R&S®CMW 500 Wideband Radio Communication Tester

Fast tests of TD-SCDMA wireless devices in production

With its integrated vector signal generator and analyzer, the new R&S®CMW 500 wideband radio communication tester offers comprehensive testing of TD-SCDMA mobile phones – at a speed that will impress you.

TD-SCDMA – Chinese 3G standard

Time division synchronous code division multiple access (TD-SCDMA) is a further third-generation (3G) mobile radio standard in addition to 3GPP FDD and CDMA2000® that has been approved by ITU. As a time division duplex (TDD) system, TD-SCDMA uses the same carrier frequency in the uplink and downlink. Data transmission rates of up to 2 Mbit/s are attained at a chip rate of 1.28 Mchip/s and a bandwidth of 1.6 MHz. Either QPSK or 8PSK – for maximum data rates – modulation is used. Seven timeslots, which can be allocated as needed between the uplink and downlink depending on utilization and data volume, are available for transmission.

This standard, which is primarily supported and driven by Chinese organizations and their industry partners, will definitely be considered and put into operation when 3G licenses are allocated in the near future in China.

This means that a large number of TD-SCDMA mobile phones and modem cards will have to be manufactured within a short period of time and that the right type of measuring equipment must be provided in sufficient numbers in production. Measurements that have to be performed during the calibration of the receive and transmit section and during final testing can be carried out in a time-optimized way in the non-signaling mode by using vector signal generators and analyzers (see box on left).

Rohde&Schwarz has already been offering test solutions for the TD-SCDMA standard for quite some time: the R&S®SMx generator family [1] and the R&S®FSU / FSP / FSQ spectrum and signal analyzers [2]. The new R&S®CMW 500 wideband radio communication tester with its integrated vector signal generator and analyzer now complements this portfolio as an ultrafast one-box solution.

The most important measurements on TD-SCDMA wireless devices

Accurate power control of the individual mobile wireless devices within a cell is essential to smooth operation – especially in CDMA networks. A mobile phone must be able to exactly maintain the transmit power allocated to it. The **transmit power is adjusted** in a relatively early phase of production. The mobile phone transmits RF signals on different frequencies and with various power levels. The values measured with an analyzer are first compared with nominal values and then correction values are defined.

To help ensure trouble-free network operation, the base station needs information about the exact receive field strength at the individual subscribers within a cell. Therefore, each mobile phone continuously measures the signal field strength and reports it to the base station. To **align the receiver signal strength indicator** (RSSI) of a mobile phone in production, the test assembly generates an RF signal in a specific frequency / level combination. The mobile phone records the field strength, thus allowing correction values to be derived and stored in the phone.

A final test, which is an integral part of production, is performed on the mobile phone to ensure standard-compliant operation. The TD-SCDMA RF signals are checked for spectral purity on the transmitter end during **power, modulation and spectrum measurements**. The receiver quality is verified by means of bit error ratio (BER) measurements. Like calibration, final testing requires the least time in the non-signaling mode.

R&S®CMW500: fast multistandard platform

As a multistandard platform, the new R&S®CMW500 wideband radio communication tester supports not only TD-SCDMA but also offers measurement options for GSM / GPRS / EDGE, WCDMA, CDMA2000® and mobile WiMAX, thus featuring a number of advantages:

R&S®Smart Alignment

For the calibration of the transmit / receive section, the R&S®CMW500 includes a flexibly configurable RF power meter and a CW / dual-tone generator as standard. This normally time-consuming calibration process can be greatly speeded up – to the extent supported by the chipset – by means of a predefined frequency / level sequence (FIG 1). The R&S®CMW500 processes such sequences with both the level meter and the generator (for details see page 6: "R&S®Smart Alignment minimizes alignment times").

Fast test of receiver quality

The R&S®CMW500's arbitrary waveform generator option (R&S®CMW-B110A) can generate any modulation signal you need. The tester can create TD-SCDMA reference measurement channels (12.2 kbit/s to 2048 kbit/s) for the uplink or downlink in realtime. These channels are required for BER measurements and for assessing the quality of receivers. During BER measurements, PRBS-modulated data content is normally sent to the mobile phone and, from there, looped back to the tester for evaluation purposes. However, most of the chipsets used with TD-SCDMA support single-ended BER, which allows evaluation by the mobile phone itself. Thus, the loop is no longer necessary. The test is carried out in the non-signaling mode, which considerably reduces test time (FIG 2).

Specified tests verify whether the mobile phone transmitter or receiver is operating in compliance with the standard. Relevant receiver tests for TD-SCDMA are stipulated in the 3GPP TS 25.102 specification (FIG 3). Required TD-SCDMA test signals can be configured with the R&S®WinIQSIM2™ waveform creation tool and generated by the ARB generator in the R&S®CMW500.

