Digital Radio Testers CTS65 and CTS60

All-rounders in servicing GSM and DECT mobile phones

In Digital Radio Tester CTS65, Rohde & Schwarz now offers a compact, favourably priced multimode service tester for GSM mobile phones and for cordless phones to DECT standard. CTS60 is available for pure DECT applications.

The successful concept of Digital Radiocommunication Testers CMD [1; 2] continues in the CTS family of service testers, which has now been completed. Multimode Tester CTS65 (FIG 1) offers the user a wide range of functions in a single unit for the following networks: GSM900 (Europe), GSM1800 (PCN, Europe), GSM1900 (PCS, USA), DECT Europe and DECT Latin America. This adds extra versatility to the proven applications of CTS, which are at POS (point of sale), in servicing and the production of mobile phones.

The great ease of operation of CTS60/65 via six softkeys on the colour monitor has proven itself in CTS55 [3]. The main menu offers selection of network standards GSM900, GSM1800, GSM1900 and DECT. With DECT it is possible to choose PP (portable part) or FP (fixed part) tests. An external keyboard can be connected, if required, as with CTS55. Apart from the TFT colour display, an external monitor can alternatively be connected via the VGA interface. Intelligent menu guidance largely excludes incorrect entries.

Testing DECT telephones

DECT (digital enhanced cordless telecommunications) is now the established standard for digital voice transmission by cordless telephone also outside of Europe. The sharp decline in prices and the qualitative edge are driving analog systems out of the market. In addition to the cordless phones application, DECT offers the possibility of covering congested areas such as airports and railroad stations, thus getting round bottlenecks in GSM networks. Field trials are currently being conducted to investigate alternative linkup of private households to the telephone network by means of DECT (wireless local loop, last mile). Ten frequency channels in the 1900 MHz band are reserved for DECT, each channel allowing twelve simultaneous calls in TDMA (time division multiple access) operation. This means that 120 simultaneous calls are possible in a cell. DECT also uses TDD (time division duplex), in which calls are transmitted at a single frequency in both directions but offset in time. DECT cells organize themselves, ie transmission channels are selected so that there is no interference with any neighbouring cordless telephone systems.

Digital Radio Tester CTS60/65 measures DECT portable parts and DECT fixed parts. The DUT is switched to the test or loopback mode, causing the data received to be returned to CTS60/65 on the transmit channel. This mode is required for measuring BER, modulation parameters and frequency accuracy.
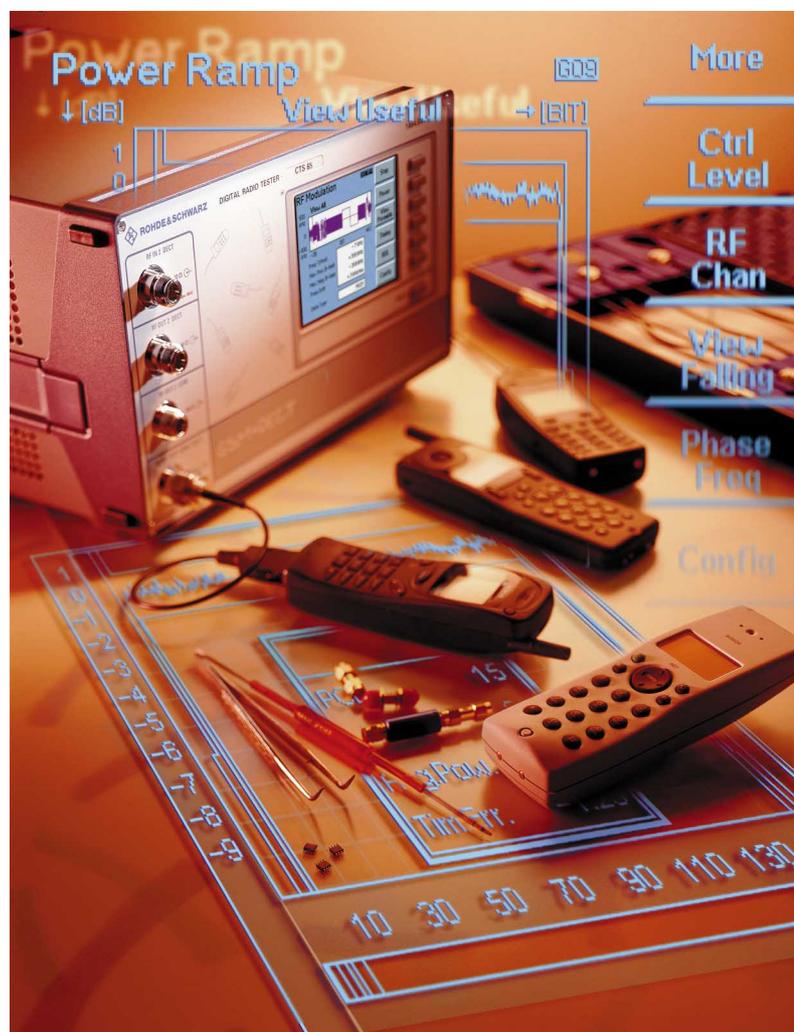

