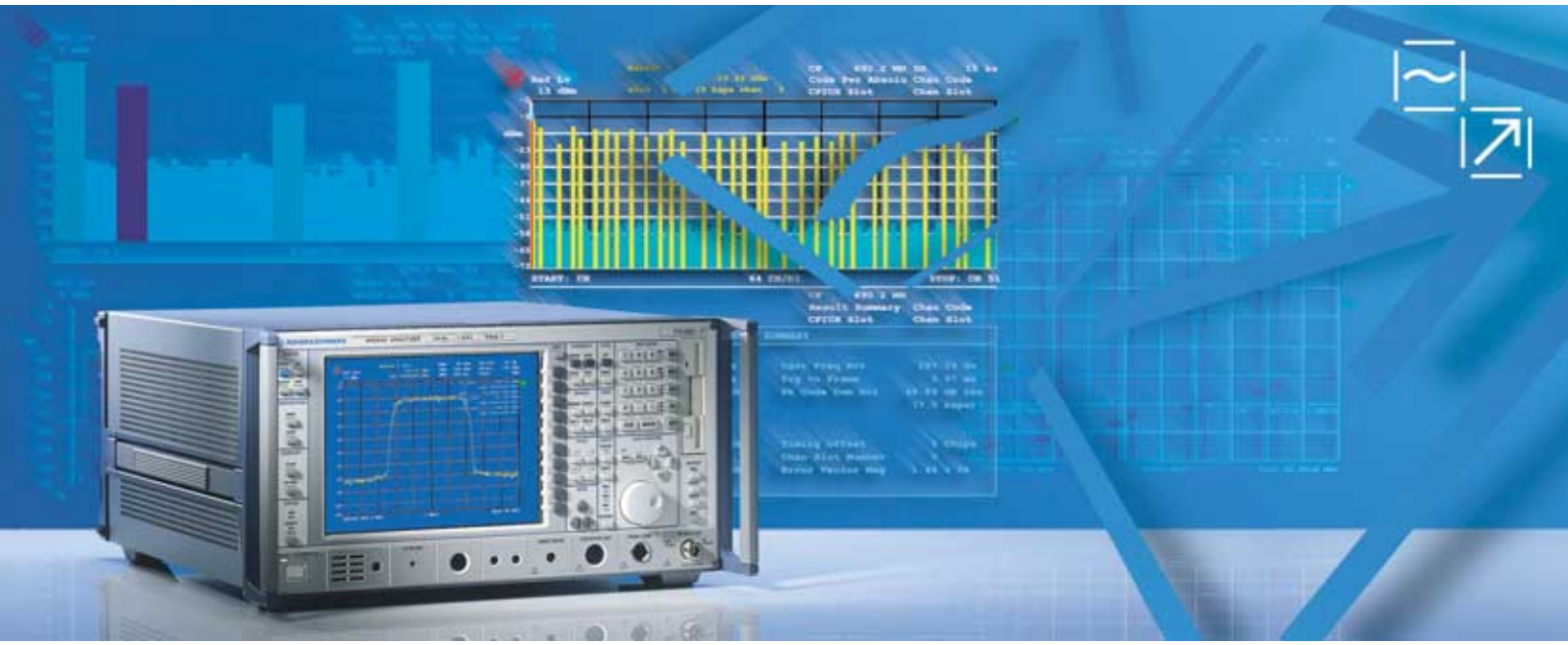


WCDMA/3GPP Application Firmware FSIQ-K72/-K73

Transmitter measurements on 3GPP equipment with Signal Analyzer FSIQ

Adds further measurement functions according to the 3GPP specifications for the FDD mode to the FSIQ analyzer family.

The FSIQ-K72 option provides the functionality and parameters needed for base station testing.

The FSIQ-K73 option provides the user equipment (UE) functionality and parameters.

