Radiocommunication Service Monitor CMS50, CMS52

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0.4 to 1000 MHz

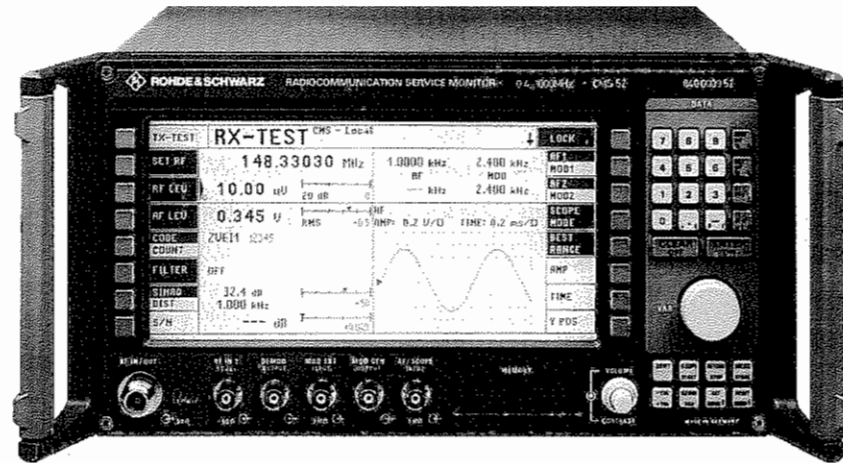The mobile radio tester for service, production and development: lightweight, compact, versatile

Photo: CMS52

Uses

Radiocommunication Service Monitor CMS52 is the ideal radio tester for service, maintenance and test departments. It does not only satisfy all requirements of radio measurements but is also able to perform tests in related fields. The lightweight and compact instrument is particularly suitable for mobile use. With its extensive test facilities, it is also a valuable aid in development laboratories.

Radiocommunication Service Monitor CMS50 is a budget-priced model of CMS52 providing almost the same measurement capabilities. Compromises are made regarding the basic configuration, variety of options and data tolerances (see also "Overview of basic configurations and options" on page 36).
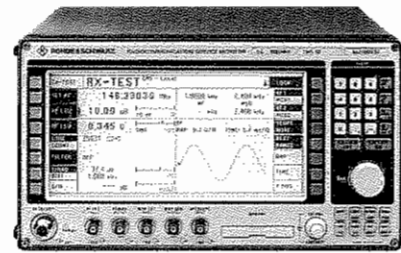
Radiocommunication Service Monitor CMS50

Characteristics

- Low weight and small size for stationary and portable use
- Universal power supply
- No eyestrain thanks to extremely easy-to-read LCD screen with simultaneous indication of all settings and results
- Versatile sources and measuring facilities for all types of transceivers including SSB
- Signalling for cellular radio, trunked radio, paging systems and ZVEI digital
- Full-duplex operation without any compromises on measurements

- Manual measurements can be stored in learn mode; fully automatic test run with hardcopy printout
- Great operating convenience thanks to softkeys and menu control
- Choice of German, English, French, Italian, Swedish and Spanish menu prompting
- Numerous submenus with complementary settings and measurements
- Analog displays with zoom function and superimposable tolerance markers
- Programmable automatic test routines with battery-backed storage
- Memory cards for program library and storage of test results
- Automatic self-adjustment functions and comprehensive selftest
- Easy integration into automatic test systems
- 600-Ω AF transformers for modulation generator and AF voltmeter
- Built-in loudspeaker for audio monitoring of demodulated signal, AF signal and beat (frequency offset)

Operation

CMS uses a large, high-resolution LCD screen with backlighting and graphics capability. It is operated via softkeys at the two sides of the display. A clear menu structure allows fast and direct access to any of the test facilities provided in the CMS.

Numbers and units can be entered directly via the keypad; settings can be varied by means of the spinwheel with variable step size.

In the learn mode, the CMS stores all manual settings and measurements and produces from them ready-to-start automatic test routines. The user need not have any programming knowledge or learn equipment-specific command sets. Tolerances, comments and conditions (loops, jumps, queries and control commands) can additionally be inserted into these test routines.

