Data sheet

Version 01.00

April 2004

TD-SCDMA Test Application Firmware R&S®FS-K76/-K77

Base station and mobile station tests on TD-SCDMA with the R&S®FSQ, R&S®FSU and R&S®FSP

- Adds measurement functions in line with 3GPP as well as China Wireless Telecommunication Standard Group (CWTS) specifications to the R&S®FSQ/FSU/FSP analyzer families
- R&S®FS-K76 provides the functionality needed for base station testing
- R&S®FS-K77 provides user equipment functionality

ROHDE&SCHWARZ

Application Firmware R&S®FS-K76 and R&S®FS-K77 can be installed on any analyzer of the R&S®FSQ/FSU/FSP series.

R&S®FS-K76 enhances the range of applications with code domain power and modulation measurements on TD-SCDMA base stations. R&S®FS-K77 provides user equipment (UE) functionality.

Featuring a wide dynamic range for adjacent channel power, the R&S®FSQ and the R&S®FSU are ideal tools for base station transmitter measurements in development. The R&S®FSP is the ideal partner in development and production, featuring low uncertainty in level measurement, high measurement speed and excellent RF characteristics.

TD-SCDMA

Two variants of the TD-SCDMA standard are available. One is the low chip rate (LCR) option of the TDD mode in 3GPP. The second is standardized by the China Wireless Telecommunication (CWTS) Standard group and is also known as TSM. The main difference between these two variants is that they connect to different core networks. R&S®FS-K76 and R&S®FS-K77 support both variants.

Code domain power measurements

The main application is to determine 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.
As a means to check power control, the power characteristic in a code channel can be displayed versus a number of slots. The number of slots to be analyzed can be changed between 2 and 63.

A very useful tool for examining the behaviour of a single code,even further is the power versus symbol feature is a very useful tool.

Measurement of modulation quality:
Two different measurements are commonly used in TD-SCDMA systems for determining the modulation quality:

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

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.

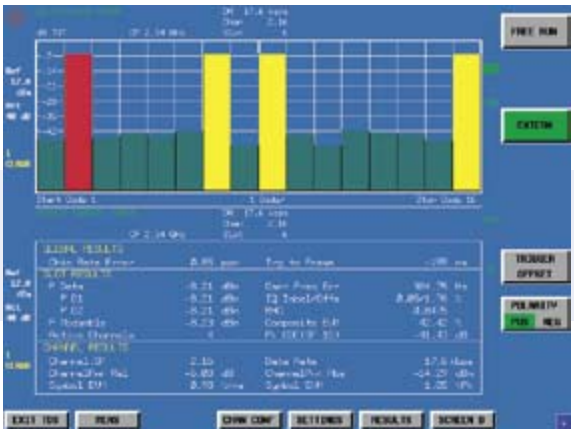
To obtain the PCDE, the vector error between the measured signal and the ideal reference signal is determined and projected to the codes of a specific spreading factor.

Automatic detection of active channels, their modulation format and data rate
The data rates of the user channels are automatically detected by R&S®FS-K76 and R&S®FS-K77 and need not be known in advance. Furthermore, the modulation format for high data rates changes from QPSK to 8PSK. This change is automatically detected by the firmware.

The channel configuration tool enables the user to define the active channels, which improves the capability to perform measurements under difficult signal conditions.

Spectrum emission mask
For spectrum emission mask measurement in line with the 3GPP specifications, the firmware provides an automatic function that returns a pass/fail result.

Measurement	R&S®FSU/FSP/FSQ	R&S®FSU/FSP/FSQ with R&S®FS-K76	R&S®FSU/FSP/FSQ with R&S®FS-K77
Maximum output power	✓	✓	✓
Frequency error	–	✓	✓
P-CCPCH power	–	✓	N/A
Power control dynamic range	–	✓	✓
Total power dynamic range	–	✓	✓
Occupied bandwidth	✓	✓	✓
Spectrum emission mask	–	✓	✓
ACLR	✓	✓	✓
Spurious emissions	✓		
ρ	–	✓	✓
Error vector magnitude	–	✓	✓
Peak code domain error	–	✓	✓
Power versus time	–	✓	✓



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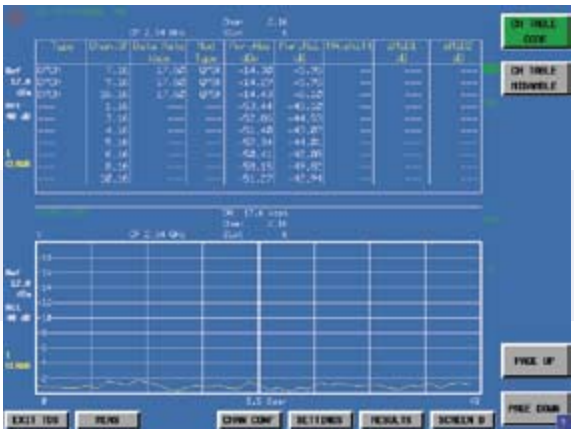

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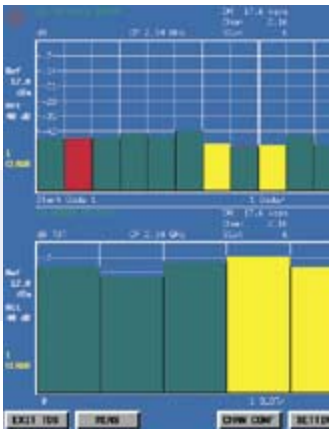

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Spectrum measurements over wide dynamic range
The RMS detector integrated as standard allows accurate transmitter power measurements irrespective of the waveform. Due to their extremely wide dynamic range, the R&S®FSU and R&S®FSQ are the ideal analyzers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

Measurements can be performed not only 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-K76 and R&S®FS-K77 ideal for use in production.