- Code domain power (code domain analyzer)
- Code domain power versus time
- Error vector magnitude (EVM)
- Peak code domain error
- Timing offset
- Occupied bandwidth (OBW)
- Adjacent-channel leakage ratio (ACLR)
- Spectrum emission mask
- Complementary cumulative distribution function (CCDF)

Featuring wide dynamic range for adjacent-channel power and high-precision RMS power measurements, the FSIQ is an ideal tool for WCDMA transmitter measurements in development and production.

ROHDE&SCHWARZ

Application Firmwares FSIQ-K72/-K73 enhance the wide range of applications of the Signal Analyzer FSIQ to include code domain power and modulation measurements on 3GPP/FDD signals.

All transmitter measurements required according to 3GPP Specifications TS 25.141 V3.5.0 and TS 34.121 can thus be performed by a single instrument.

Measurement	FSIQ	FSIQ with FSIQ-K72	FSIQ with FSIQ-K73
Maximum output power	x		
CPICH power accuracy		x	N/A
Frequency error	x[2)]	x	x[3)]
Power control dynamic range		x	
Total power dynamic range		x	N/A
Occupied bandwidth	x		
Spectrum emission mask	x[1)]	x	x
ACLR	x		
Spurious emissions	x[1)]		
Error vector magnitude	x[2)]	x	x
Peak code domain error		x	x

1) These measurements can be performed with basic functions of the FSIQ, without any 3GPP-specific setting functions.
2) These measurements can be performed on a 3.84 MHz QPSK signal (e.g. only P-CCPCH without SCH or one DPCCH and one DPDCH).
3) UE frequency relative to frequency received from BS.

Code domain power measurements

The main application of FSIQ-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 effects that are not obvious from the spectrum alone.

The power of the different codes is shown versus the code number. The width of the displayed bargraph intuitively provides information about the occupied code domain and the spreading factor.

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

Measurement of modulation quality: peak code domain error and EVM

Two different measurements are stipulated in the 3GPP Specifications TS 25.141 and TS 34.121 for determining the modulation quality:

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

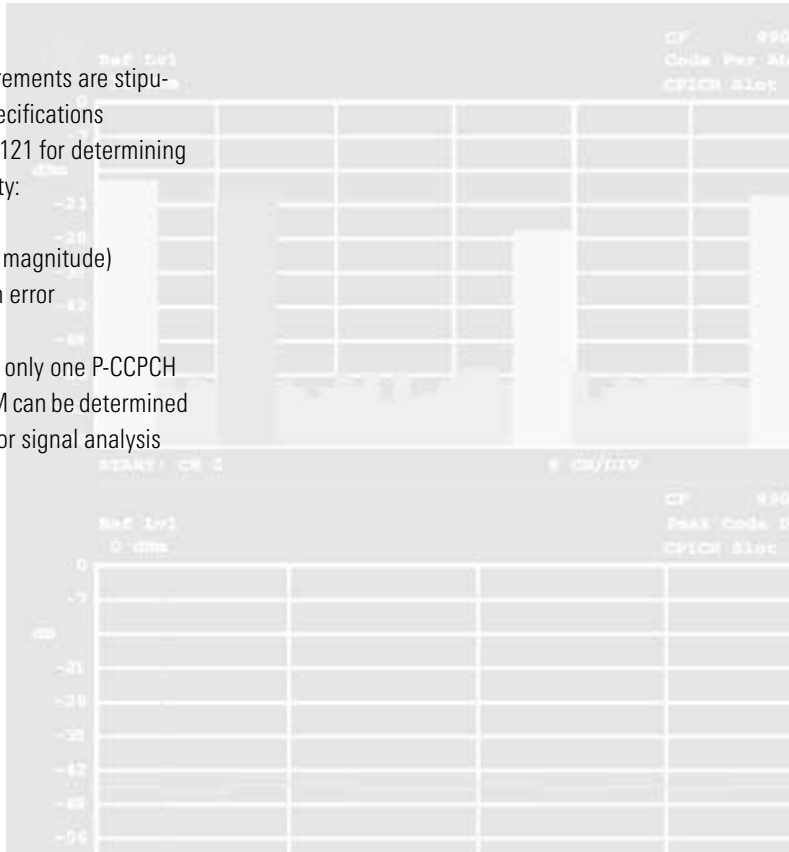
For a signal with e.g. only one P-CCPCH without SCH, the EVM can be determined with the normal vector signal analysis function of the FSIQ.

