Testing GSM/PCN/PCS base stations in production, installation and service with CMD54/57

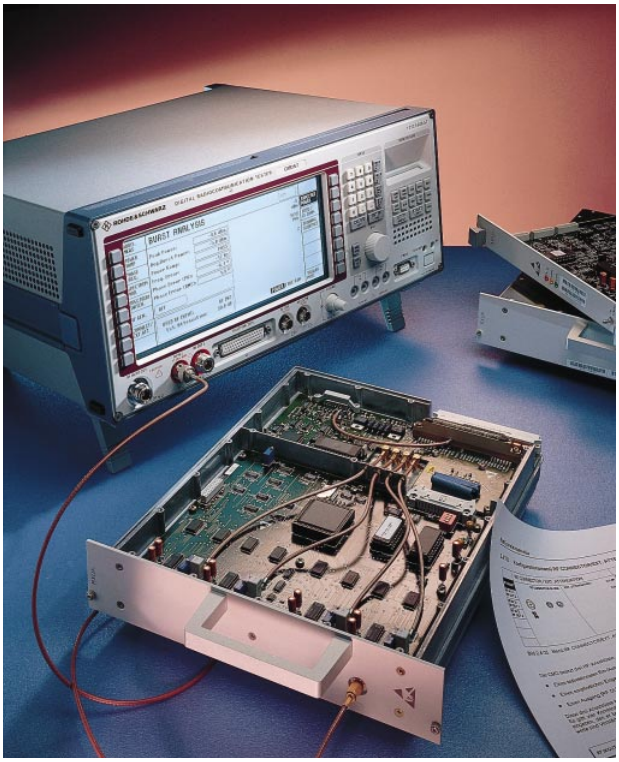

FIG 1
Digital Radiocommunication Tester CMD57, ideal compact tester for production, installation and service of GSM/PCN/PCS base stations
Photo 42 362/1

Base stations for digital mobile radio must function reliably at all times. To guarantee this, the transceivers are subjected to stringent quality tests at all stages of production from the individual module to the ready-made product, and key RF parameters are measured during on-site installation and during service. However different the measurement tasks may be, they can all be performed with a single compact test system – Digital Radiocommunication Tester CMD54/57 (FIG 1)*. It covers the frequency ranges for GSM, PCN (DCS1800) and optionally also PCS (DCS1900). With the aid of an option the two models can also be used in the field of European train radio. Since signalling has not yet been defined for this application, measurements are in compliance with current GSM specifications.

The following **features** make CMD54/57 ideal for measurements in the applications outlined above:

- flexibility for production,
- A_{bis} control for installation and final testing in production and,
- unique worldwide, uninterrupted operation while checking or retrofitting transceiver modules during servicing.

The following **parameters** of the **base station** (BTS = base transceiver station) can be measured with the radiocommunication tester:

Transmitter

- Transmitter power to an accuracy of ± 0.6 dB with integrated peak-power meter
- Power ramping at full dynamic range (72 dB) using the zoom function
- Phase and frequency errors with graphic and numeric display
- Modulation spectrum in only 60 s for 500 bursts on 23 frequencies (FIG 2)
- Switching spectrum

Receiver

- Bit error rate (BER) (single or continuous) with various evaluation and connection capabilities, eg loopback in CMD, loopback in BTS, A_{bis} monitoring, IEC/IEEE-bus or RS-232-C interface
- Bit pattern to CCITT standard
- Transmitter level with high accuracy (eg error <1 dB at –104 dBm).

Use in module production

Important aspects for selecting test equipment in production are easy integration into existing production lines and measurement speed. Thanks to a great variety of synchronization and trigger facilities and a number of analog measurement functions, CMD can be matched optimally to the DUT. The SCPI-compatible IEC/IEEE bus

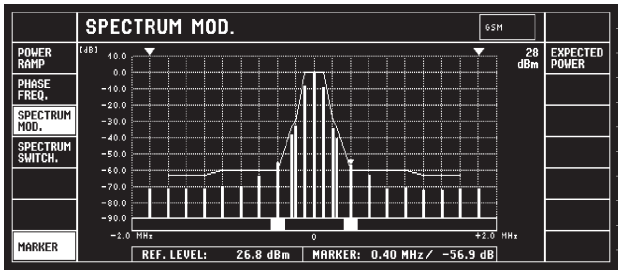

FIG 2
Modulation spectrum of base-station transmitter

* Schindlmeier, R.: Digital Radiocommunication Tester CMD54/57 – GSM/PCN base-station testers for production, installation and service. News from Rohde & Schwarz (1994) No. 146, pp 16–18

ensures fast remote control (FIG 3). Transmitter measurements are possible without signalling – an indispensable feature in module testing – with triggering to pulsed and non-pulsed signals. The built-in RF signal generator allows measurements to be carried out on receiver modules. The DC ammeter and voltmeter of CMD are optimized for measuring pulsed signals and an optional AF generator/analyzer is provided for AF measurements including frequency measurements.

