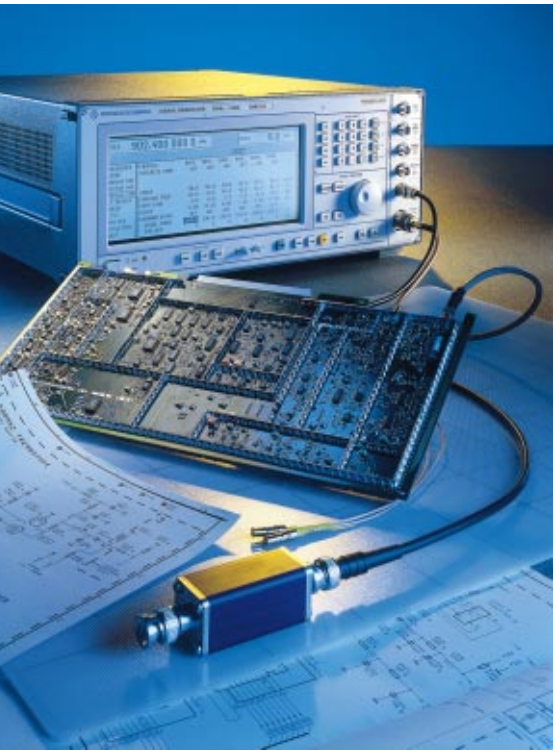
Measurement solutions for W-CDMA

ROHDE&SCHWARZ

Getting started for third-generation mobile radio



Wideband code division multiple access (W-CDMA) currently under development is one of the favourite technologies for third-generation mobile radio systems. The high demands that the new technology makes on test and measurement cannot or only partly be met by the presently available test equipment. A new generation of measuring equipment is therefore required. Rohde & Schwarz, a pacesetter in the field of mobile radio measurements for many years, already has such products for both signal generation and signal analysis.

Applications

There are three main applications for W-CDMA test equipment:

- Tests of components and devices (eg BTS power amplifiers)
- Receiver tests
- Transmitter tests

Component tests

The most important test at the component and module level is leakage power in the adjacent channels or adjacent channel power ratio. The device under test has to be stressed by the test signal as close as possible to operating conditions. The test signal not only has to be correct in the frequency domain but also with regard to the statistical distribution of the amplitude values. A 127-channel W-CDMA signal will stress the components differently than a signal with only a few channels or just one (un)coded channel.

If the device is a base transceiver station (BTS) power amplifier, a signal that only represents the spectrally correct channel bandwidth of a W-CDMA signal would not stress the amplifier as much as a statistically correct signal consisting of a certain number of code channels. These statistically and partly coded channels are sufficient as a stimulus for performing out-of-channel measurements such as adjacent channel power ratio (ACPR). Full data encoding and interleaving, however, is not required for these types of measurement.

Receiver tests

For in-channel tests such as sensitivity a mobile receiver must be able to despread and decode the test signal to access the data bits. Therefore, a fully coded and spread test signal must be provided. The test signal data bits must be properly coded as they are measured internally while the receiver is in the test mode. Alternatively they can be sent to a bit error rate (BER) tester in order to check the receiver's correction algorithm (eg forward error correction).

Transmitter tests

Transmitters have to be tested in the frequency domain, time domain and modulation domain. In the frequency domain the most important tests are leakage power in the adjacent channels, intermodulation of multiple carriers transmitted and spurious response. To fulfil the requirements for all three parameters the required dynamic range is extremely high. Due to the wide transmission bandwidth spurious have also to be measured with the appropriate resolution bandwidth (eg 5 MHz).

In the time domain the ON/OFF ratio and the level steps with fast power control have to be measured. The measurements require a high resolution bandwidth (5 MHz or 10 MHz) of the analyzer. With fast power control measurement power has to be measured within every 625 µs step very accurately and repeatedly.

In the modulation domain the error vector magnitude (EVM) and the power of the different code channels are the most important parameters to be tested.

Signal generation solutions for W-CDMA

The **SMIQ signal generator family** is the third generation of signal generators which has been designed to meet the special requirements of digital communications. It offers an unrivalled versatility regarding signal generation and signal quality. Therefore SMIQ is ideal for use in development and type approval testing. It is prepared for the third generation of mobile radiocommunication as it has been enhanced with W-CDMA capabilities.

