

# Digital Radio Tester CTS for mobile phones GSM 900/1800/1900

### Tester family for fast and conclusive GSM and DECT measurements in service

#### Compact, modular testers

- Fast and precise measurements for service and adjustment
- Brilliant TFT colour display
- Menus in six different languages
- Connectors for external monitor and keyboard to make operation even more convenient
- Problem-free upgrading of existing units

#### for GSM900/1800/1900

- Measurements to GSM recommendations
- Quick test (fast go/nogo test)
- Versatile autotest
- Manual test for exact fault location
- Module test (RF measurements without signalling)
  - burst analysis
  - RF generator
  - narrowband spectrum monitor
- Windows<sup>™</sup> application program for customized autotest

### ... and DECT

- Measurements to CTR06
- Configurable autotest
- Manual test for exact fault location
- Off-air measurements via sensitive input and power output
- Universal DECT frequency range



# Testing a mobile is so easy

# GSM and DECT measurements with one and the same tester

Digital Radio Tester CTS – a new tester family from Rohde&Schwarz – comes in three models:

- CTS55 for mobile phones to GSM900/ 1800/1900
- CTS60 for DECT phones (portable part and fixed part)
- CTS65 for GSM and DECT

#### Fast automatic functional test ....

The automatic test routines of the CTS enable you to demonstrate the reliable functioning of a GSM or DECT mobile phone to the customer in a convincing manner. In case of complaints raised about mobiles, you will be able to show your technical competence: right in front of the customer the CTS detects whether the mobile is defective or whether the origin of the problems is to be sought elsewhere.

#### ... and precise manual fault location

Additional manual measurement routines are provided to permit exact fault location on the basis of the conclusive results of the automatic test. The CTS allows indepth measurements of bit error

Digital Radio Tester CTS is an extremely compact, modular yet powerful measuring instrument. It combines great ease of operation and the necessary test depth for use in all service areas for mobile and cordless phones: from a simple functional test to repairs. Both the newcomer and the service specialist will be able to conveniently carry out fast automatic functional tests as well as complex and comprehensive manual measurements down to component level. rate, phase, frequency and modulation errors as well as analysis of timing and power ramp to be performed with great speed and high precision. The grounds for a perfect mobile radio service are thus well prepared.

# Module test down to component level

Fitted with the GSM Module Test Option CTS-K7, the CTS provides additional functions allowing repairs down to the component level (see page 8).

#### All under remote control

The Remote Control Option CTS-K6 provides remote control and individual automatic test runs (see page 9).

### Convenient, ergonomic servicing

The CTS adapts itself to the user and not vice versa. Operation is extremely easy and does not require any special GSM or DECT knowledge. Functional tests can immediately be performed without any action being required from the user. Automatic test runs or manual test routines with a large variety of preset system-specific parameters are called up menu-driven via softkeys. The CTS immediately recognizes any input parameters that are not meaningful and limits them to the maximum permissible values. Inappropriate entries are thus largely excluded.

Despite its great variety of test and measurement capabilities, the CTS follows one important principle: to encompass as many features as required and to keep them as simple as possible. The CTS is an ergonomically designed dedicated GSM/DECT mobile tester which presents the essential test parameters clearly and extremely user-friendly.

# High-resolution colour display with outstanding brilliance

With its TFT colour display the CTS is exploring new grounds. The excellent brilliance and intensity are ideal prerequisites for eye-strain-free work even under adverse ambient illumination.



## Sum of experience

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Rohde&Schwarz, being one of the worldwide leading companies in the field of mobile radio measurements, was able to put its wide range of knowhow and expertise into the development of type-approval systems such as the GSM system simulator and the extremely successful Digital Radiocommunication Tester CMD for production and service environments. This background was fully utilized in the development of the Digital Radio Testers CTS, service testers which are also fit for the measurement tasks of the future.