Additional 2G, 2.5G and 3G standards
Application software packages allow the R&S®FSQ/FSU/FSP to support the following mobile standards:

- GSM/EDGE (MS/BTS)
- WCDMA/HSDPA (MS/BTS)
- cdmaOne
- cdma2000 1x (MS/BTS)
- 1xEV-DO (MS/BTS)
- 1xEV-DV (MS/BTS)

TD-SCDMA applications and examples

Code domain power measurement on a signal with 4 active channels (1)
Active and inactive channels are displayed. Inactive channels (noise, interference) are displayed with a spreading factor of 16.

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

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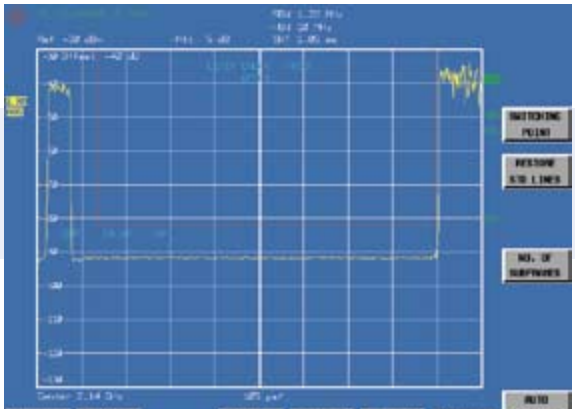

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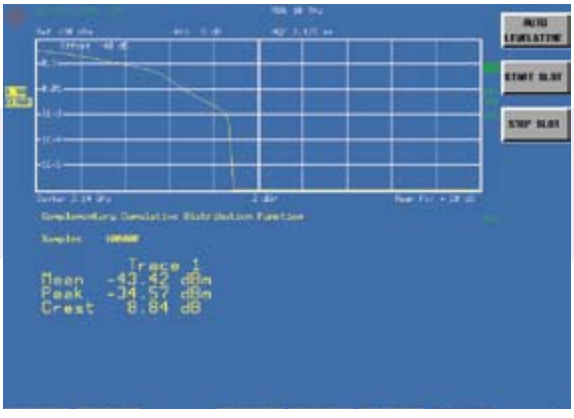

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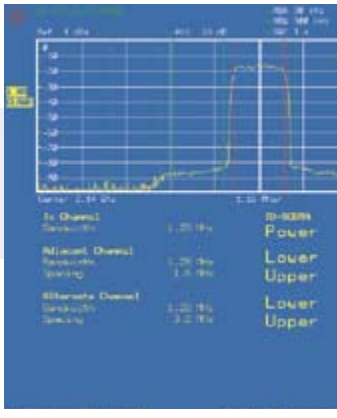

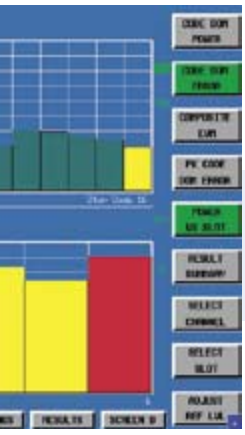

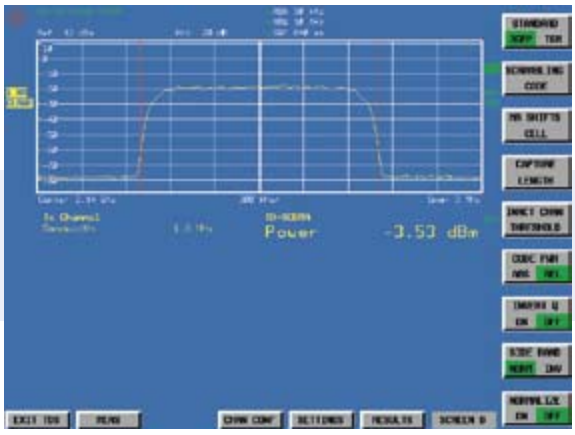

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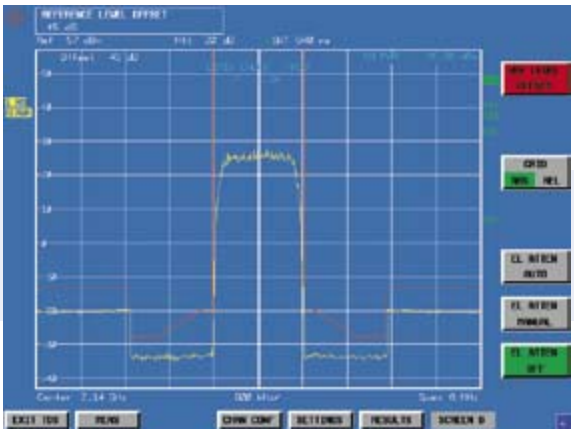

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Measurement of error vector magnitude versus symbol (2)
The upper half of the screen displays information about the active channels in list format. The composite EVM for each slot is shown in the lower half of the screen.