SMIQ – the versatile RF signal generator for mobile radio applications

AMIQ is a dual-channel modulation generator for the generation of I/Q baseband signals. It has been especially designed for generating digitally modulated signals with high symbol rates and therefore it is an excellent source for generating W-CDMA signals.

AMIQ – the high-end baseband signal source for demanding applications

According to the customer's W-CDMA application requirements we offer three different solutions:

- **SMIQ**: The stand-alone signal generator for real-time applications
- **SPIQ03E**: The economical and flexible test and development package
- **SMIQ & AMIQ**: The ultimate high-end combination with unrivalled flexibility and performance

SMIQ

Two models of the SMIQ with different frequency ranges are available:

- SMIQ02 (300 kHz to 2.2 GHz)
- SMIQ03 (300 kHz to 3.3 GHz)

Option SMIQB43 adds W-CDMA signal generation to simulation according to proposed W-CDMA specification. This configuration is first of all meant for uplink applications but can also be used for standard downlink applications. The Low ACP option (SMIQB46) enhances the ACPR performance of the SMIQ regarding W-CDMA so that it meets the requirements of the provisional test specifications for BTS (guaranteed/typical ACPR <–64 dBc/–68 dBc for 1 code channel). An optional baseband Fading Simulator (SMIQB14) or Noise and Distortion Simulator (SMIQB17) enhances the application range of the SMIQ.

W-CDMA capabilities of SMIQ:

- Generation of uplink and downlink signals
- 4.096 Mchips/s (8.192 Mchips/s planned)
- Generation of physical channels with frame structure:
  Downlink channel types: perch1, common control 64 ksymb/s, dedicated channel with 32, 64, 128, 256, 512, 1024 ksymb/s
  Uplink channel types: dedicated control channel with 16 or 64 ksymb/s, dedicated data channel with 16, 32, 64, 128, 256, 512, 1024 ksymb/s
- PRBS and user-defined modulation data
- ACPR at 5 MHz offset <–64 dBc (1 code channel with option SMIQB46, typ. –68 dBc)