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Digital Radio Tester CTS55 for GSM measurements



Digital Radio Tester CTS60 for DECT measurements

#### The CTS at a glance

- User-friendly menu-guided control via softkeys
- Logical user prompting without interleaved submenus
- Brilliant TFT colour display: a new dimension in this class of instruments
- Menus in six different languages
- Compact and robust design, low weight
- Eye-strain-free working
- Dynamic range for measuring the power ramp: GSM >55 dB, DECT >60 dB
- Built-in reference oscillator TCXO or OCXO (option CTS-B1)
- Combined RF input/output for GSM and DECT
- DECT off-air measurements via additional input/output
- Remote control via RS-232-C

# Technical features in detail

#### Active TFT colour display

The high-resolution TFT colour display is outstanding for its brightness and extremely large viewing angle which is flexible for any requirement. There are no reading problems due to reflections on the display or due to unfavourable light conditions (direct sun light).

Coloured menus provide additional means of clearly displaying the test results or highlighting important events such as out-oftolerance conditions.

# Flexible us interface

The CTS can be fully controlled via six softkeys and one hardkey. Maximum operating convenience is obtained by connecting an external PC keyboard. Individual keyboard driver<mark>s c</mark>ater for country-specific keyboards. In addition to the TFT display, an external monitor can alternatively be connected via the VGA interface.

### Results at a keystroke

The specific parameters of the networks and the mobile phones can be preset. An automatic test run which immediately produces conclusive results can be started simply at a keystroke.

### For interference-free test results: universal shielded chamber

For measuring the receiver sensitivity of mobile phones, transmit levels below -90 dBm for DECT phones and even -100 dBm with GSM mobiles are required. The measurement may be impaired by external interference which occurs for instance in the immediate vicinity of base stations. The Universal Shielded Chamber CTS-Z12 from Rohde & Schwarz ensures an interference-free measurement environment in all cellular mobile radio bands. It allows error-free measurement of the bit error rate (BER) as well as of the receiver parameters RxLev and RxQual of the mobile phone even under strong interference.

Functional testing of GSM mobiles is also possible via the Universal Antenna Coupler CTS-Z10 without an adapter cable. Antenna coupling in the 900 MHz, 1800 MHz and 1900 MHz bands is via the air interface and allows any fault in the antenna to be reliably detected. All "cableless" couplers are sensitive to radiated interference and should therefore be effectively screened. The Universal Shielded Chamber CTS-Z12 has been optimized for use with the Universal Antenna Coupler CTS-Z10 and permits undisturbed measurements to be performed.

CTS ensures optimum interplay between the shielded chamber and the universal coupler. All essential parameters such as input and output coupling, adapter cable losses and other devicespecific parameters can be stored in the CTS and recalled simply at a keystroke.



# GSM measurement, test and adjustment capabilities

- Synchronization of mobile phone with base station (which is simulated by CTS)
- Location update
- Call setup (incoming/outgoing)
- Call release (incoming/outgoing)
- Control and measurement of transmitter power
- Handover (channel change)
- Sensitivity
  - bit error rate BER and RBER
  - limit sensitivity via search routine
  - RxLev and RxQual
- Phase and frequency error
- Power ramp versus time
- Timing error
- AFC (automatic frequency correction) and RSSI (radio signal strength indication) with optional GSM Module Test CTS-K7
- I/Q modulator adjustment via narrowband spectrum monitor (option CTS-K7)
- Echo test (voice test, includes also testing of loudspeaker and microphone)
- Functional test of mobile's keypad through display of dialled number
- Display of
  - IMSI (international mobile subscriber identity)
  - IMEI (international mobile equipment identity)
  - power class
  - revision level
- Short message service (SMS)



							2
Autote	st	Mobile	XYZ			G09	
Values	Ch1	1	Ch2	65			
Power		13.2		14.1			
Power		22.3		22.4			
Power 🔳		33.0		33.1			
RxLev		-101.0		-100.0			
RxQual	≤	0.2	≤	0.2	LocUpd	M	Stop
Phase RMS		1.6		1.7	Call to	$\mathbf{\nabla}$	
Phase Pk		4.9		4.5	Echo	$\mathbf{\nabla}$	
Freq		-22		1	MSRel		
Ramp		OK		OK	Callfrom		
RBER II		0.0		run	NuRel		Talazanaa
RBER lb		0.0		run			Tolerance
FER		0.0		run			
Dialled No	0049 <sup>,</sup>	180512	4242				



# GSM measurements in detail

### Quick test (1)

The quick test provides an extremely fast go/ nogo information covering all essential parts of the mobile phone. A speech test (echo test) is carried out immediately after the call setup.