Generated programs can be stored and test results saved on a memory card. Programs, test results and memory card content can be recorded on a directly connectible printer, eg CM-Z22, (see page 52).

Signal sources

- RF synthesizer from 0.4 to 1000MHz, resolution 10 Hz (CMS50: 50 Hz) with AM, FM, φM and multitone modulation capabilities
- Two independent modulation generators
- Selective-call encoder to all standards and freely programmable
- DTMF encoder
- 10-MHz reference frequency input/output

Signalling unit

- NMT450, NMT900 (SIS), E-TACS, J-TACS, TACS Issue 4, C Net, E-AMPS, Radiocom 2000
- Trunked radio (MPT 1327/1343), POCSAG, ZVEI digital, VDEW digital
- NMT base station test
- Freely programmable FFSK modem

Measuring facilities

- RF counter, RF frequency-offset counter
- Power meter (5 mW to 100 W)
- Selective RF power meter
- RF spectrum monitor with wide dynamic range
- RF tracking generator in frequency range 1 to 1000 MHz
- Adjacent-channel power meter with switch-selectable filters
- Modulation meter for AM, FM and φM; detectors: +PK, –PK, PK HOLD, PK/2, RMS, RMS$\sqrt2$
- Duplex modulation meter for duplex spacings of any size
- AF voltmeter with peak and rms weighting
- SINAD meter with variable test frequency
- Distortion meter with variable test frequency
- S/N meter
- AF counter with period and gate time counting
- Selective-call decoder for all standards and freely programmable
- DTMF decoder
- Oscilloscope up to 20 kHz
- DC ammeter/voltmeter

Filters

- 300-Hz highpass filter for pilot-tone suppression
- 3.4-kHz lowpass filter for voice-band limiting
- Bandpass filter from 300 Hz to 3.4 kHz
- CCITT filter for weighting to various standards
- Continuously tunable bandpass filter with high skirt selectivity for selective modulation and AF measurement
- Continuously tunable notch filter for signal suppression
- 300-Hz lowpass filter for measurement of pilot tones and voice-band suppression
- Switch-selected IF filter for increasing the sensitivity and selectivity for off-air measurements

Interfaces

- IEC/IEEE-bus interface to IEC 625-2 and IEEE 488.2
- Centronics printer connector for test reports, program listings or hardcopy of screen display
- Relay matrix with eight relays
- 12 programmable BCD control lines
- RS-232-C interface for sending and receiving ASCII control characters
- Second RF input of high sensitivity for off-air measurements, can be used independently for module testing, including frequency-converting modules
- Additional, 3rd RF input/output
- Connector for battery (11 to 32 V)

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Cellular networks

Signalling unit

The signalling unit of the CMS supports the networks described in the following. There are two operating modes for signalling: In the convenient QUICK MODE, the menu is configured according to the operating status of the DUT. Any activity can be initiated via softkeys so that practically only the mobile phone needs to be operated. For measurements at bit level or for telegram evaluation of signalling, an in-depth analysis at telegram level is possible in FULL MODE.

NMT 450/900 with SIS code

NMT is operated in several countries with different frequencies, duplex and channel spacing. The CMS takes account of this fact by allowing free selection and country-specific definition of each parameter. This basic setting is retained for further measurements after the instrument is switched on and off. The signalling test combines analog RF and AF measurements with digital signalling which can be recalled very easily and is adaptable in practically all network parameters.

E-TACS, J-TACS, TACS Issue 4

The test configuration for TACS and AMPS phones is similar, but signalling is completely different. However, the user need not refer to the specifications, but will conveniently be menu-guided through the mobile phone test like with all the other signalling methods.

Link set-up in TACS network

C-Net (CMS52)

C-Net tests place higher requirements on the radio tester regarding frequency accuracy and speed of level and frequency setting. In the standard test, two base stations with different level and separation are simulated by the CMS52. For test purposes, up to 32 base stations with programmable level, distance and signalling can however also be defined.

Radiocom 2000

In addition to NMT, Radiocom 2000 is used in France. It supports private and public telephone networks as well as mixed types of networks which include channel change. Transmitter frequency, duplex spacing and channel spacing can be freely defined for special phones.

