

Radiocommunication Service Monitor CMS50, CMS52

0.4 to 1000 MHz

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

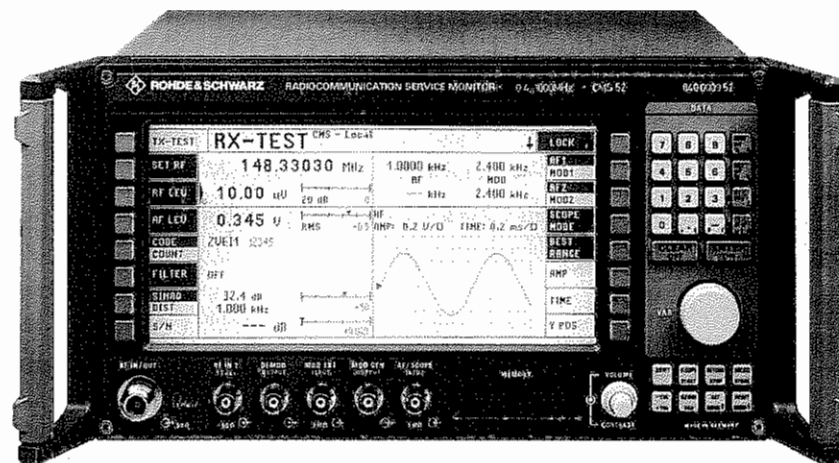
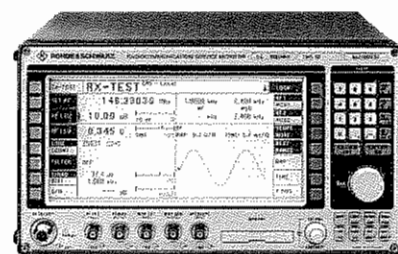


Photo: CMS52

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 print-out
- 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 self-test
- 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, ϕ M 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 ϕ M; detectors: +PK, -PK, PK HOLD, PK/2, RMS, RMS $\sqrt{2}$
- 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.

TACS			
RX-TEST	942.48750 MHz	897.48750 MHz	TX-TEST
SET RF	0.499 mV	2.606 V	COUNT
RF LEV	0.0 mV	2.697 kHz	SET RF
AF LEV	1.000 kHz	-2.892 kHz	POWER
MOD1	0.000 kHz	1.0000 kHz	DEMOD
MOD2		1.00 mV	AF1
EXEC	Release by Phone	Conversation	LEU1
EXEC	Release by Base	224327	POWER
EXEC	Change Channel	300	CHANNEL
EXEC	Origination by Phone	Registered	SAT VOICE
EXEC	Origination by Base	111.111111	SAT VOICE
EXEC	Registration	23	PREU MENU
EXEC	Direct Activation		CONTROL CHANNEL
PHONE No	234.2.123456		

Link set-up in
TACS network

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.

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
Aging

$\leq 1 \times 10^{-6}$
 $\leq 2 \times 10^{-6}/\text{day}$

Signal generator

Frequency range
Resolution
Frequency error
Level FM, PM, CW
Error, level -3 dBm, $f > 1$ MHz
Harmonics
Residual AM, CCITT, RMS
Residual FM, CCITT, RMS
Phase noise

0.4 to 1000 MHz
10 Hz (50 Hz)
same as timebase
 ≤ -128 to 0 dBm; AM: to -3 dBm
 ≤ 2 dB
 ≤ -25 dBc (≤ -20 dBc)
 $\leq 0.03\%$ ($\leq 0.1\%$)
 ≤ 10 Hz
 ≤ -110 dBc [Hz] (no spec)

Modulation

AM modulation depth meas. range
Frequency range
Mod. frequency range, $f \geq 8$ MHz
Distortion for $m < 0.8$, $f_{AF} = 1$ kHz
Error for $m < 0.8$
FM deviation meas. range
for $f_{RF} = 250$ to 500 MHz
Mod. frequency range
Distortion, $f_{AF} = 1$ kHz, $f < 10$ kHz
Error
M deviation meas. range (int.)
for $f_{RF} = 250$ to 500 MHz
Mod. frequency range
Distortion, $f_{AF} = 1$ kHz, $\phi < 1$ rad
Error
Modulation modes

0 to 99%
0.4 to 1000 MHz (2 to 500 MHz)
DC to 20 kHz (1.5 Hz to 10 kHz)
 $\leq 2\%$ ($\leq 3\%$)
 $\leq 5\%$ + resolution + residual AM
0 to 100 kHz (50 Hz to 50 kHz)
0 to 50 kHz (not CMS50)
20 Hz to 20 kHz (50 Hz to 20 kHz),
suitable for POCSAG
 $\leq 1\%$
 $\leq 5\%$ + resolution + residual FM
0 to 10 rad (0 to 5 rad)
0 to 5 rad
100 Hz to 6 kHz
 $\leq 1\%$
 $\leq 5\%$ + resolution + residual PM
internal (single-tone/two-tone),
external, internal + external