#### Echo test

Speech received by the microphone of the mobile is sent to the CTS, stored in a buffer memory and sent back to the phone. In this way it is possible to check the whole signal path from the microphone via the RF transmitter/receiver section, modulator, demodulator, signalling section, speech coder/ decoder, analog audio components to the loudspeaker. Measurement sequences and results are clearly displayed in graphical form.

### Autotest (2)

The autotest routines allow complete functional tests to be started at a keystroke. The tests cover all essential signalling functions as well as the transmitter and receiver characteristics of the mobile phone. In addition to the various signalling functions, the CTS checks the transmitter power of the different power classes and the receiver sensitivity by measuring the RxLev and RxQual parameters output by the mobile phone. A digital signal processor also enables measurement of the phase and frequency error, bit error rate and power ramp.

#### Versatile testing

The scope of measurements and hence the automatic test run time are variable: the user can decide whether he wants a short test or more in-depth testing. The number of channels or measured values can for instance also be adapted to the individual requirements.

#### Display modes

The individual results can be displayed as follows:

- as an OK/not OK statement in the Pass/Fail mode
- in full detail with accurate values in the Value mode, in tabular form on the display and, if desired, as a printout

The default tolerance values can be displayed in addition.

### Manual test (6)

Digital Radio Tester CTS provides autotest routines as well as extensive manual test functions. Transmitter power and characteristic receiver parameters such as RxLev and RxQual are displayed. Moreover, the following signalling functions are available: location update, call setup and release by CTS or mobile. The dialled number as well as IMSI, IMEI, power class and revision level are indicated. The CTS also allows the transmission and reception of short messages SMS (point-topoint short message service).

#### **GSM-specific RF measurements**

#### Power ramp (3)

The power ramp can be measured by the CTS with a dynamic range of >55 dB and displayed in numerical or graphical form. In the graphical display mode the user can choose between overall view and partial view selected with the zoom function. The power ramp is evaluated with reference to the training sequence. Out-of-tolerance values are highlighted.

#### Phase and frequency error (4)

As soon as the training sequence is recognized, the CTS carries out these measurements in accordance with the GSM specifications. The results are displayed graphically and numerically.

#### Bit error rate (5)

The BER is an essential criterion for evaluating the receiver characteristics of the mobile phone. The CTS measures these characteristics with the aid of various test routines such as RBER (class Ib; II; FER) and BER (class lb; II). A search routine allows fast and precise determination of the limit sensitivity of mobile phones.

#### Menus in six languages(6)

The multilingual CTS offers the user a choice of six working languages, ie English, German,

French, Italian, Spanish and Dutch.

### **User-selectable** network parameters (MCC, MNC, NCC, LAC)

The CTS is able to simulate any GSM network. This is of advantage if:

- the mobile is to be checked together with the SIM card of the network
- the test SIM card is not accepted by the mobile phone
- a test SIM card is not available



#### **BER Continuous** 609 Stop -101 to -100dBm 11 RxLev BER 4 1.6 to 3.2% RxQual Sens. **RF** Channel RF RBER II 2.698% Chan 63 0.000% RBER Ib **BS Signal** Tune FER 0.000% **BS-Sig** -102.0 dBm Samples Curr Preset 46 50 Config









# Testing at component level

### GSM module test (option CTS-K7)

The GSM module test provides additional functions allowing repairs down to the component level:

- burst analysis
- RF generator
- narrowband spectrum monitor for adjustment of the I/Q modulator

The mobile phone is set to a special service mode. Usually an external PC is used to control the mobile and trigger it to send. The CTS is then able to measure the RF parameters of the transmitter section without the signalling section of the mobile being required.

