Data sheet

Version 01.00

September 2004

Mobile Station Test Application Firmware R&S®FS-K83/R&S®FS-K85

Transmitter measurements on CDMA2000®, CDMA2000®/1xEV-DV and 1xEV-DO reverse link with the Signal Analyzer R&S®FSQ and the Spectrum Analyzers R&S®FSU and R&S®FSP

- Adds measurement functions in line with 3GPP2 specifications to the R&S®FSU/R&S®FSQ and R&S®FSP analyzer families
- R&S®FS-K83 provides the functionality needed for CDMA2000® and CDMA2000®/1xEV-DV testing
- R&S®FS-K85 provides 1xEV-DO functionality
- Provides the functionality needed for mobile station testing as well as the related parameters:
  - Code domain power
  - Code domain power versus time
  - Rho
  - Error vector magnitude (EVM)
  - Peak code domain error
  - Power versus symbol
  - Symbol constellation
  - Channel table
  - Code domain error power
  - Power versus chip (R&S®FS-K85)

ROHDE&SCHWARZ

The R&S®FS-K83 and R&S®FS-K85 application firmware packages can be installed on all models of the Signal Analyzers R&S®FSQ and Spectrum Analyzers R&S®FSU and R&S®FSP. R&S®FS-K83 enhances the range of applications to include code domain power and modulation measurements on CDMA2000® signals for radio configurations 3 and 4. 1xEV-DV reverse link channels of Release C are also supported. The R&S®FS-K85 application firmware adds the capability to measure code domain power modulation accuracy on all five channel types (PICH, RRI, DATA, ACK and DRC) as well as TRAFFIC and ACCESS operating modes of an access terminal.

Featuring wide dynamic range for adjacent channel power, the R&S®FSQ and the R&S®FSU are ideal tools for CDMA2000® mobile station transmitter measurements in development.

The R&S®FSP is the ideal development tool with easy-to-use measurement functions integrated into a cost-effective analyzer – the workhorse for every engineer.

Code domain power measurements

The main application 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 transmitter impairments such as clipping or intermodulation that are not obvious from the spectrum alone.

CDMA2000®

The power of the different codes can be shown versus the code number. This is called Hadamard order. The code powers can also be displayed in bit-reversed order which intuitively provides information about how much of the code domain is occupied by each single user.

To investigate power control, the power characteristic in a code channel can be displayed versus a number of power control groups (PCG). The number of PCGs to be analyzed can be changed. A pilot channel has to be present in the signal, but not in every PCG enabling the analysis of pilot-gated signals.

In R&S®FS-K83 for the R&S®FSQ and the R&S®FSU this number ranges between 2 and 50 and for the R&S®FSP between 2 and 12.

To look even further into the behaviour of a single code, the power versus symbol feature is a very useful tool.

1xEV-DO

The signal is in its structure similar to CDMA2000®, with some important differences such as a shorter slot length. Furthermore, the power control from CDMA2000® is replaced by a fast data rate control mechanism.

The code domain analysis in the R&S®FS-K85 application firmware comprises the analysis in the two operating modes ACCESS and TRAFFIC.

The number of half slots that can be analyzed ranges between 2 and 70 for the R&S®FSU and the R&S®FSQ and between 2 and 24 for the R&S®FSP.

Measurement of modulation quality

Three different measurements are commonly used in CDMA2000® systems for determining the modulation quality:

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

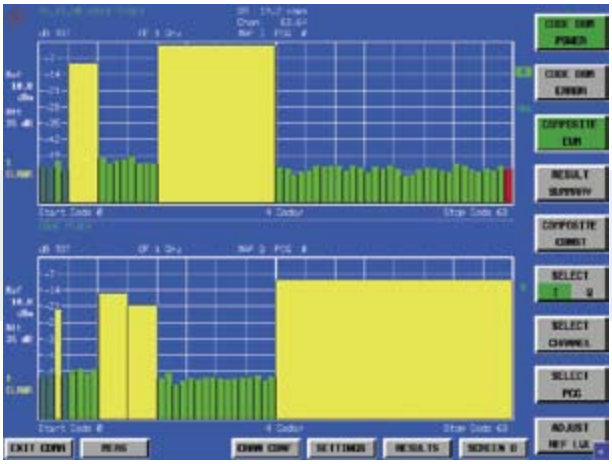
Rho is the correlation between the measured signal and the ideal reference signal and is a measure of the overall modulation quality.

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.