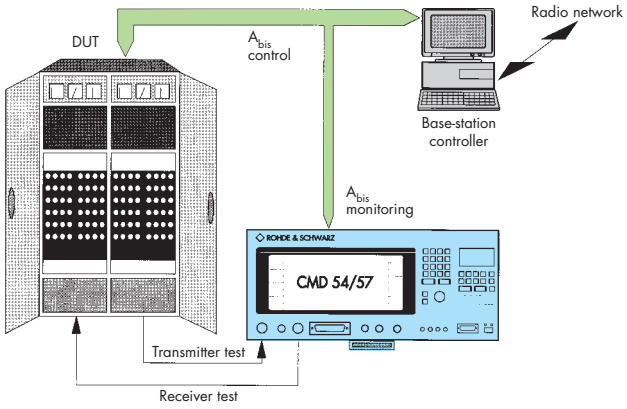

FIG 5 CMD54/57 servicing base station on the air

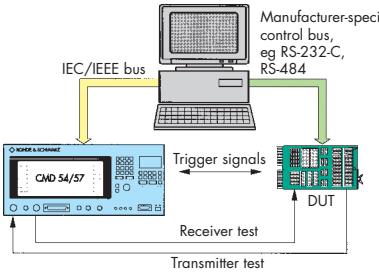

FIG 3 Typical test setup in module production

Use in final testing in production and installation

Main tasks of CMD54/57 for final tests in production and on-site installation of a BTS are measurements with signalling, call setup for signalling tests, audio check, control of the complete BTS system via the A_{bis} interface and automatic testing.

In final testing **measurements on active base stations** have to be carried out, ie stations which, driven by external equipment, emit RF carriers with signalling information. Even the CMD basic model evaluates and indicates important network codes, permits synchronization to the C0 carrier (broadcast carrier) and gives an overview of RF parameters. Optionally, software permitting complete call setup with signalling to the RF interface can be loaded into CMD. Supported are incoming and outgoing calls, location update, call cleardown, frequency hopping, channel and time-slot changing. With the **realtime speech encoder/decoder option** (CMD-B5) integrated, the audio quality of the base station can be tested.

CMD offers an interesting concept for **A_{bis} control** for final testing in production and installation. The A_{bis} interface is a digital interface with a data rate of 2048 kbit/s capable of handling up to 120 voice channels of 16 kbit/s each and two 64-kbit/s signalling channels. Equipped with an A_{bis} plug-in card and a BTS-specific control software, CMD performs the following functions via the A_{bis} interface: BTS reset, BTS configuration, software download, BTS reconfiguration as well as transmitter/receiver activation and deactivation.

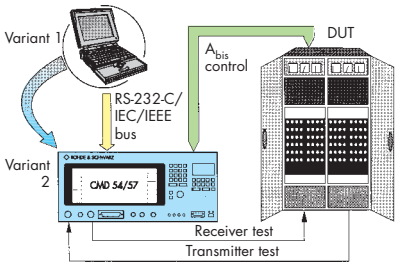

FIG 4 A_{bis} control with external notebook or CMD54/57

A_{bis} control comes in two variants, either for control via an external controller or by CMD alone (FIG 4). With variant 1, CMD executes A_{bis} application programs remotely controlled, eg from a notebook. The application programs serve for controlling the BTS. If special measurement tasks are to be carried out, the user may modify in any way the application program supplied by Rohde & Schwarz. Once the program on the external controller matches the user's requirements, it can be loaded into CMD for controlling the BTS from CMD (variant 2). The menus of the external controller will be displayed on CMD. The supplied software comprises an application program for variants 1 and 2 for manual BTS control. Switchover between A_{bis} control and RF measurement is possible by means of a softkey. An application program permitting fully automatic BTS measurements is supplied in addition.

Use in service

Once a base station has been put into operation, it should only be switched off in cases of emergency. This means that any service work is to be performed with the transceiver in full operation. CMD is worldwide the first compact radio tester to carry out transmitter and receiver measurements on base stations in operation. CMD permits even transmitter and receiver modules to be retrofitted without interrupting the operation. For this application CMD has been upgraded by a number of

important functions making it a test mobile phone. CMD is connected to the RF interface of the base station, a call is set up and then all RF parameters are measured (FIG 5).

The **signalling software** performs call setup, holding (even under adverse conditions) and cleardown. It also supports, for instance, a change of channel and time slot as well as authentication. Signalling protocols complying with the OSI reference model required for the measurements are implemented in CMD.

Like a real telephone, the test mobile phone CMD54/57 obtains access to the network only via a registered SIM card. The required **SIM-card reader** is fitted below the instrument without enlarging the size of the basic unit.

After call setup CMD allows **A_{bis} monitoring.** To do so it feeds RF signals modulated with a CCITT bit pattern to the base-station receiver. Depending on the quality and sensitivity of the receiver, the bits are received correctly or with errors. The BTS forwards the received bits via the A_{bis} interface to the base-station controller and then to the network. CMD connected with high impedance to this line measures the received bits at the respective time slot. Errors detected between the transmitted and received bits are displayed as bit error rate on CMD.

In the GSM network up to 16 RF carriers with a channel spacing of 600 kHz may be on the air simultaneously. One of these carriers is assigned to the test mobile phone CMD54/57 and has to be measured selectively. For this reason all other channels are suppressed by means of a special **SAW (surface acoustic wave) filter** so that they cannot impair measurement results.

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Reader service card 151/09 for further information on CMD54/57