### Burst analysis (1)

All characteristic test parameters of the transmitter such as output power or phase and frequency error are clearly displayed in a menu.

The CTS is able to recognize and analyze typical modulation patterns (training sequence, pattern 0 to 8).

# RF generator (2)

An independent RF generator generates GSM-specific signals which are required for adjustments such as AFC or RSSI. In addition to the typical modulation patterns (training sequence 0 to 7) a frequency offset corresponding to a permanent 0 or 1 modulation can alternatively be entered.

A second RF output enhances the power range of the CTS (RF OUT2, -15 dBm to -75 dBm).

### Narrowband spectrum monitor (3)

The narrowband spectrum monitor in the module test option allows fast and convenient adjustment of the I/Q modulator of mobile phones.

The menu is optimized for typical applications to ensure problem-free interplay with the existing software.

### OCXO reference oscillator (option CTS-B1)

It ensures:

- excellent absolute accuracy
- minimum temperature-dependent drift
- especially high long-term stability (aging 0.2 x 10<sup>-6</sup>/year)

In the service mode, the absolute frequency error of the mobile is measured rather than the error relative to the CTS. Since the stability of the reference oscillator directly influences the measurement accuracy, option CTS-B1 should be used for this application.

# All under remote control

### Remote control (option CTS-K6)

Option CTS-K6 allows the CTS to be remote-controlled via the serial interface (RS-232-C). All settings of the manual test and module test can be called up via the RS-232-C interface and the results and displays read out. The Windows<sup>™</sup> Application Program CTS-GO supplied with this option allows extremely fast and easy generation of individual automatic test runs. A test program with individual tolerance evaluation can be configured just with a few mouse clicks (1).

Individual tolerance values can be stored for each automatic test run. This affords maximum flexibility. Mobilespecific critical parameters can thus be taken into account by selecting appropriate tolerance values.

The test run can very easily be adapted with just a few mouse clicks and stored. Up to six different test sequences per test run can be defined. All RF measurements can be performed separately in each test sequence (2).

The CTS outputs the results in a measurement report (3). The results can also be stored in a PC for archiving or exported via data filters to other programs (eg Microsoft<sup>®</sup> Excel) for statistical evaluation.

1	Tests running.		6	
Current Test	- Augusta - 1990			
Per	forming BER I	Measur	ements	
rocess urrent: otal:	1	00.0% 08 49.0% 01	Tests passed Tests failed	Egit
	12:09		CAPS NUM	SCRL 0

TCH Power Leve

Г

BS Powe

Standard:

at BER:

02 1 06 1 10 1

01 10 05 109 13 17 17

03 - 07 - 11 - 15 - 19

-70.0

-90.0

DK

I ▼ Timing

Average Burst Powe

Template Matching

BER Erased Frame:

Help

BER Class Ib

BER Class II

RX Qual

RX Lev

Echotest

Cancel

12 1 16

14 1 18



	Dent VI/Z		Abort
02. Portable	PartATZ		
Action/Parameter	Value	Result	
(01) Timing:			
Timing Accuracy	2.2 pp	Pass	
MaxPosJitter	0.0 us	Pass	
MaxNegJitter	-0.8 us	Pass	
(02) Setup Connection			
Detected RFPI	0002EB0E0		
Dummy Slot	2		
Dummy Carrier	0		





# **DECT** measurements

#### DECT

# measurements with CTS 60 and CTS 65

These two CTS models provide DECT measurements on the fixed part (FP) and on the portable part (PP) in the service mode (CTR06 mode). They measure the relevant RF parameters and check the standard signalling. Fast automatic functional tests as well as comprehensive manual measurements can of course be carried out.

The two CTS models feature a high-level output which in conjunction with the additional sensitive input allows off-air measurements.

### Autotest (1)

DECT autotests can simply be generated and started at the push of a button.

Each individual function, eg call setup or power measurement, is available as a test step. Tolerance limits for the OK/not OK statement are separately stored for each macro and allow an individual configuration. With the aid of conditional branching the test run can be modified depending on the results, ie certain parts of the measurement can be repeated several times or not carried out at all.