The code domain power measurement offers an in-depth analysis for a WCDMA signal with several active channels. The modulation accuracy 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 FSIQ-K72/-K73, 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 on the FSIQ, 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 FSIQ-K72/-K73 and need not be known beforehand.



Spectrum measurements over wide dynamic range

The FSIQ is a powerful analyzer for WCDMA signals even without Application Firmware FSIQ-K72/-K73 and of course retains these functions when fitted with FSIQ-K72/-K73.

An RMS detector integrated as standard allows precise transmitter power measurements irrespective of the waveform. The reproducibility of the measurement can easily be adapted to the test requirements via the measurement time.

Given the settings defined for channel power measurements in line with the 3GPP standard and a measurement time of 200 ms, the reproducibility (1 σ value) is <0.1 dB.

Thanks to its extremely wide dynamic range the FSIQ is the ideal analyzer for out-of-band emissions that have to be detected for instance by means of adjacent-channel power measurements.

With a dynamic range of more than 75 dB in the adjacent channel and more than 82 dB in the alternate channel the FSIQ exceeds by far the values prescribed by the specification.

Measurements cannot only be performed on systems but also on individual components such as amplifiers which have to meet more stringent requirements. To achieve the maximum dynamic range, the optimum mixer level can be set very precisely using the optional 1 dB Attenuator FSE-B13.

Spectrum emission mask
To perform the spectrum emission mask measurement in line with 3GPP Specifications TS 25.141 and TS 34.121, the FSIQ provides a measurement function that gives a pass/fail result.

FSIQ-K72 detects the output power of the BS and applies the correct limits. FSIQ-K73 includes the limits for the UE. The limits are not dependent on the output power. Both K72 and K73 enable the user to define new limits.

Complementary cumulative distribution function (CCDF)
Additional information about the time domain statistics of the signal can be obtained by using the CCDF function of FSIQ-K72/-K73.

This measurement can for instance provide information about the correlation between different codes and the influence of multiple code transmission.

To simplify operation, FSIQ-K72/-K73 provide the main measurements in the main menu:

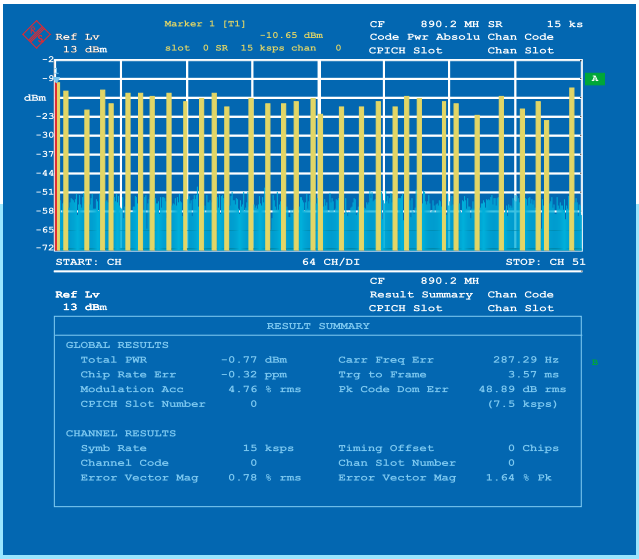
- Power
- ACLR
- Occupied bandwidth
- Spectrum
- Spectrum emission mask
- Time domain
- CCDF