Signal generation solutions for W-CDMA

SPIQ03E

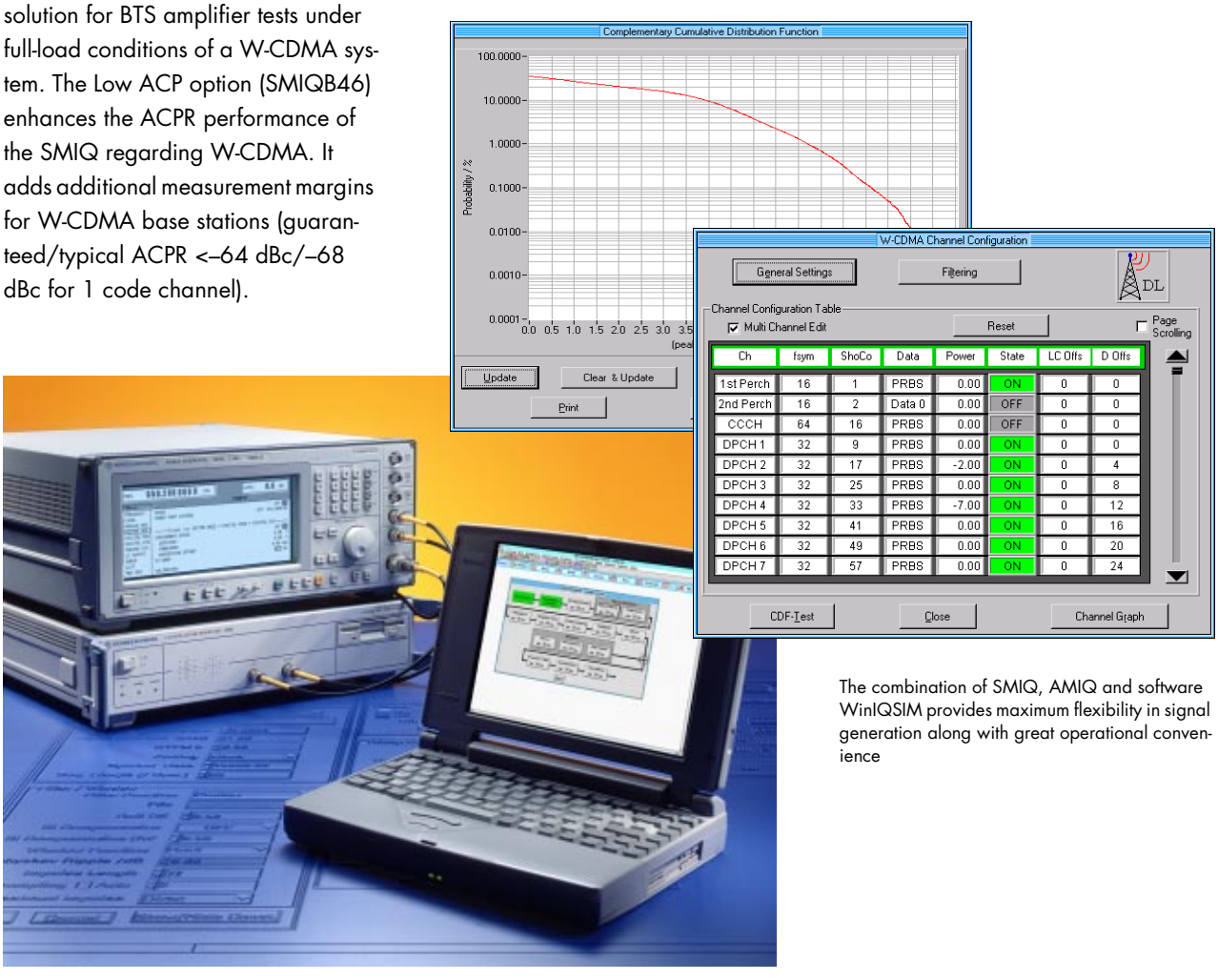
The SPIQ03E (system package for I/Q signal simulation and generation) consists of an economy version of SMIQ (SMIQ03E, 300 kHz to 3.3 GHz) and I/Q modulation source AMIQ (including the powerful I/Q simulation software WinIQSIM). In this combination the SMIQ works as a vector signal generator and the AMIQ serves as an I/Q signal source driving the SMIQ's I/Q modulator. For both IS-95 and W-CDMA this package provides a maximum of flexibility and performance regarding the forward link. Up to 512 code channels can be simulated with WinIQSIM. Therefore it is the ideal solution for BTS amplifier tests under full-load conditions of a W-CDMA system. The Low ACP option (SMIQB46) enhances the ACPR performance of the SMIQ regarding W-CDMA. It adds additional measurement margins for W-CDMA base stations (guaranteed/typical ACPR <–64 dBc/–68 dBc for 1 code channel).

W-CDMA features of SPIQ03E:

- Generation of chip rates from 4.096 up to 16.384 Mchips/s (AMIQ + WinIQSIM)
- Up to 512 code channels
- High degree of flexibility regarding W-CDMA signal parameters (codes, symbol rates, number of channels, modulation parameters, etc)
- Calculation of Cumulative Distribution Function (CDF)
- User-definable short and long codes

SMIQ + AMIQ

For those who need to have the full performance and flexibility regarding uplink and downlink signal generation the right solution is the SMIQ0x (high-end model) together with the AMIQ. This duo is a 'no compromise' solution and serves as a general-purpose tool in R&D. It combines the strong points of the SMIQ's internal CDMA signal generation for receiver tests and the additional unrivalled performance of AMIQ/WinIQSIM for component tests.



