

WCDMA 3GPP Application Firmware R&S FS-K72/-K73

3GPP transmitter measurements on base stations and modules with Signal Analyzer R&S FSQ and Spectrum Analyzers R&S FSU and R&S FSP

- ◆ Adds measurement functions to the R&S FSU, R&S FSQ and R&S FSP analyzer families in line with the 3GPP specifications for the FDD mode
- ◆ Application Firmware R&S FS-K72 provides the functionality needed for base station testing. Application Firmware R&S FS-K73 provides user equipment (UE) functionality:
 - Code domain power (code domain analyzer)
 - Code domain power versus time
 - Error vector magnitude (EVM)
 - Peak code domain error
 - Timing offset

Application Firmware R&S FS-K72/-K73 can be installed on all models of the Signal Analyzer R&S FSQ and Spectrum Analyzers R&S FSU and R&S FSP, and enhances the range of applications to include code domain power and modulation measurements on 3GPP FDD signals.

Featuring wide dynamic range for adjacent channel power, the R&S FSU and the R&S FSQ are ideal tools for WCDMA base station transmitter measurements in development and production.

The R&S FSP is the ideal development tool with easy-to-use measurement functions integrated into a cost-effective analyzer, especially in mobile radio development.

Code domain power measurements

The main application of R&S FS-K72/-K73 is the determination of the power in 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. Moreover, this measurement is a very efficient tool for 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.

To investigate power control, the power characteristic in a code channel can be displayed versus all slots of a frame (10 ms).

The R&S FSP requires the option R&S FSP-B70 to perform measurements over more than one slot in the code domain.

Measurement of modulation quality: peak code domain error and EVM

Two different measurements are stipulated in the 3GPP specifications for determining the modulation quality:

- ◆ EVM (error vector magnitude)
- ◆ Peak code domain error

The code domain power measurement offers an in-depth analysis for a WCDMA signal with several active channels. The composite EVM measurement returns a

modulation error value for the total signal, whereas the symbol EVM function yields the individual vector errors of the active channels.

To obtain the peak code domain error (PCDE), the vector error between the measured signal and the ideal reference signal is determined and projected to the codes of a specific spreading factor. With R&S FS-K72, the spreading factor for the PCDE measurement can be selected by the user.

Automatic detection of active channels and their data rate

The scrambling code, which is user-selectable in the application firmware, must be known for the code domain power measurement. 3GPP FDD signals may use different spreading factors and data rates in the various channels. The data rates are automatically detected by R&S FS-K72/-K73 and need not be known beforehand.

Spectrum emission mask

To perform the spectrum emission mask measurement in line with the 3GPP specifications, the R&S FS-K72/-K73 provides an automatic function that gives a pass/fail result.

Spectrum measurements over wide dynamic range

The RMS detector integrated as standard allows precise transmitter power measurements irrespective of the waveform.

Owing to their extremely wide dynamic range, the R&S FSU and the R&S FSQ are the ideal analyzers for out-of-band emissions that have to be detected for instance by means of adjacent-channel power measurements. Noise correction yields a value of 84 dB in the adjacent channel which exceeds by far the values prescribed by the specification.

Measurement	R&S FSU/ FSP	R&S FSU/ FSP with R&S FS-K72	R&S FSU/ FSP with R&S FS-K73
Maximum output power	x		
CPICH power accuracy		x	N/A
Frequency error		x	x ¹⁾
Power control dynamic range		x	
Total power dynamic range		x	N/A
Occupied bandwidth	x		
Spectrum emission mask	x	x	x
ACLR	x		
Spurious emissions	x		
Error vector magnitude		x	x
Peak code domain error		x	x

¹⁾ Frequency relative to frequency received from BS.

Measurements cannot only be performed on systems but also on individual components such as amplifiers which have to meet more stringent requirements.

Remote control

All measurements can be remote-controlled. The results and demodulated data bits can be transferred via the IEEE bus. Ideal for use in production.

Other standards

Application Package R&S FS-K5 (GSM and EDGE measurements) turn the R&S FSP/R&S FSU/R&S FSQ into multi-standard signal analyzers for base stations as well as for mobiles.

Applications and examples

Code domain power measurement on a signal with 32 active channels (1)

Active and inactive channels are marked in different colours. Inactive channels (noise, interference) are displayed with the highest spreading factor.

The table also shows the main parameters of the total signal at a glance, e.g. total power, frequency error and error of chip rate, as well as the parameters of the marked code channel such as timing offset and code power.

Peak code domain error measurement (2)

The peak code domain error is projected to the codes of the highest spreading factors. The maximum value of all codes per slot is displayed.

Automatic detection of channels and decoding of information (3)

Information about the active channels is presented in a list. In addition, the user data transmitted on each physical channel can be analyzed.