Remote control

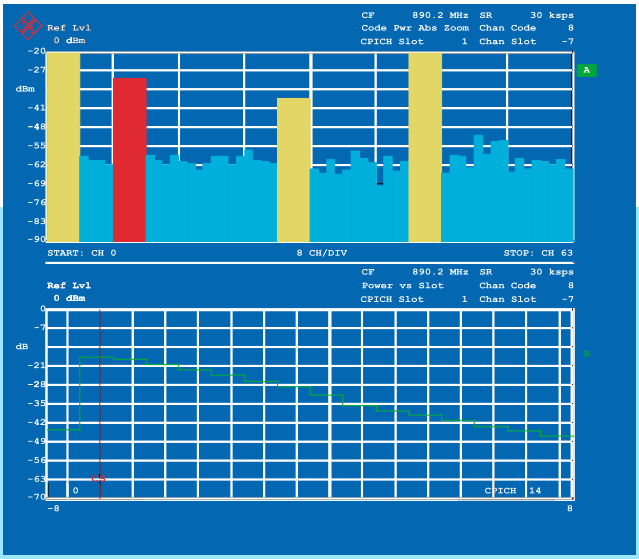
All measurements can be remote-controlled as well as results and demodulated data be transferred via the IEEE bus. The settings already defined in the application firmware make the handling of the FSIQ extremely easy so that it is ideal for use in production environments.

Other standards

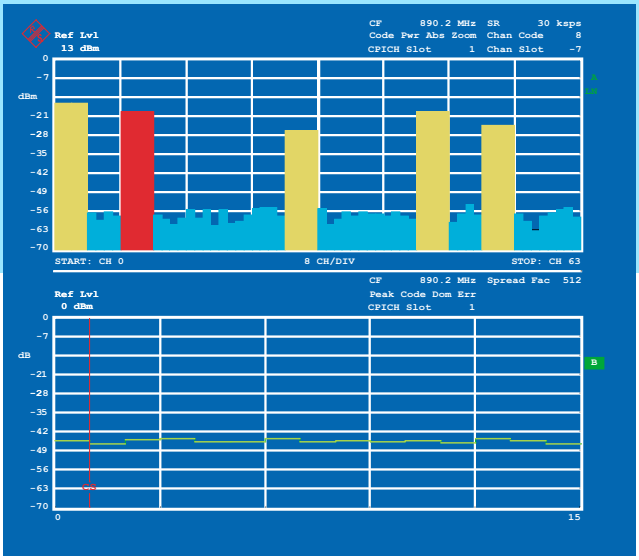
Application Software Packages FSE-K11 (GSM transmitter measurements), FSIQ-K71 (code domain power measurements for IS-95) and the basic vector signal analysis functions of FSIQ itself make FSIQ a universal and multistandard-capable platform for base station transmitter measurements.