AF voltmeter

Frequency range
Measurement range
Error

50 Hz to 20 kHz (50 Hz to 10 kHz)
0.1 mV to 30 V, Z_{in} approx. 1 M Ω
 $< 5\%$ + resolution

RF power meter

Frequency range
Measurement range
Error for $P > 20$ mW, AM = 0%

1.5 to 1000 MHz (2 to 1000 MHz)
5 mW to 50 W
 ≤ 0.4 dB of rdg + resolution

RF frequency counter

Frequency range
Resolution
Error

0.5 to 1000 MHz
10 Hz, 1 Hz
same as timebase + resolution

Frequency deviation meter

Operating modes
RF frequency range
FM deviation meas. range
AF frequency range
Residual FM
Error

\pm PK, PK/2, PK HOLD, RMS, RMS/2
1.5 to 1000 MHz (2 to 1000 MHz)
DC to 100 kHz (DC to 50 kHz)
20 Hz to 20 kHz (20 Hz to 15 kHz)
 ≤ 10 Hz
 $\leq 5\%$ + resolution + residual FM

Phase deviation meter

Operating modes
RF frequency range
Phase deviation meas. range
AF frequency range
Error

\pm PK, \pm PK, PK/2, RMS, RMS/2
1.5 to 1000 MHz (2 to 1000 MHz)
0.001 to 5 rad
300 Hz to 6 kHz
same as frequency deviation meter
+ 2% frequency response

AM depth meter

Operating modes
RF frequency range
Modulation depth meas. range
AF frequency range
Residual AM
Error for $m \leq 0.8$

\pm PK, \pm PK, PK/2, RMS, RMS/2
1.5 to 1000 MHz (2 to 1000 MHz)
0.01 to 99%
50 Hz to 20 kHz (50 Hz to 10 kHz)
 $\leq 0.03\%$
 $\leq 7\%$ + resolution + residual AM

RF spectrum monitor

Frequency range
Reference level
Display dynamic range
Span

1 to 1000 MHz
 $+47$ to -47 dBm
60 dB, for reference level > -7 dBm
DC = zero span to 10 MHz

Filter for 3-dB bandwidth
Error

150 Hz, 6 kHz, 16 kHz, 50 kHz
 ≤ 3 dB

Tracking generator: CMS52 only, option CMS-B9/B59 required

Frequency range
Reference level
Display dynamic range
for $f = 1$ to 500 MHz
Span
Filter (3-dB bandwidth)
Error
Output level
Frequency offset

1 to 1000 MHz
 -27 to -67 dBm
50 dB
0 to 10 MHz
150 Hz, 6 kHz, 16 kHz, 50 kHz
 < 3 dB, with relative measurement
 < 0.5 dB
0 to -128 dBm
0 to 999 MHz

Second RF input

Measurement of RF frequency, modulation (AM, FM, PM), 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
Resolution
Frequency error
Output level range
Level error
Distortion

20 Hz to 30 kHz (20 Hz to 20 kHz)
0.1 Hz
same as timebase + resolution
10 μ V to 5 V
 $\leq 5\%$, $V > 1$ mV
 $\leq 0.5\%$ ($\leq 0.6\%$)

Distortion meter

Frequency
Measurement bandwidth
Measurement range
Inherent distortion
Error

100 Hz to 5 kHz (100 Hz to 3 kHz)
in 10-Hz steps
max. 12 kHz
0.1 to 50%
 $\leq 0.5\%$
 $\leq 5\%$ + inherent distortion

SINAD meter

Frequency
Measurement bandwidth
Measurement range
Error

100 Hz to 5 kHz (1 kHz)
max. 12 kHz
1 to 46 dB
1 dB + inherent distortion

AF frequency counter

Operating modes
Frequency range
Error
Oscilloscope
Bandwidth DC
AC
Horizontal deflection
Vertical deflection
Input level range

demodulation, AF, beat (frequency offset), external
20 Hz to 500 kHz, superimposed RF (20 Hz to 20 kHz)
same as timebase + resolution
DC to 20 kHz (not CMS50)
10 Hz to 20 kHz (20 Hz to 20 kHz)
20 to 0.1 ms/div
scaled in kHz, rad, %, mV/V
0 to 40 V_p, Z_{in} approx. 1 M Ω

AF filters

300-Hz highpass
3.4-kHz lowpass
Bandpass, broadband
Bandpass, narrowband
Notch filter
CCITT filter

attenuation at 200 Hz typ. 40 dB
attenuation at 10 kHz typ. 40 dB
highpass + lowpass
50 Hz to 5 kHz (50 Hz to 3 kHz),
10-Hz steps,
attenuation 40 dB for 0.8f and 1.2f
100 Hz to 5 kHz (100 Hz to 3 kHz),
10-Hz steps, 40 dB
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
Dimensions (W x H x D)
Weight without options

AC 100/120/220/240 V $\pm 10\%$,
47 to 420 Hz, DC 11 to 32 V, 50 W
320 mm x 175 mm x 375 mm
13 kg (12 kg)

Ordering information

Radiocommunication
Service Monitor

CMS52 840.0009.52
CMS50 840.0009.50