### Manual test (2)

#### Central test menu

Faulty functions detected in the automatic test can be exactly located by means of the manual test. A central test menu shows the main RF parameters at a glance. All further test routines are directly available in submenus.

#### Power ramp (3)

The CTS measures the power ramp of the signal sent by an FP or PP with a dynamic range of >60 dB. The power ramp is evaluated with reference to the P0 bit and allows an accurate timing analysis of the signal in addition to the transmit power measurement. Out-oftolerance values are quickly and precisely determined with the aid of zoom functions and colour highlighting.

#### RF modulation (4)

In the RF modulation menu the demodulated signal is graphically displayed in an oscilloscope window in order to allow simple and fast detection of typical data patterns with the aid of various zoom functions. Characteristic modulation parameters can be measured and numerically displayed for the data patterns "Figure 31; 01010101, 000011111".

#### Timing (5)

The test parameters "Timing Accuracy" (FP test only), "Jitter" and "Packet Delay" (PP test only) provide information about the accuracy and stability of the sent frame intervals.

#### Bit error rate (6)

The bit error rate measurement furnishes reliable information about the receiver characteristics in the FP or PP. The CTS measures the bit and frame error rate (BER, FER) and displays both the current measured value and a statistical value averaged over a defined number of frames. To obtain DECT measurements of highest accuracy, an OCXO reference oscillator (option CTS-B1) should be used (page 8).

# DECT measurement, test and adjustment capabilities

- Synchronization of DUT with the CTS
- Call setup
- Call release
- Echo test
- Detection and display of RFPI (FP)
- Normal transmit power (NTP)
- Power ramp versus time
- Modulation characteristics versus time
- Frequency offset
- Maximum modulation deviation
- Frequency drift
- Timing (jitter, packet delay)
- Bit error rate (BER), frame error rate (FER)



# **Specifications**

#### Common data

#### Built-in reference oscillator Frequency drift in

standard temperature range +5 °C to 40 °C  $\leq$ 1 x 10<sup>-6</sup>

±0.1 x 10<sup>-6</sup>

Aging OCXO reference oscillator

≤0.5 x 10<sup>-6</sup>/year at 35°C option CTS-B1

≤0.2 x 10<sup>-6</sup>/year at 35°C

Frequency drift in temperature range +5 to +40 °C Aging

#### GSM

Resolution Output level RF IN/OUT

Level error

Modulation

Markers

#### **GSM** signal generator

RF OUT2 GSM

Frequency range GSM900 band 935 MHz to 960 MHz 1805 MHz to 1880 MHz 1930 MHz to 1990 MHz GSM1800 band GSM1900 band GSM channel spacing 200 kHz with 0 dB ext. attenuation -50 dBm to -110 dBm

-20 dBm to -75 dBm with 0 dB ext. attenuation **RF IN/OUT** ≤1.5 dB **RF OUT2 GSM** <2 0 dB GMSK,  $B \times T = 0.3$ 

#### Narrowband Spectrum Monitor Option CTS-K7 300 kHz Span 4/10/20/50/100 kHz Resolution bandwidths Dynamic range (P >5 dBm) $\Delta f = 0 \text{ kHz to 30 kHz}$ typ. 35 dBc

typ. 50 dBc 3 markers and delta marker  $\Delta f = 30 \text{ kHz}$  to 150 kHz

#### GSM signal generator in Module Test Option CTS-K7

Frequency offset Resolution Power ramp Bit modulation

GSM peak power meter Frequency range GSM900 band GSM1800 band GSM1900 band Measurement range with 0 dB ext. attenuation

with 15 dB ext. attenuation

Resolution Error with 0 dB ext. attenuation P > 5 dBm-5 dBm < P ≤ 5 dBm -15 dBm < P ≤ -5 dBm

