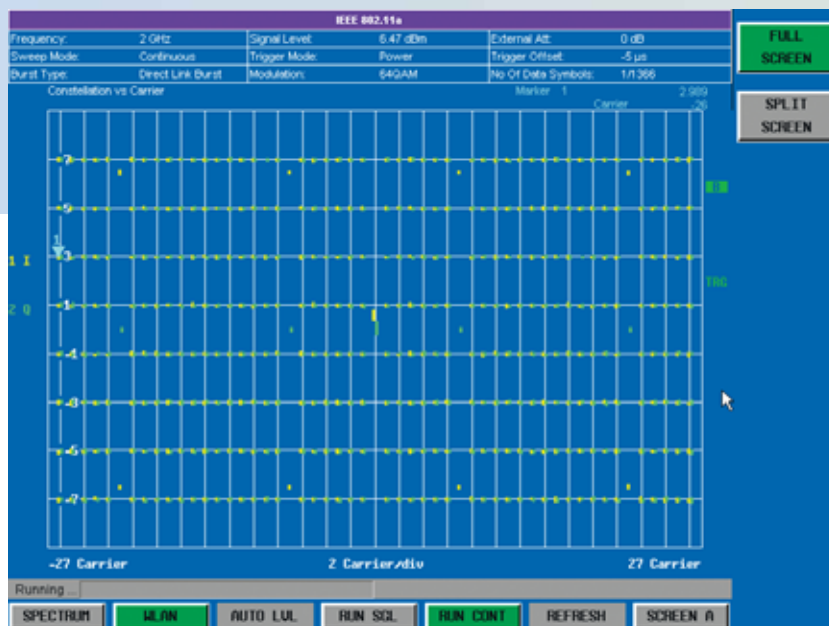
FIGs 5a + b: Setup; tables permit a quick overview of the selected settings and immediate access to the setting parameters

The optional Vector Signal Analyzer R&S FSQ-K70 enhances the R&S FSQ by universal demodulation and analysis functions for digitally modulated signals up to a symbol rate of 25 Msps. Thus, the AM/AM and AM/φM distortion curves of an amplifier, for example, can be determined directly from a digitally modulated signal, i.e. very realistically.

For analysis down to the chip layer, the option R&S FSQ-B71 has selectable balanced or unbalanced I and Q base-band inputs.

Measurements in the 2.4 GHz range already support 802.11g OFDM.

**Specifications for R&S FSQ-K90 see PD 0758.0200.**



**FIG 6:** Constellation overview of all carriers; single-carrier constellation is vertical; I and Q values have different colours. This diagram gives a quick overview of all carriers.



**ROHDE & SCHWARZ**