Code domain error power and power versus slot (3)
The distribution of error power in the code domain is displayed together with power changes of one code over seven slots.

Output power measurement (4)
The output power of one slot is measured.

Spectrum emission mask (5)
The measurement is performed in one sweep using different measurement bandwidths. The limit lines are set according to the measured power.

Power versus time (6)
The measurement checks the ramp-up and ramp-down time of the signal. A pass or fail result is returned.

CCDF (7)
The complementary cumulative distribution function is measured over one selected slot .

ACLR (8)
this value refers to high-performance adjacent-channel leakage ratio measurements using noise correction. The measurement is performed over one selectable slot.

FAST ACLR (9)
This is the ACLR measured using the channel filters, drastically reducing measurement time.

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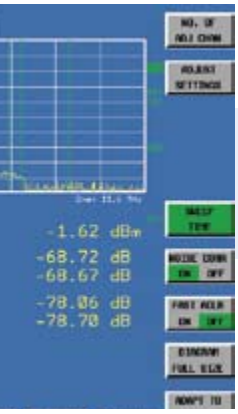

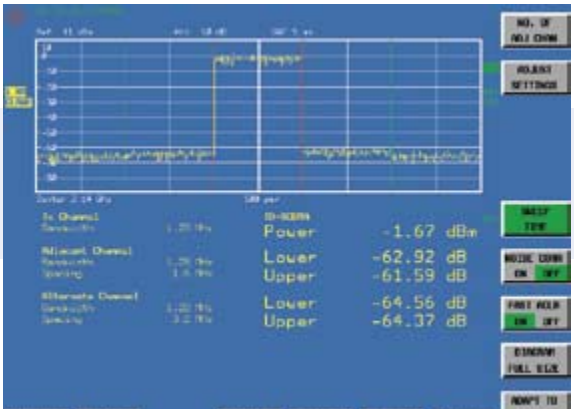

Specifications

The specifications below apply to the R&S®FSQ 3/8/26, R&S®FSU3/8/26/46 and R&S®FSP3/7/13/30/40. They are based on the specifications of the R&S®FSU, R&S®FSQ and R&S®FSP analyzers and have not been checked separately.
The specifications apply under the following conditions:
15 minutes warm up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to and internal calibration performed. Data with tolerances: measurement uncertainties with a confidence level of 95%. Data without tolerances: typical values. The specified level measurement uncertainties do not take into account systematic errors due to reduced S/N ratio.

Measurement	R&S®FSP	R&S®FSQ/FSU
Code domain power		
Total signal power, measurement uncertainty	<0.5 dB	<0.3 dB
Code power, measurement uncertainty Absolute Relative	 <0.6 dB <0.1 dB	 <0.4 dB <0.1 dB
Frequency error		
Measurement range Uncertainty (S/N > 40 dB)	<4 kHz <1.5 Hz + error of reference frequency	<4 kHz <1.5 Hz + error of reference frequency
Composite EVM		
Measurement range	1.5% to 25%	1% to 25%
Inherent EVM	<1.5%	<1%
Measurement uncertainty	<0.5%	<0.25%
Peak code domain error (PCDE)		
Measurement range	0 dB to –50 dB	0 dB to –54 dB
Inherent PCDE	–44 dB	–54 dB
Measurement uncertainty	<1 dB (0 dB to –40 dB)	<1 dB (0 dB to –40 dB)
Output power		
Measurement uncertainty Absolute Relative	 <0.5 dB <0.3 dB	 <0.3 dB <0.1 dB
Occupied bandwidth (99%)		
Measurement uncertainty	<20 kHz	<20 kHz
Spectrum emission mask		
Level uncertainty		
<3.6 GHz	<0.5 dB	<0.5 dB
3.6 GHz to 13 GHz	<2.5 dB	<2.5 dB
Trigger to frame		
Accuracy	<500 ns	<500 ns (R&S®FSU) <100 ns (R&S®FSQ)

Ordering information

Application Firmware R&S®FS-K76 and R&S®FS-K77 can be integrated into any member of the R&S®FSU/FSQ or R&S®FSP families.

Designation	Type	Order No.
TD-SCDMA Base Station Test Application Firmware	R&S®FS-K76	1300.7291.02
TD-SCDMA Mobile Station Test Application Firmware	R&S®FS-K77	1300.8100.02

Recommended extras

Designation	Type	Order No.
High-Power Attenuator 20 dB, 50 W, 0 Hz to 6 GHz	R&S®RDL50	1035.1770.52
TV Trigger/RF Power Trigger (R&S®FSP only)	R&S®FSP-B6	1129.8594.02

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