#### GSM measurement of phase and frequency error

Frequency range GSM900 band GSM1800 band GSM1900 band Measurement mode

#### Level range

Internal phase error GSM900 band <1.4 ° (rms) <4.5 ° (pea GSM1800/1900 band <2.0 ° (rms) <5.5 ° (pea Frequency measurement uncertainty <15 Hz + drift of timebase GSM900 band

-100 kHz to +100 kHz approx. 33 Hz CW. burst none/dummy burst (midamble 0 to 8)

890 MHz to 915 MHz 1710 MHz to 1785 MHz 1850 MHz to 1910 MHz

-15 dBm to +39 dBm (peak values up to 41 dBm) ÖdBm to +39 dBm (peak values up 41 dBm) Ö.1 dB

≤1 dB ≤1.5 dB ≤2 dB

890 MHz to 915 MHz 1710 MHz to 1785 MHz 1850 MHz to 1910 MHz frequency error phase error (rms) and phase error (peak) current value, average value and maximum value over several bursts -15 dBm to +39 dBm (peak values up to 41 dBm)

<4.5 ° (peak) <5.5 ° (peak)

#### GSM measurement of burst power

Frequency range GSM900 band GSM1800 band GSM1900 band Measurement modes

#### Display modes

Reference level for full dynamic range with 0 dB ext. attenuation

Dynamic range (P >5 dBm) Total error of peak power measurement (P > 0 dBm) Resolution

### DECT

#### **DECT** signal generator Frequency range

Frequency drift Output level RF IN/OUT RF OUT2 DECT

Burst switch-off Resolution Level error RF IN/OUT RF OUT2 DECT Modulation Modulation error

#### DECT analyzer

Frequency range Measurement range RF IN/OUT RF IN2 DECT FM demodulator Frequency range Resolution DC offset Residual FM **RF IN/OUT** 

RF IN2 DECT

Level meter Range RF IN/OUT **RF IN2 DECT** Dynamic range Resolution Accuracy RF IN/OUT

**RF IN2 DECT** 

#### 890 MHz to 915 MHz 1710 MHz to 1785 MHz 1850 MHz to 1910 MHz

- power ramp
- rms and peak power of burst
- full burst (view all)
- rising edge • useful range
- falling edge
- zoom

0 dBm to +39 dBm (peak values up to 41 dBm) ≥55 dB

 $\leq 1.5$  dB + resolution 0.1 dB

1876.608 MHz to 1935.360 MHz and half channels same as reference oscillator

-100 dBm to -40 dBm -40 dBm to 0 dBm (-20 dBm to 0 dBm if RF IN2 DECT is active) useable up to 5 dBm >30 dB 0.1 dB

≤1.5 dB ≤2.0 dB GFSK ( $B \times T = 0.5$ ) <5% (at 288 kHz frequency deviation)

same as signal generator with 0 dB external attenuation 30 dBm to -30 dBm -35 dBm to -55 dBm

0 kHz to 450 kHz 1 kHz <3 kHz

<15 kHz, peak, 95% confidence (30 dBm to 5 dBm) <5 kHz, peak, 95% confidence (30 dBm to 15 dBm) <15 kHz, peak, 95% confidence (-35 dBm to -55 dBm) <5 kHz, peak, 95% confidence (-35 dBm to -40 dBm)

30 dBm to -30 dBm -35 dBm to -55 dBm  $\geq 60 \text{ dB} \text{ (for P = 24 dBm)}$ 0.5 dB <1 dB + resolution (30 dBm to 5 dBm)

<2 dB + resolution (<5 dBm) <2 dB + resolution (-35 dBm to -51 dBm) <2.5 dB + resolution (<-51 dBm)

# Specifications (continued)

#### Audio interface

Output Range Output impedance S/N + THD Passband ripple Input Range Input impedance S/N + THD Passband ripple

DECT applications Accuracy and stability of RF carrier Error Accuracy and stability of timing Error Modulation section 1, 2, 4 Error

Frequency drift Error Transmit power Measurement accuracy RF IN/OUT RF IN2 DECT

Power versus time Power measurement accuracy RF IN/OUT

RF IN2 DECT

Timing measurement accuracy

#### General data

VSWR at all RF connectors Rated temperature range Operating temperature range Storage temperature range Electromagnetic compatibility