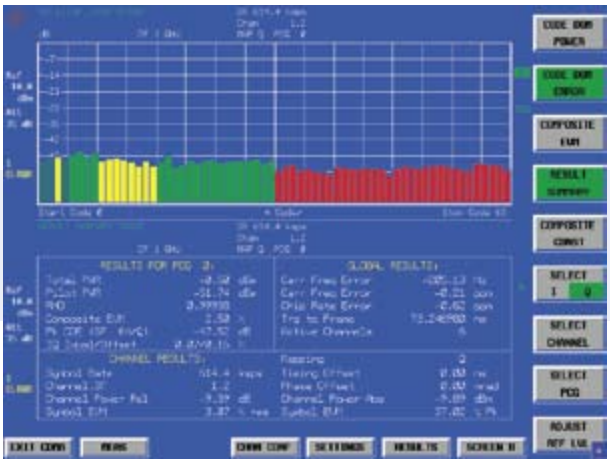
To obtain the peak code domain error (PCDE), the vector error between the measured signal and the ideal reference signal is determined. In CDMA2000® reverse link signals, the base spreading factor is selectable between 16, 32 and 64.

Measurement overview

Measurement	R&S®FSU/R&S®FSQ	R&S®FSU/FSP/FSQ with R&S®FS-K83	R&S®FSU/FSP/FSQ with R&S®FS-K85
Maximum output power	x	x	x
Frequency error		x	x
Power control dynamic range		x	N/A
Total power dynamic range		x	x
Occupied bandwidth	x	x	x
Spectrum emission mask		x	x
ACLR	x	x	x
Spurious emissions	x		
Rho		x	x
Error vector magnitude		x	x
Peak code domain error		x	x



Code domain power measurement on a signal with 6 active code channels (1)



Code domain error power and result summary (2)

With 1xEV-DO, the spreading factors are fixed for the different channel types of the signal. The transmission rate of the base station (access node) is changed by means of signalling from the mobile station (access terminal) by means of the data rate channel. Furthermore, the access terminal indicates with ACK/NACK if the data was received properly on the acknowledgment channels. The quality of the transmission channels is sent on the reverse rate indication channel.

Automatic detection of active channels and their data rate

The data rates of the user channels are automatically detected by R&S®FS-K83 and R&S®FS-K85 and need not be known beforehand. With the channel configuration tool the user can define the active channels, which improves the capabilities to measure under difficult signal conditions.

Band class settings

The frequency band classes 0 to 12 as specified by the standard are user-selectable, so that the correct limits are set in the ACLR and spectrum emission mask measurements.

Spectrum emission mask

To perform the spectrum emission mask measurement in line with the 3GPP2 specifications, R&S®FS-K83 and R&S®FS-K85 provide an automatic function that produces a pass/fail result. If requested by the band class setting, the limits depend on the channel power.

Spectrum measurements over wide dynamic range

The RMS detector integrated as standard allows accurate transmitter power measurements irrespective of the waveform. Due to their extremely wide dynamic range, the R&S®FSU and the R&S®FSQ are the ideal analyzers for detecting out-of-band emissions, e.g. by means of adjacent-channel power measurements.

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 IEC/IEEE bus. This makes R&S®FS-K83 and R&S®FS-K85 ideal for use in production.

CDMA2000® applications and examples

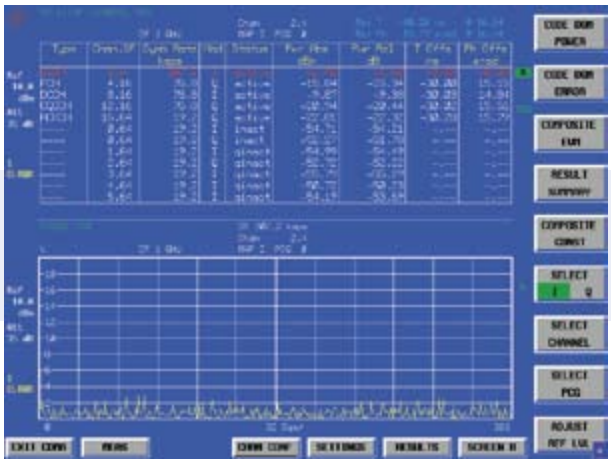
Code domain power measurement on a signal with 6 active code channels (1)

Active and inactive channels are displayed in bit-reversed order. Both the I and the Q branch of the signal are displayed. Inactive channels (noise, interference) are displayed with the base spreading factor.

Code domain error power and result summary (2)

The upper part of the screen displays the distribution of the error power on the Q branch.