Measurement of code domain power versus time (4)

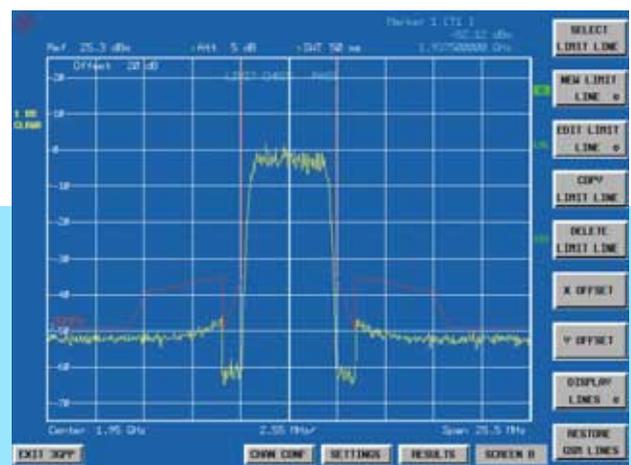
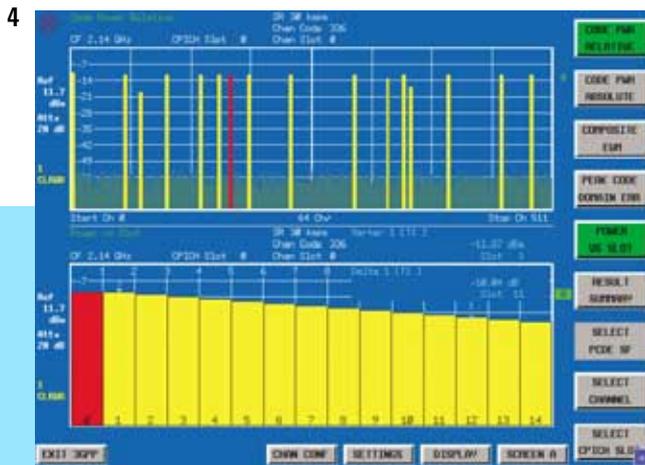
The code power can additionally be displayed versus the 15 slots of a frame to determine the accuracy of power control.

Spectrum emission mask measurement (5)

The measurement is defined with a 30 kHz measurement bandwidth at 2.5 MHz to 3.5 MHz offset from the carrier. From 3.5 MHz to 12.5 MHz, the measurement is performed in a 1 MHz measurement bandwidth. The limit values are according to 3GPP Specifications TS 34.121.

Multicode UE transmission (6)

The mapping of the active channels on the I and Q branches is automatically detected and displayed.



Specifications R&S FS-K72

The specifications below apply to the R&S FSQx (R&S FSQ.3/8/26), R&S FSUx (R&S FSU.3/8/26) und R&S FSPx (R&S FSP.3/7/13/30/40). They are based on the data sheet specifications of the Spectrum Analyzers R&S FSQ, R&S FSU and R&S FSP and have not been checked separately. Specifications apply under the following conditions: 15 minutes warmup time at ambient temperature, specified environmental conditions met, calibration cycle adhered to and internal calibration performed. Data with tolerances are measurement uncertainties with a confidence level of 95%. The specified level measurement errors do not take into account systematic errors due to reduced S/N ratio.

The R&S FSPx analyzer has to be equipped with options R&S FSP-B15 and R&S FSP-B70.

Measurement	R&S FSP	R&S FSQ/R&S FSU	Test specifications and permissible measurement uncertainty of 3GPP TS 25.141
Code domain power (applies to code domain power and code domain power versus slot)			
Total signal power, measurement uncertainty	<0.5 dB	<0.3 dB	6.2.1 <0.7 dB
CPICH power, measurement uncertainty	<0.6 dB	<0.4 dB	6.2.2 <0.8 dB
Code power; measurement uncertainty Absolute Relative	<0.6 dB <0.1 dB	<0.4 dB <0.1 dB	<0.1 dB
Frequency error Measurement range Measurement uncertainty (S/N >40 dB)	<1 kHz <1.5 Hz + error of reference frequency	<1 kHz <1.5 Hz + error of reference frequency	6.3, 6.7.1 <12 Hz
Composite EVM			
Measurement range	2% to 25%	1.5% to 25%	12.5% to 25%
Inherent EVM	<2%	<1.5%	
Measurement uncertainty	<1%	<0.5%	<2.5%
Peak code domain error			
Measurement range	0 dB to -55 dB	0 dB to -60 dB	-33 dB
Inherent PCDE	-55 dB	-60 dB	
Measurement uncertainty	<1 dB (0 dB to 40 dB)	<1 dB (0 dB to 40 dB)	<1 dB
Output power			
Measurement uncertainty Absolute Relative	<0.5 dB <0.2 dB	<0.3 dB <0.1 dB	<0.7 dB
Occupied bandwidth (99 %)			
Measurement uncertainty	<85 kHz	<85 kHz	<100 kHz
ACLR (adjacent-channel leakage ratio) (3.84 MHz BW)			
5 MHz offset			45 dB
Dynamic range Without noise correction	65 dB	77 dB	
Measurement uncertainty	<0.3 dB + error due to S/N	<0.2 dB + error due to S/N	<0.8 dB
Spurious emissions			
Level uncertainty <3.6 GHz 3.6 GHz to 13 GHz	<0.5 dB <2.5 dB	<0.5 dB <2.5 dB	
Spectrum emission mask	<1.5 dB	<1 dB	<1.5 dB