POCSAG; ZVEI, VDEW digital

POCSAG signalling (Post Office Code Standardization Advisory Group) allows extremely simple addressing of and test calls to all paging systems currently on the market and operating according to this standard (ZVEI digital as well as numeric and alphanumeric pagers). ZVEI/VDEW digital is a digital selective-call method featuring extremely variable parameters. It is used for mobile phones with digital identification code.

Trunking

Trunked radio to MPT1327/1343 is an intelligent, analog radio system which with the aid of digital signalling organizes a few physical channels for a large number of mobile subscribers and additionally allows user-specific applications. System flexibility permits a large number of menu parameters to be varied.

Specifications

Data refer to CMS52, values in parentheses to CMS50

Timebase/standard
Temperature effect 0 to 35°C	$\leq 1 \times 10^{-6}$
Aging	$\leq 2 \times 10^{-6}$/day

Signal generator
Frequency range	0.4 to 1000 MHz
Resolution	10 Hz (50 Hz)
Frequency error	same as timebase
Level FM, φM, CW	$\leq$ –128 to 0 dBm; AM: to –3 dBm
Error, level –3 dBm, f >1 MHz	$\leq$2 dB
Harmonics	$\leq$ –25 dBc ($\leq$ –20 dBc)
Residual AM, CCITT, RMS	$\leq$0.03% ($\leq$0.1%)
Residual FM, CCITT, RMS	$\leq$10 Hz
Phase noise	$\leq$ –110 dBc [Hz] (no spec)

Modulation
AM modulation depth meas. range	0 to 99%
Frequency range	0.4 to 1000 MHz (2 to 500 MHz)
Mod. frequency range, f ≥8 MHz	DC to 20 kHz (15 Hz to 10 kHz)
Distortion for m <0.8, f_{AF} = 1 kHz	$\leq$2% ($\leq$3%)
Error for m <0.8	$\leq$5% + resolution + residual AM
FM deviation meas. range	0 to 100 kHz (50 Hz to 50 kHz)
for f_{RF} = 250 to 500 MHz	0 to 50 kHz (not CMS50)
Mod. frequency range	20 Hz to 20 kHz (50 Hz to 20 kHz), suitable for POCSAG
Distortion, f_{AF} = 1 kHz; f <10 kHz	$\leq$1%
Error	$\leq$5% + resolution + residual FM
M deviation meas. range (int.)	0 to 10 rad (0 to 5 rad)
for f_{RF} = 250 to 500 MHz	0 to 5 rad
Mod. frequency range	100 Hz to 6 kHz
Distortion, f_{AF} = 1 kHz, φ <1 rad	$\leq$1%
Error	$\leq$5% + resolution + residual φM
Modulation modes	internal (single-tone/two-tone), external, internal + external

AF voltmeter
Frequency range	50 Hz to 20 kHz (50 Hz to 10 kHz)
Measurement range	0.1 mV to 30 V, Z_{in} approx. 1 MΩ
Error	<5% + resolution

RF power meter
Frequency range	1.5 to 1000 MHz (2 to 1000 MHz)
Measurement range	5 mW to 50 W
Error for P >20 mW, AM = 0%	$\leq$0.4 dB of rdg + resolution

RF frequency counter
Frequency range	0.5 to 1000 MHz
Resolution	10 Hz, 1 Hz
Error	same as timebase + resolution

Frequency deviation meter
Operating modes	± PK, PK/2, PK HOLD, RMS, RMS√2
RF frequency range	1.5 to 1000 MHz (2 to 1000 MHz)
FM deviation meas. range	DC to 100 kHz (DC to 50 kHz)
AF frequency range	20 Hz to 20 kHz (20 kHz to 15 kHz)
Residual FM	$\leq$10 Hz
Error	$\leq$5% + resolution + residual FM

Phase deviation meter
Operating modes	+PK, –PK, PK/2, RMS, RMS√2
RF frequency range	1.5 to 1000 MHz (2 to 1000 MHz)
Phase deviation meas. range	0.001 to 5 rad
AF frequency range	300 Hz to 6 kHz
Error	same as frequency deviation meter + 2% frequency response