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



Automatic detection of channels and error vector magnitude vs symbol (3)

Decoding of information (4)

1xEV-DO applications and examples

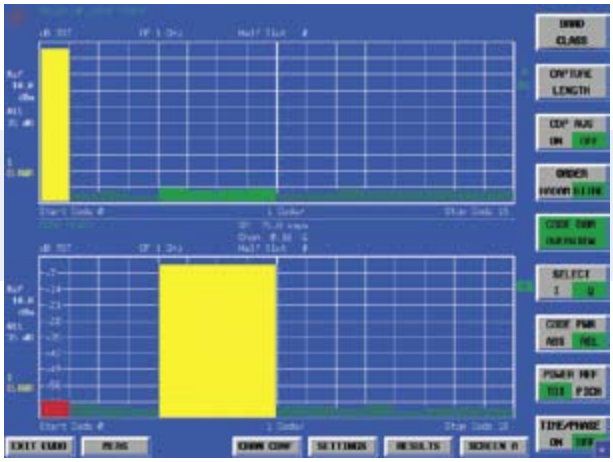
Automatic detection of channels and error vector magnitude vs symbol (3)
Information about the active channels is presented in a list. In addition, the EVM for each symbol in a power control group is shown in the lower half of the screen.

Decoding of information (4)
User data on the selected channel (marked red in the channel list) can be analyzed.

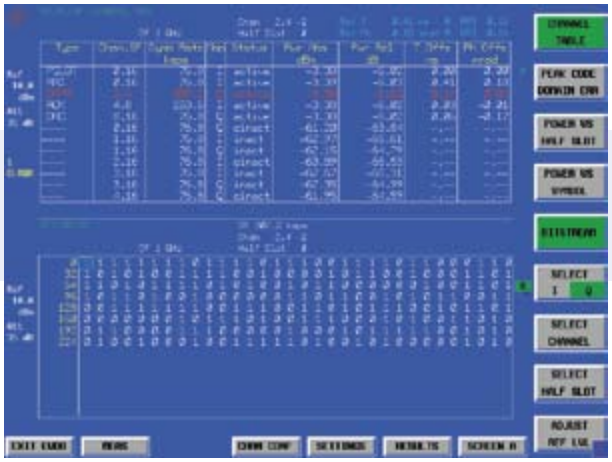
Code domain overview (5)
The in-phase component of the signal is displayed in the upper part of the domain of the quadrature-phase component as well as in the lower part. Detected active codes are marked in yellow. Inactive codes are marked in blue and quasi-active channels in green. The code selected for in-depth analysis is marked in red.

Channel table and decoded data (6)
The upper part of the screen shows an overview of the detected channels and a number of parameters such as power, modulation format and timing offset. The lower part shows the user data on the selected channel.

Code domain overview (5)



Channel table and decoded data (6)



Specifications

The specifications below apply to the R&S®FSU, R&S®FSQ and R&S®FSP families. They are based on the data sheet specifications of the R&S®FSQ, R&S®FSU and R&S®FSP analyzers 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.

Measurement	R&S®FSP	R&S®FSU/R&S®FSQ
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
Pilot power, measurement uncertainty	<0.6 dB	<0.4 dB
Code power, measurement uncertainty Absolute Relative	 <0.6 dB <0.1 dB	 <0.4 dB <0.1 dB
Composite EVM		
Measurement range	1.5% to 25%	1% to 25%
Inherent EVM	<1.5%	<1%
Measurement uncertainty	<0.5% of reading	<0.25% of reading
Peak code domain error (PCDE)		
Measurement range	0 dB to 55 dB	0 dB to 60 dB
Inherent PCDE	55 dB	60 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
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
Trigger to frame		
Accuracy	<210 ns	<210 ns

Ordering information

The R&S®FS-K83 and R&S®FS-K85 application firmware can be integrated into any member of the R&S®FSU, R&S®FSQ or R&S®FSP families.

Designation	Type	Order No.
cdma2000/1xEV-DV Mobile Station Test	R&S®FS-K83	1147.2416.02
1xEV-DV Mobile Station Test	R&S®FS-K85	1300.6689.02
Recommended extras		
Designation	**Type**	**Order No.**
High-Power Attenuator 20 dB, 50 W, 0 Hz to 6 GHz	R&S®RDL50	1035.1770.52

More information at
www.rohde-schwarz.com
(search term: FS-K83, FS-K85)

Certified Quality System
ISO 9001
DQS REG. NO 1954 QM

Certified Environmental System
ISO 14001
DQS REG. NO 1954 UM

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