The combination of SMIQ, AMIQ and software WinIQSIM provides maximum flexibility in signal generation along with great operational convenience

Signal analysis solutions for W-CDMA

FSIQ

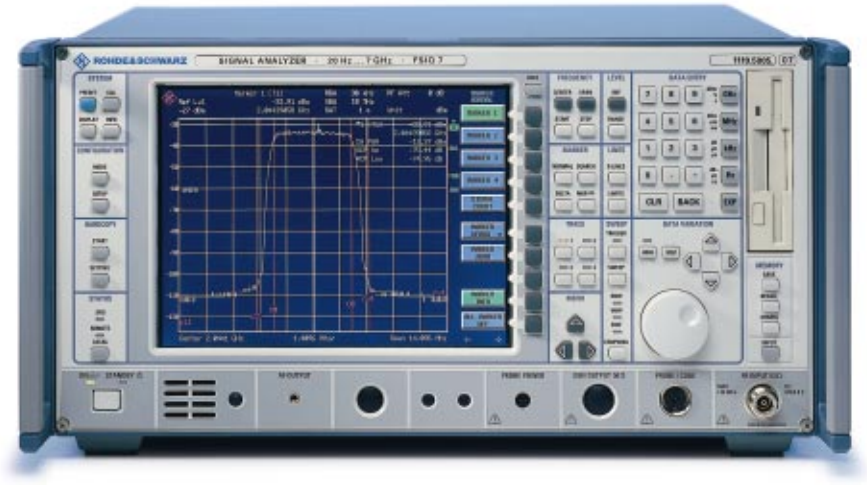
Signal Analyzer FSIQ is a versatile single-box solution for testing the physical parameters of the emerging W-CDMA standard as well as of existing standards such as GSM or IS95. It performs measurements in the

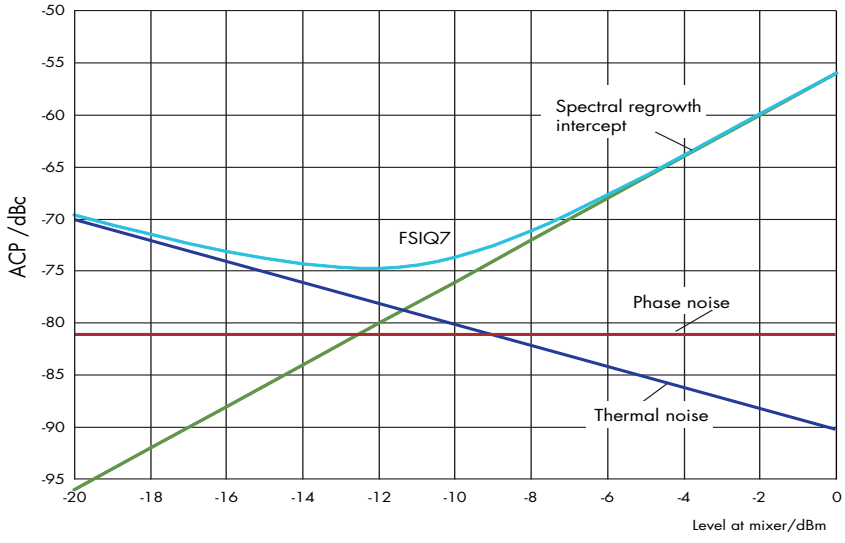
- frequency domain (spectrum, ACPR, etc)
- time domain (power) and
- modulation domain (EVM, ρ)

with very low inherent measurement errors and high speed.

The FSIQ series comprises three models which solely differ in their frequency ranges:

- FSIQ3 (20 Hz to 3.5 GHz)
- FSIQ7 (20 Hz to 7.0 GHz)
- FSIQ26 (20 Hz to 26.5 GHz)





With its excellent ACPR dynamic range of 75 dB FSIQ offers sufficient headroom for conclusive, reproducible W-CDMA measurements