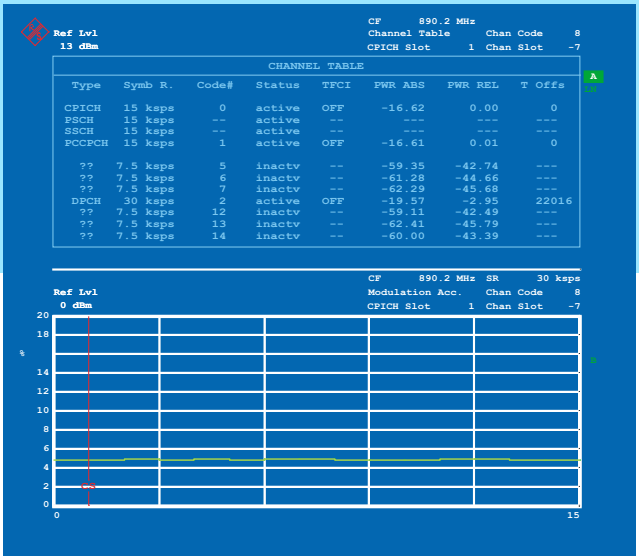
1



2



3



4

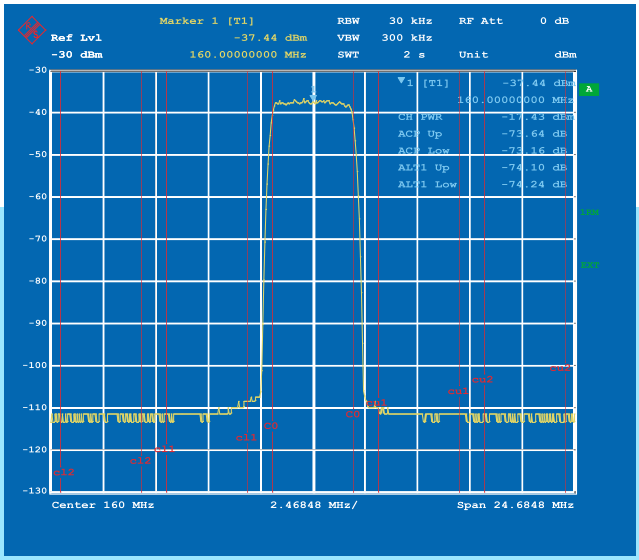
Applications and examples

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 shows in addition 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.

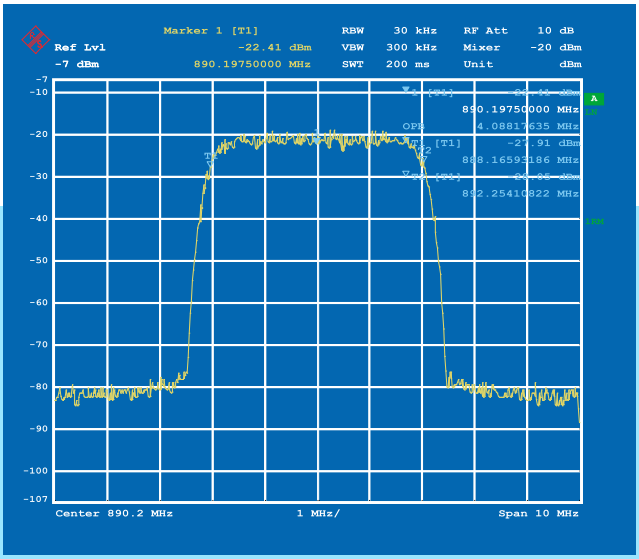
Measurement of code domain power versus time (2)
The code power can additionally be displayed versus the 15 slots of a frame to determine the accuracy of power control.

Peak code domain error measurement (3)
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.

Error vector measurement (4)
A signal comprising a large number of active channels can no longer be analyzed with the usual vector signal analyzer functions. FSIQ-K72 therefore provides the modulation accuracy measurement function that allows the EVM of a total signal to be measured for multichannel signals too. This measurement is closer to reality than the EVM measurement with one active channel only (P-CCPCH).