Specifications R&S FS-K73

The specifications below apply to the R&S FSQx (R&S FSQ.3/8/26), R&S FSUx (R&S FSU.3/8/26) und R&S FSPx (R&S FSP.3/7/13/30/40). They are based on the data sheet specifications of Spectrum Analyzers R&S FSP and R&S FSU, and have not been checked separately. Specifications apply under the following conditions: 15 minutes warmup time at ambient temperature, specified environmental conditions met, calibration cycle adhered to and internal calibration performed. Data with tolerances are measurement uncertainties with a confidence level of 95%. Data without tolerances are typical values. The specified level measurement errors do not take into account systematic errors due to reduced S/N ratio.

The R&S FSPx analyzer has to be equipped with option R&S FSP-B15.

Measurement	R&S FSP	R&S FSQ/R&S FSU	Test specifications and permissible measurement uncertainty to 3GPP TS 34.121
Code domain power (applies to code domain power and code domain power vs slot)			
Maximum output power	<0.5 dB	<0.3 dB	5.2 <0.7 dB
Minimum output power	<0.5 dB	<0.4 dB	5.4.3 <1 dB
Code power; measurement uncertainty Absolute Relative	<0.6 dB <0.1 dB <0.3 dB	<0.4 dB <0.1 dB <0.3 dB	<0.1 dB over a 1.5 dB range <0.3 dB over a 12 dB range
Frequency error Measurement range Measurement uncertainty (S/N > 40 dB)	<1 kHz <1.5 Hz + error of reference frequency	<1 kHz <1.5 Hz + error of reference frequency	5.3 <10 Hz
Composite EVM			
Measurement range	2% to 25%	1.5% to 25%	12.5% to 25%
Inherent EVM	<2%	<1.5%	
Measurement uncertainty	<1%	<0.5%	0%
Peak code domain error			
Measurement range	0 dB to -55 dB	0 dB to -60 dB	-15 dB
Inherent PCDE	-55 dB	-60 dB	
Measurement uncertainty	<1 dB (0 dB to 40 dB)	<1 dB (0 dB to 40 dB)	<1 dB
Output power			
Measurement uncertainty Absolute Relative	<0.5 <0.2	<0.3 dB <0.1 dB	<0.7 dB
Occupied bandwidth (99%)			
Measurement uncertainty	<85 kHz	<85 kHz	<100 kHz
ACLR (adjacent-channel leakage ratio) (3.84 MHz BW), test model 1 with 32 DPCH			
5 MHz offset			32.2 dB
Dynamic range Without noise correction	65 dB	77 dB	
Measurement uncertainty	<0.3 dB + error due to S/N	<0.2 dB + error due to S/N	<0.8 dB
Spurious emissions			
Level uncertainty <3.6 GHz 3.6 GHz to 13 GHz	<0.5 dB <2.5 dB	<0.5 dB <2.5 dB	
Spectrum emission mask	<1.5 dB	<1 dB	<1.5 dB

Configuration overview

	Base station		User equipment (UE)	
	R&S FSQ/R&S FSU	R&S FSP	R&S FSQ/R&S FSU	R&S FSP
R&S FS-K72	●	●		
R&S FS-K73			●	●
R&S FSP-B15		●		●
R&S FSP-B70		●		○ ¹⁾

¹⁾ Extends measurement range from one slot to one frame.

Ordering information

R&S FS-K72

Application Firmware R&S FS-K72 can be integrated into any member of the R&S FSU and R&S FSQ family. Options R&S FSP-B70 and option R&S FSP-B15 are prerequisites for operating the application firmware on any member of the R&S FSP spectrum analyzer family.

Designation	Type	Order No.
WCDMA 3GPP Application Firmware	R&S FS-K72	1154.7000.02
Pulse Calibrator for R&S FSP	R&S FSP-B15	1155.1006.02
Demodulator Hardware for R&S FSP	R&S FSP-B70	1157.0559.02

R&S FS-K73

Application Firmware R&S FS-K73 can be integrated into any member of the R&S FSQ & R&S FSU family. Option R&S FSP-B15 is a prerequisite for operating the application firmware on any member of the R&S FSP spectrum analyzer family.

Designation	Type	Order No.
WCDMA 3GPP Application Firmware	R&S FS-K73	1154.7252.02
Pulse Calibrator for R&S FSP	R&S FSP-B15	1155.1006.02

Recommended extras

R&S FSP-B70 extends the measurement range of the Application Firmware R&S FS-K73 for the Spectrum Analyzer R&S FSP from one slot to one frame.

Designation	Type	Order No.
Demodulator Hardware for R&S FSP	R&S FSP-B70	1157.0559.02





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