FIG 1
Multimode Service Tester CTS65 for GSM and DECT systems
Photo 43 115/3

The following parameters are determined in **DECT measurements:**

The **normal transmit power** is the average power during transmit time. With DECT it is max. 250 mW, which corresponds to 24 dBm.

The **power ramp** verifies compliance with specified timing parameters and power ranges during transmission. The graphic display shows any abnormal conditions at a glance.
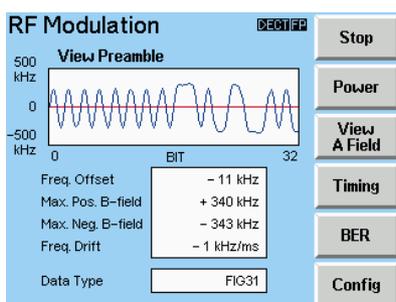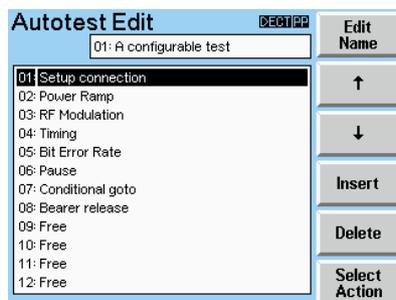
GSM		DECT	
CTS-B1	OCXO reference oscillator for enhanced accuracy of all frequency-related parameters	CTS-B1	OCXO reference oscillator for enhanced accuracy of all frequency-related parameters
CTS-K7	GSM module test		
CTS-K6	Remote control via RS-232-C with GSM application software for Windows	CTS-K6	Remote control via RS-232-C
CTS-U56	Upgrade of CTS55 to Multimode Tester CTS65	CTS-U65	Upgrade of CTS60 to Multimode Tester CTS65

Options for Digital Radio Testers CTS55/60/65

FIG 2   RF modulation menu

FIG 3   Free configuration of auto test
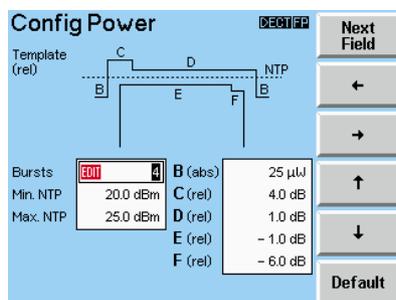
FIG 4   Configuration of single test step

Frequency deviation during transmission is another graphic display allowing fast diagnosis of frequency synthesis and modulation characteristics (FIG 2).

The **frequency offset** indicates inaccuracy of the center frequency.

Frequency drift is a measure of center frequency change during transmission.

Display of maximum positive and negative **modulation deviation** verifies compliance with specified modulation deviation and enables adjustment of deviation.

The **timing accuracy** gives the percentage deviation of the time frame from the specified figure of 10 ms.

Jitter is a measure of the irregularity of the time frame.

The **packet accuracy** measurement reveals if transmission of a PP starts exactly half a frame period after the FP.

The **bit error rate** (BER) is the ratio of errored bits received to all bits received. Unlike the foregoing, this is a receiver measurement.

The **frame error rate** (FER) is another parameter indicating receiver quality. It covers completely lost frames and frames with at least 25% BER.

The **echo test** allows a rapid check of DUT loudspeaker and microphone functionality. Voice signals sent by the PP to CTS60/65 are returned by the tester with a delay.

For each measurement, **tolerances** prescribed by ETSI are preset, but can be changed by the user as required. Out-of-tolerance values are highlighted by the coloured display of results. Coloured display increases information quality especially in the graphical measurement menus for the power ramp and RF modulation and makes CTS60/65 a valuable instrument for efficient troubleshooting.