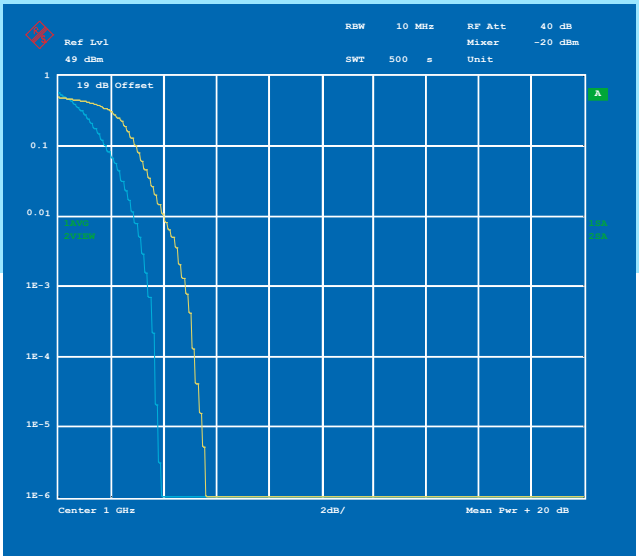


5

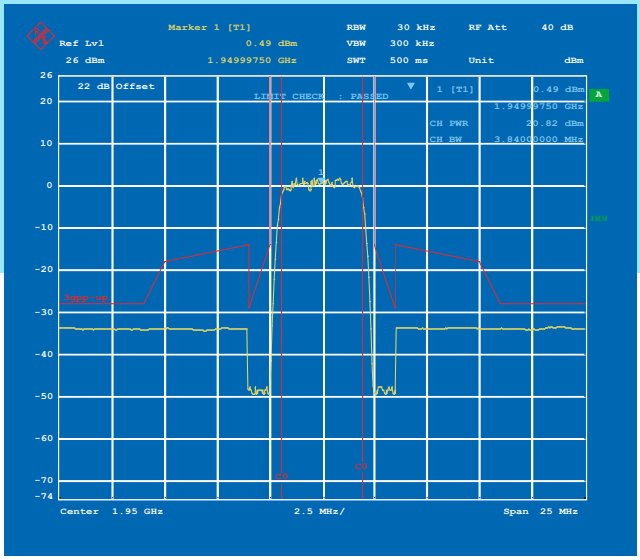


6

7



8



ACLR measurement with maximum dynamic range and highly reproducible RMS power measurement (5)

The requirements for measurements on components are usually more stringent than the limit values prescribed by the specification. With its low noise figure of 18 dB and third-order intercept point of 20 dBm (FSIQ7), the FSIQ features an adjacent-channel leakage ratio of 75 dB.

Measurement of occupied bandwidth (6)

The occupied bandwidth is measured to determine the bandwidth in which 99% of the signal power is transmitted. The limit value according to 3GPP is 5 MHz.

Spectrum emission mask measurement (7)

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

Measurement of the complementary cumulative distribution function (8)

The graphs display the CCDF of two signals, i.e. one single code signal and one signal comprising two codes. Both signals are uplink signals.

Specifications

The specifications below apply to the FSIQ3, FSIQ7, FSIQ26 and FSIQ40 fitted with the options FSIQ-B70 and FSIQ-K72/-K73. They are based on the data sheet specifications of the Signal Analyzer FSIQ and have not been checked separately. Specifications are guaranteed 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.

FSIQ-K72

Measurement		Test specifications and permissible measurement uncertainty to 3GPP TS 25.141 V3.5.0
Code domain power (applies to code domain power and code domain power vs slot)		
Total signal power, measurement uncertainty	<0.6 dB	6.2.1 <0.7 dB
CPICH power, measurement uncertainty	<0.7 dB	6.2.2 <0.8 dB
Code power, measurement uncertainty Absolute Relative	<0.7 dB <0.1 dB	<0.1 dB
Frequency error Measurement range Uncertainty (S/N >40 dB)	<1 kHz <1.5 Hz + error of reference frequency	6.3, 6.7.1 <12 Hz
Modulation accuracy (composite EVM)		
Measurement range	1.5% to 25%	12.5% to 25%
Inherent EVM	<1.5%	
Measurement uncertainty	<0.5%	<2.5%
Peak code domain error		6.7.3
Measurement range Inherent PCDE Measurement uncertainty	0 dB to –60 dB –60 dB <1 dB (0 dB to –40 dB)	–33 dB <1 dB
Output power		6.2.1
Measurement uncertainty, absolute	<0.6 dB	<0.7 dB
Measurement uncertainty, relative	<0.2 dB	
Occupied bandwidth (99%)		6.5.1
Measurement uncertainty	<85 kHz	<100 kHz
ACLR (adjacent channel leakage ratio) (3.84 MHz BW)		6.5.2.2
5 MHz offset Dynamic range Measurement uncertainty	75 dB <0.5 dB (ACLR <60 dB)	45 dB <0.8 dB
10 MHz offset Dynamic range Measurement uncertainty	82 dB <0.5 dB (ACLR <60 dB)	50 dB <0.8 dB
Spurious emissions		
Level uncertainty <2.2 GHz 2.2 GHz to 4 GHz >4 GHz Spectrum emission mask	 <1 dB <1.5 dB <2.5 dB <1.5 dB	