W-CDMA features of FSIQ

- **75 dB ACPR dynamic range**
  This excellent value is achieved thanks to the FSIQ's low phase noise (–148 dBc/Hz at 5 MHz offset) and low thermal noise floor (–147 dBm in 10 Hz bandwidth) when driven with the optimum mixer level. For the alternate channel with 10 MHz offset even 82 dB is achieved. This reduces ACPR measurement errors to insignificant levels. In R&D applications, the increased headroom makes it possible to characterize new mobile phone and base station designs with greater accuracy and a higher confidential level than before. In manufacturing, the improved dynamic range allows for narrower guardbands which provide higher yields.
- **Up to 10 MHz resolution bandwidth**
  Due to the wideband nature of W-CDMA, measurements especially in the time domain must not be influenced by the resolution bandwidth of the analyzer. With 5 MHz and 10 MHz RBW the FSIQ provides the necessary resolution bandwidth, eg for fast power control testing.
- **EVM measurement accuracy typ. <1 % at 4.096 Mchips/s**
  The FSIQ series includes integral modulation analysis capability. This tool measures the error vector magnitude and all other relevant modulation parameters with high accuracy.
- **Built-in RMS detector**
  Due to the statistical power distribution in a W-CDMA signal, RMS detection is advisable to achieve reliable and reproducible power measurement results. The FSIQ is the first analyzer on the market to offer RMS measurement functions. Even more, CDF analyses can be made with the aid of an additional Rohde & Schwarz Windows software.

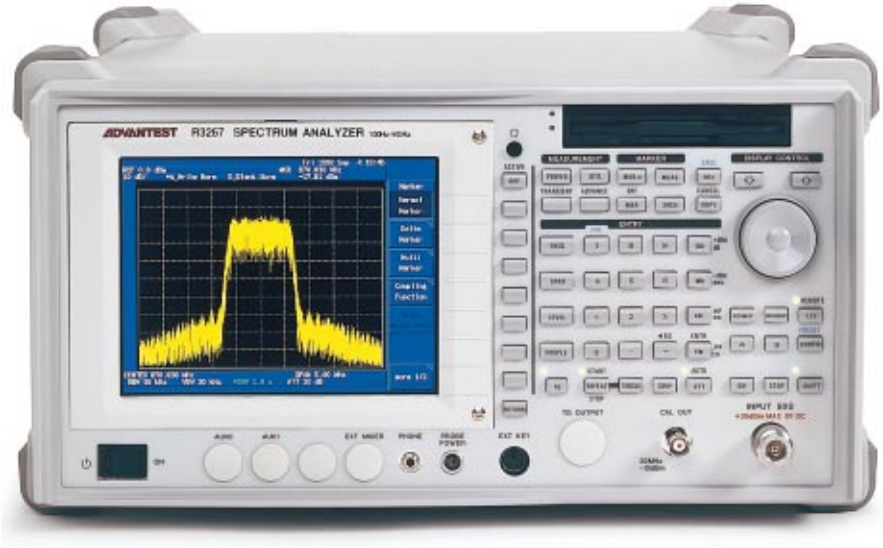
Signal analysis solutions for W-CDMA

Advantest R3267

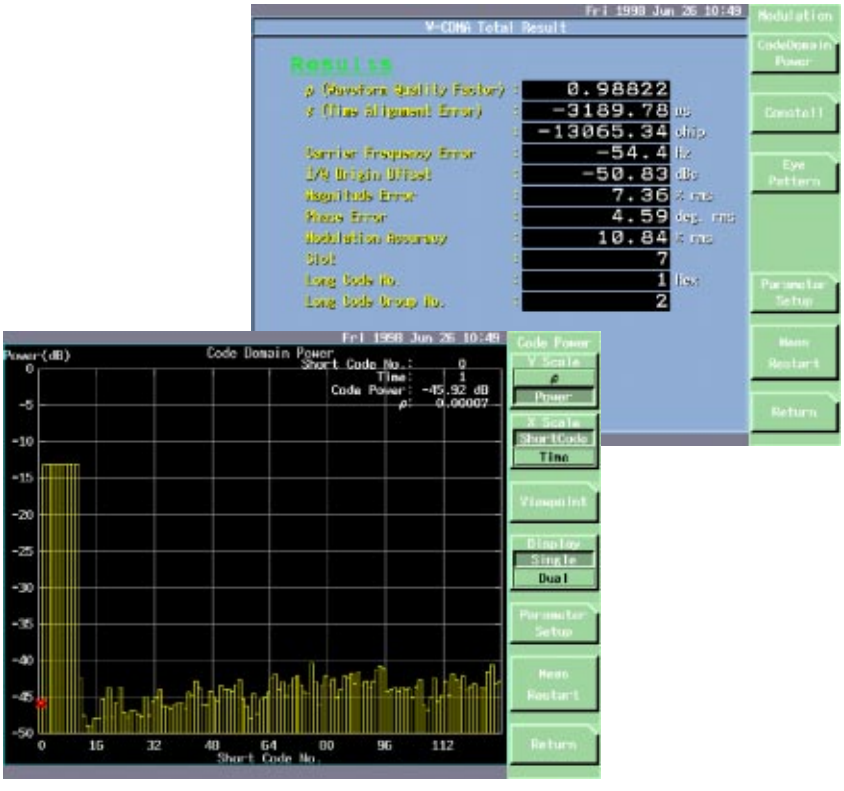
Equipped with the W-CDMA option, Spectrum Analyzer R3267 is a complete measurement solution for W-CDMA physical parameters including modulation and code domain power analysis.