Multiple transmitter tests in parallel

The relevant test cases for transmitter tests are defined in the 3GPP TS 25.102 specification (FIG 3). The R&S®CMW500 supports all these measurements. Owing to specially developed hardware, its fast DSP system evaluates the measured data in a very short amount of

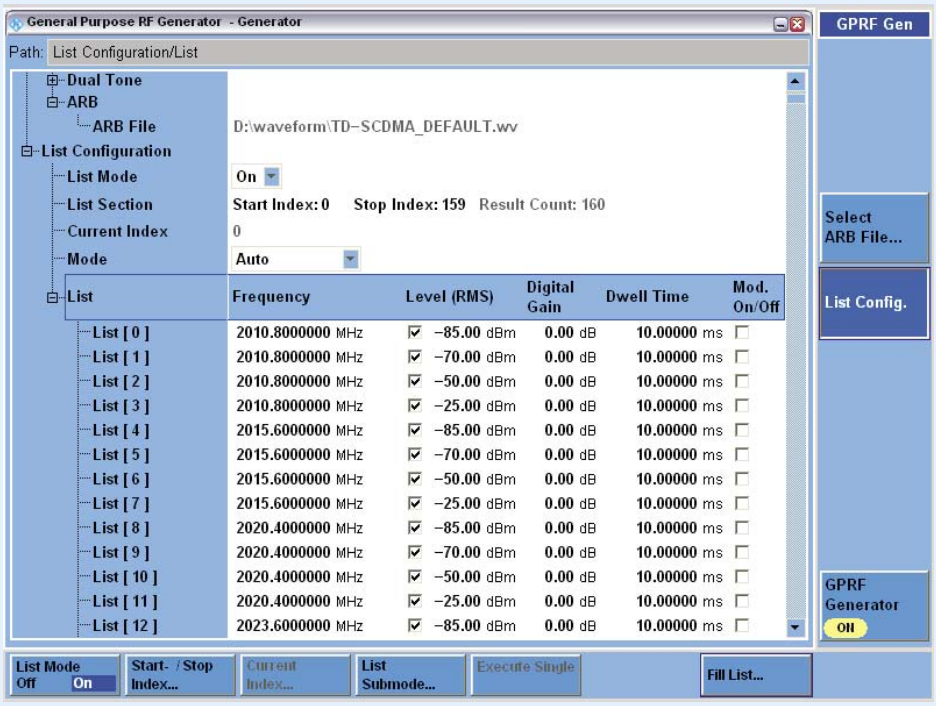
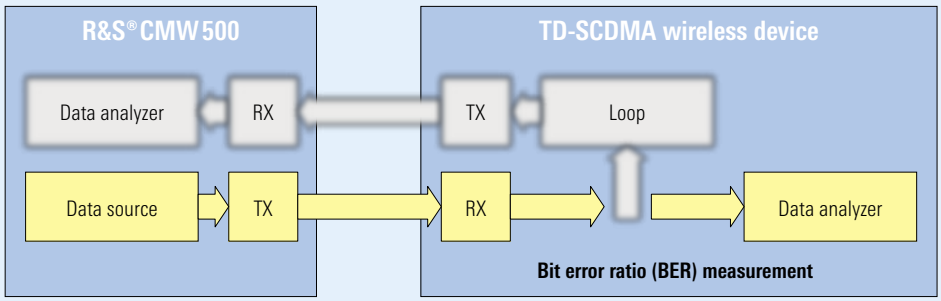


FIG 1 Fast alignment of the receiver signal strength indicator (RSSI) in a mobile phone using a predefined frequency / level sequence from the R&S®CMW500 generator. As a precondition, a mobile phone must be able to adhere to this sequence on its own.

FIG 2 Checking of the receiver quality without the customary loop back to the measuring instrument. Once the generation algorithm of the data stream sent by the tester is known, the wireless device can calculate the bit error ratio of the demodulated and decoded data stream on its own.



Transmitter tests		Receiver tests	
6.2	Transmit power	7	Receiver characteristics
6.2.1	UE maximum output power	7.3	Reference sensitivity level
6.3	UE frequency stability	7.4	Maximum input level
6.4	Output power dynamics	7.5	Adjacent channel selectivity (ACS)
6.4.2	Minimum output power	7.6	Blocking characteristics
6.5	Transmit ON/OFF power	7.7	Spurious response
6.5.1	Transmit OFF power	7.8	Intermodulation characteristics
6.5.2	Transmit ON/OFF time mask		
6.6	Output RF spectrum emissions		
6.6.1	Occupied bandwidth		
6.6.2.1	Spectrum emission mask		
6.6.2.2	Adjacent channel leakage power ratio (ACLR)		
6.8	Transmit modulation		
6.8.2	Error vector magnitude (EVM)		
6.8.3	Peak code domain error		

FIG 3 Transmitter and receiver tests in the 3GPP TS 25.102 specification.

time and allows multiple measurements to be performed in parallel on the same signal segment also in realtime (multi-evaluation measurement, FIG 4). If an error occurs, all measurements can easily be used to trace the cause of the error. For details, see page 6: "Speed advantage through multi-evaluation measurements".

Summary

The R&S®CMW500 wideband radio communication tester is a powerful test platform that is setting new standards in measurement speed, accuracy and safety of investment owing to its versatile enhancement options.

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FIG 4 Based on identical sample sets, the multi-evaluation measurement allows the parallel evaluation of the measured signal. The measurement determines the error vector magnitude (EVM), magnitude error, phase error, frequency error, I/Q origin offset, I/Q imbalance, adjacent channel leakage ratio, spectrum emission mask, occupied bandwidth, code domain power and peak code domain error power.

More information at www.rohde-schwarz.com (search term: CMW500)

REFERENCES
[1] R&S®SMx Signal Generators: The world's first integrated signal generator solution for TD-SCDMA. News from Rohde&Schwarz (2006) No. 189, pp 16–19
[2] R&S®FSP/FSU/FSQ Analyzers Test of TD-SCDMA base stations. News from Rohde&Schwarz (2004) No. 181, pp 18–19