FSIQ-K73

Measurement		Test specifications and permissible measurement uncertainty to 3GPP TS 34.121 V3.4.0
Code domain power (applies to code domain power and code domain power vs slot)		
Maximum output power	<0.6 dB	5.2 <0.7 dB
Minimum output power		5.4.3 <1 dB
Code power, measurement uncertainty Absolute Relative	<0.7 dB <0.1 dB <0.3 dB	<0.1 dB over 1.5 dB range <0.3 dB over 12 dB range
Frequency error Measurement range Uncertainty (S/N >40 dB)	<1 kHz <1.5 Hz + error of reference frequency	5.3 <10 Hz
Modulation accuracy (composite EVM)		
Measurement range	1.5% to 25%	12.5% to 25%
Inherent EVM	<1.5%	
Measurement uncertainty	<0.5%	<2.5%
Peak code domain error		5.1.3
Measurement range Inherent PCDE Measurement uncertainty	0 dB to –60 dB –60 dB <1 dB (0 dB to –40 dB)	–15 dB <1 dB

Output power		5.2
Measurement uncertainty, absolute	<0.6 dB	<0.7 dB
Measurement uncertainty, relative	<0.2 dB	
Occupied bandwidth (99%)		5.8
Measurement uncertainty	<85 kHz	<100 kHz
ACLR (adjacent channel leakage ratio) (3.84 MHz BW)		5.10
5 MHz offset		32.2 dB
Dynamic range	75 dB	
Measurement uncertainty	<0.5 dB (ACLR <60 dB)	<0.8 dB
10 MHz offset		42.2 dB
Dynamic range	82 dB	
Measurement uncertainty	<0.5 dB (ACLR <60 dB)	<0.8 dB
Spurious emissions		
Level uncertainty		
<2.2 GHz	<1 dB	<1.5 dB
2.2 GHz to 4 GHz	<1.5 dB	<2 dB
>4 GHz	<2.5 dB	<4 dB
Spectrum emission mask	<1.5 dB	

Ordering information

Application Firmwares FSIQ-K72/-K73 can be integrated into any member of the FSIQ family. Option FSIQ-B70, memory extension and DSP, is a prerequisite for operating the application firmware. Additional modifications may become necessary if FSIQ-B70 is retrofitted.

.

Designation	Type	Order No.
Application Firmware 3GPP BTS Code Domain Power Measurements for FSIQ	FSIQ-K72	1126.4746.02
Application Firmware 3GPP UE Code Domain Power Measurements for FSIQ	FSIQ-K73	1153.1009.02
DSP and IQ Memory Extension 2 x 512 k	FSIQ-B70	1119.6747.02

Recommended extras

1 dB Attenuator for FSE/FSIQ	FSE-B13	1126.4746.02
High-Power Attenuator 20 dB, 50 W, 0 GHz to 6 GHz	RDL50	1035.1700.52

Certified Environmental System
ISO 14001
REG. NO 1954

Certified Quality System
ISO 9001
DQS REG. NO 1954

PD 0757.6391.22 · WCDMA/3GPP Application Firmware FSIQ-K72/-K73 · Trade names are trademarks of the owners · Subject to change · Data without tolerances: typical values

Printed in Germany 0701/0902 (U bb)

ROHDE&SCHWARZ GmbH & Co. KG · Mühldorfstraße 15 · 81671 München · Germany · P.O.B. 80 14 69 · 81614 München · Germany
Telephone +49 89 41 29-0 · www.rohde-schwarz.com · CustomerSupport: Tel. +49 180 5 12 42 42, Fax +49 89 41 29-137 77, E-mail: CustomerSupport@rohde-schwarz.com