Mechanical resistance Sine vibration

> Random vibration Shock

Rel. humidity Power supply

Power consumption Electrical safety

Dimensions (W x H x D) Weight CTS55, CTS60 CTS65 unbalanced 558 mV, 300 Hz to 3 kHz  $<10~\Omega~(R_L>2~k\Omega)$  30 dB at max. level 0.5 dB unbalanced 80 mV, 300 Hz to 3 kHz 22 k\Omega 30 dB at max. level 0.5 dB

averaging 10 bursts

<2 kHz + reference

<0.1 µs + reference

approx. 11 kHz with min. (202 kHz) permissible deviation approx. 13 kHz with max. (403 kHz) permissible deviation

approx. 1 kHz/ms (over 200 bursts)

<1 dB + resolution (30 dBm to 5 dBm) <2 dB + resolution (<5 dBm) <2 dB + resolution (-35 dBm to -51 dBm) <2.5 dB + resolution (<-51 dBm)

<1 dB + resolution (30 dBm to 5 dBm) <2 dB + resolution (<5 dBm) <2 dB + resolution (-35 dBm to -51 dBm) <2.5 dB + resolution (<-51 dBm) <0.1 µs + reference

≤1.5 +5 °C to +40 °C +5 °C to +45 °C -25 °C to +60 °C complies with requirements of European EMC Directives EN 50081-1 and EN 50082-1

IEC 68-2-6, IEC 1010-1, VG standard 95332-24-A2, MIL-T-28800 D class 5 DIN 40046, IEC 68-2-34 MIL-STD-810 D, MIL-T-28800 D classes 3 and 5

IEC 68-2-3 200 V to 240 V AC  $\pm$ 10%, 100 V to 120 V AC  $\pm$ 10%, 50 Hz to 60 Hz  $\pm$ 5% approx. 60 W ENG 1010-1; IEC 1010-1, VDE 0411 Part 1 319 mm x 177 mm x 350 mm approx. 7.8 kg approx. 8.8 kg

#### Ordering information

Order designation Digital Radio Tester (GSM)	CTS 55	1094 0006 55
Digital Radio Tester (DECT)	CTS 60	1094.0006.60
Digital Radio Tester (GSM and DECT	) CTS 65	1094.0006.65
Options		
OCXO Reference Oscillator		
Aging 0.2 x 10 <sup>-o</sup> /year	CTS-B1	1079.0809.02
GSM Remote Control (with		1070 2001 01
Application Software for Windows	TS K7	1079.2001.01
	13-N/	10/ 9.2301.02
Modification and upgrade kits		
Upgrade CTS55 to CTS65 <sup>1)</sup>	CTS-U56	1079.1605.02
Upgrade CTS60 to CTS65	CTS-U65	1079.1705.02
Modification: new front panel with		
RF OUT2 on front	CTS-U7	1079.1805.02
De comune de de contener		
Kecommended extras	CTS 712	1070 1470 02
Antenna Coupler (for handheld	C13-212	10/ 7.14/ 0.02
telephones 900/1800/1900 MHz)	CTS-710	1079 1240 02
GSM Test SIM	CRT-Z2	1039.9005.02
DECT antenna (with N connector)		1086.3116.00
Compact Keyboard		
German	PSP-Z1	1091.4000.02
US	PSP-Z2	1091.4100.02
Production Calibration	DCV-1	0240.2187.08
Service Manual		1094.3405.24



Certified Quality System

<sup>&</sup>lt;sup>1)</sup> CTS-U7 is required for units manufactured in May 1998 or before.

Fax Reply (Digital Radio Tester CTS)

	Please send me an offer				
	I would like a demo				
	Please call me				
	I would like to receive your free-of-charge CD-ROM catalog (including Test&Measurement Products + Sound and TV Broadcasting)				
Others:					
Name:					
Company/	Department:				
Position:					
Address:					
Country: Telephone:					
Fax: E mail:					
L-mun.					