Another feature enhancing the practicality of CTS60/65 in servicing is the configurable **auto test** familiar from CMD60/65. This allows user-defined combination of test steps such as call setup, power ramp, modulation, timing and BER measurements and call release (FIG 3). Measurement parameters and tolerances are freely configurable for each of these test steps (FIG 4). The auto test further provides interactive commands and conditional plus unconditional loops. Despite this outstanding performance, operation is extremely easy, making it as a rule unnecessary to consult the manual. Test report printouts provide information on all settings, measured values and out-of-tolerance conditions.

Digital Radio Tester CTS65 incorporates the modules of CTS55 and in addition a DECT module similar to the one in CMD60. The DECT module not only contains all the required RF hardware

(transmitter, signalling receiver and test receiver) but also the signalling and measurement unit including the software. The blue BOX lists the available options allowing application-oriented, cost-effective configuration of the digital radio testers. CTS55 is easily upgraded to CTS65 of course.

New test facilities in GSM mode

As with all mobile radio testers from Rohde & Schwarz, the GSM members of the CTS family are continuously expanded to cover new applications [4]. For example, new menus are provided for the selection of different display modes in **remote control;** either the window with the current device status or the remote-control commands together with device and error status can be displayed. Baud rate, start, stop and parity bits can be user-configured for the **RS-232-C interface.**

Fast power measurement (approx. ten measurements per second) and the narrowband spectrum monitor make CTS an ideal instrument for adjusting the transmitter power and modulation of GSM mobile phones.

An interesting feature is the **GSM application software** included in the optional remote control via RS-232-C. The software contains a configurable automatic test sequence that runs on an external PC under Windows 3.1, Windows 95 and Windows NT. Parameters such as network used, type and extent of measurements as

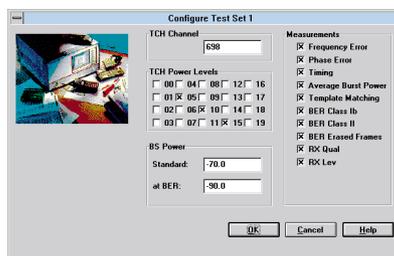FIG 5   Call setup (registration) with user interface of GSM application software

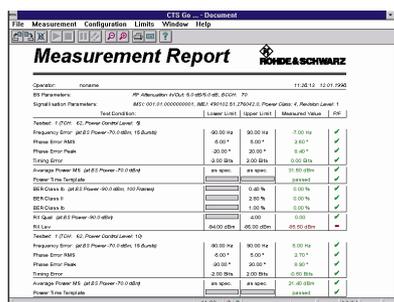FIG 6   Configuration of measurements

FIG 7   Extract from measurement report

well as tolerances can be selected by simple mouse clicks (FIGs 5 to 7). The straightforward measurement report allows further evaluation and archiving of test data. Results can be exported to other programs via data filters.

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[3] Vohrer, M.: Digital Radio Tester CTS55 – All-in-one service tester for GSM, PCN and PCS mobile telephones. News from Rohde & Schwarz (1996) No. 152, pp 4 – 6

[4] Holzmann, G.: New measurement functions in Digital Radio Tester CTS55. News from Rohde & Schwarz (1997) No. 155, p 33
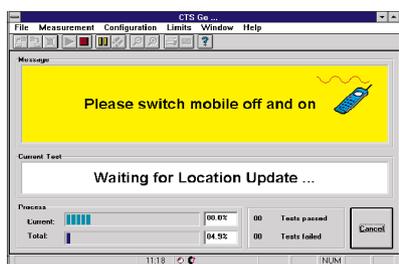
Condensed data of Digital Radio Testers CTS

	GSM mode (CTS55/65)	DECT mode (CTS60/65)
DUTs	GSM900, GSM1800, GSM1900 mobile phones	FPs and PPs for DECT Europe and DECT Latin America
Modes	quick test, manual test, auto test, module test, remote control via RS-232-C	loopback mode, manual test, auto test, remote control via RS-232-C
Functions	synchronization, location update, call setup and release, handover, power change, echo test	synchronization, call setup and release, echo test
Test parameters	power, power ramp, phase/frequency error, timing accuracy, sensitivity (BER, RBER, FER, RxLev, RxQual)	power, power ramp, demodulated frequency/offset/drift, modulation deviation, timing accuracy, jitter, packet accuracy, sensitivity (BER, FER)

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