AM depth meter
Operating modes	+PK, –PK, PK/2, RMS, RMS√2
RF frequency range	1.5 to 1000 MHz (2 to 1000 MHz)
Modulation depth meas. range	0.01 to 99%
AF frequency range	50 Hz to 20 kHz (50 Hz to 10 kHz)
Residual AM	$\leq$0.03%
Error for m $\leq$0.8	$\leq$7% + resolution + residual AM

RF spectrum monitor
Frequency range	1 to 1000 MHz
Reference level	+47 to –47 dBm
Display dynamic range	60 dB, for reference level >–7 dBm
Span	DC = zero span to 10 MHz

Filter for 3-dB bandwidth	150 Hz, 6 kHz, 16 kHz, 50 kHz
Error	$\leq$3 dB

Tracking generator: CMS52 only, option CMS-B9/B59 required
Frequency range	1 to 1000 MHz
Reference level	–27 to –67 dBm
Display dynamic range	
for f = 1 to 500 MHz	50 dB
Span	0 to 10 MHz
Filter (3-dB bandwidth)	150 Hz, 6 kHz, 16 kHz, 50 kHz
Error	<3 dB, with relative measurement <0.5 dB
Output level	0 to –128 dBm
Frequency offset	0 to 999 MHz

Second RF input
Measurement of RF frequency, modulation (AM, FM, φM), modulation frequency and spectrum (level) of small RF signals, eg in off-air or module measurements, for low input levels

Modulation generator I and II
Frequency range	20 Hz to 30 kHz (20 Hz to 20 kHz)
Resolution	0.1 Hz
Frequency error	same as timebase + resolution
Output level range	10 µV to 5 V
Level error	$\leq$5%, V >1 mV
Distortion	$\leq$0.5% ($\leq$0.6%)

Distortion meter
Frequency	100 Hz to 5 kHz (100 Hz to 3 kHz) in 10-Hz steps
Measurement bandwidth	max. 12 kHz
Measurement range	0.1 to 50%
Inherent distortion	$\leq$0.5%
Error	$\leq$5% + inherent distortion

SINAD meter
Frequency	100 Hz to 5 kHz (1 kHz)
Measurement bandwidth	max. 12 kHz
Measurement range	1 to 46 dB
Error	1 dB + inherent distortion

AF frequency counter
Operating modes	demodulation, AF, beat (frequency offset), external
Frequency range	20 Hz to 500 kHz, superimposed RF (20 Hz to 20 kHz)
Error	same as timebase + resolution

Oscilloscope
Bandwidth DC	DC to 20 kHz (not CMS50)
AC	10 Hz to 20 kHz (20 Hz to 20 kHz)
Horizontal deflection	20 to 0.1 ms/div
Vertical deflection	scaled in kHz, rad, %, mV/V
Input level range	0 to 40 V_p, Z_{in} approx. 1 MΩ

AF filters
300-Hz highpass	attenuation at 200 Hz typ. 40 dB
3.4-kHz lowpass	attenuation at 10 kHz typ. 40 dB
Bandpass, broadband	highpass + lowpass
Bandpass, narrowband	50 Hz to 5 kHz (50 Hz to 3 kHz), 10-Hz steps, attenuation 40 dB for 0.8f and 1.2f
Notch filter	100 Hz to 5 kHz (100 Hz to 3 kHz), 10-Hz steps, 40 dB
CCITT filter	included in option CMS-B5/-B20

Selective call encoder/decoder
Tone sequences	ZVEI, 2/CCIR/EIA/EEA/EURO/NATEL/CCITT/VDEW/DTMF/VDEW direct dialling/user-defined sequences

General data
Power supply	AC 100/120/220/240 V ± 10%, 47 to 420 Hz, DC 11 to 32 V, 50 W
Dimensions (W x H x D)	320 mm x 175 mm x 375 mm
Weight without options	13 kg (12 kg)

Ordering information
Radiocommunication Service Monitor	CMS52	840.0009.52
	CMS50	840.0009.50