Features

- Spectrum analysis from 100 Hz to 8 GHz with 10 Hz to 5 MHz RBW for measurement of ACPR (dynamic range >70 dB), OBW, etc
- Modulation analysis in RF range or directly from I/Q baseband signals
- QPSK measurements for chip rates from 1.2288 to 4.096 Mchips/s for measurement of
  – EVM (error vector magnitude)
  – carrier frequency error
  – magnitude error
  – phase error
  – I/Q offset
  – waveform quality (ρ)
- Code domain analysis for measurement of
  – power distribution vs time of the different code channels



Complete signal analysis for any W-CDMA development lab: R3267 with W-CDMA option



The W-CDMA option of R3267 features code domain analysis (in the example multiple 32ksps DTCH signals from BTS) as well as easy-to-follow numerical display of all relevant signal parameters

Power measurement solutions for W-CDMA

NRT

The accurate measurement of the transmit power is an indispensable part of base station tests for all digital standards including W-CDMA. In the case of W-CDMA, however, the determination of the average power is not sufficient. The peak power and/or amplitude distribution (CDF) have to be measured as well. These measurements are the prerequisite for an accurate assessment of the transmitter output stage regarding its dynamic response under real operating conditions.

Power Reflection Meter NRT for the frequency range 200 MHz to 4 GHz offers all the measurement functions required including reflection measurement at the antenna output: peak power of max. 75 W with Power Sensor NRT-Z43 and 300 W with Power Sensor NRT-Z44. The directional coupler required to obtain the test signal is integrated in both sensors. In comparison with peak power and spectrum analyzers used so far for such applications, NRT is a compact, value-for-money instrument offering high measurement accuracy for use in R&D, production and service. Both sensors can be driven at the RS-232 or PC-card interface of PCs or laptops without needing the basic power meter.

Power sensor equalling a power meter. It is not just the sensor itself but the complete sensor electronics that is integrated in Power Sensors NRT-Z43 and -Z44. Basic unit NRT merely serves as a display unit and user and control interface. The sensors can also be connected to the PC-card interface of a computer. Operation then takes place via a graphical interface

Features

- Frequency range: 200 MHz to 4 GHz
- Measurement range for average power: 0.007 W to 120 W
- Measurement range for peak power and CDF: 4 W to 300 W
- Very low measurement error for average power measurements on W-CDMA signals
- Very small and easy-to-use; only PC with PC-card interface required

Configuration table and fax reply form

Application	Basic unit(s)	Recommended option(s) for W-CDMA measurements	
Component tests	SPIQ03E	No option required	
	For maximum flexibility: SMIQ (any model) + AMIQ	Low ACP SMIQB46, Modulation Coder SMIQB10, Data Generator SMIQB11	
	FSIQ (any model)	No option required	
Receiver tests	SMIQ (any model)	Low ACP SMIQB46	
	For maximum flexibility: SMIQ (any model) + AMIQ	Low ACP SMIQB46, Modulation Coder SMIQB10, Data Generator SMIQB11	
	For fading simulation: SMIQ (any model)	SMIQB46, B10, B11 and Fading Simulator SMIQB14	
Transmitter tests	FSIQ (any model)	No option required	
	R3267	W-CDMA option	
	Power Sensors NRT-Z43 or -Z44 plus NRT or PC with PC-card interface	No option required	

I am interested in ...
(please check box)

❑ **Please send me an offer**
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