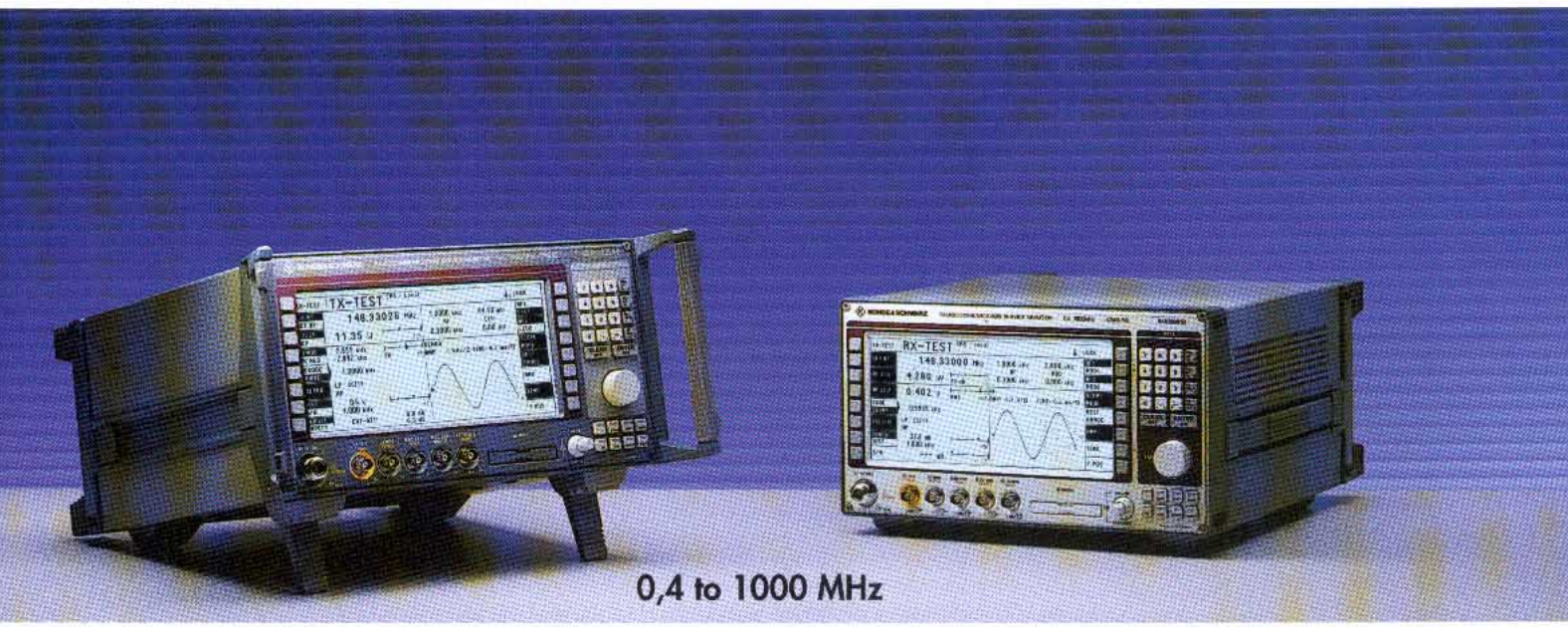
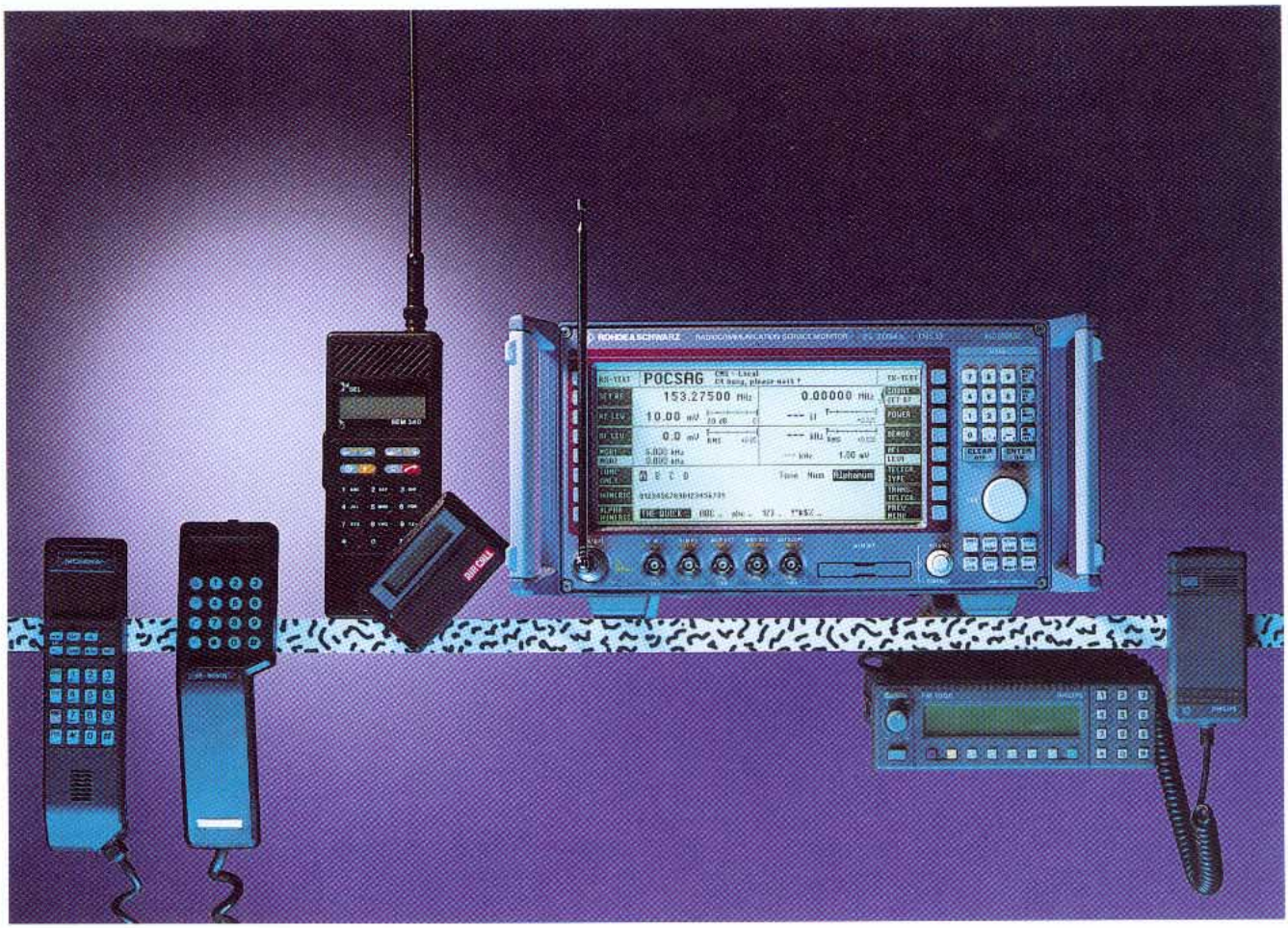


Radiocommunication Service Monitor CMS

Radio testers for service, production and development

- Radio tester family comprising three models to cover all measurement requirements
- Suitable for every type of radio equipment
- Transmitter, receiver and duplex measurements on mobile radios, base stations and RF modules
- Analog and digital signalling
- Large high-contrast LCD screen
- Simultaneous display of settings and results
- Manual and automatic measurements
- Tracking generator
- Spectrum monitor
- Stationary and mobile use
- Cable fault finder

ROHDE&SCHWARZ



Ergonomic tester for all fields of radiocommunications: Radiocommunication Service Monitor CMS

Radiocommunication Service Monitor CMS ...

The Radiocommunication Service Monitor CMS from Rohde & Schwarz is the ideal radio tester for use in **service, maintenance and test departments**. It is suitable for all transceivers using AM, FM or φM as well as SSB.

Optional extensions enable the CMS to satisfy all requirements of radio measurements and even to cover related fields.

Low weight, compact size and low power consumption make this instrument particularly suitable for **mobile use**. Whether stationary or mobile, the CMS with its extensive test facilities always provides a valuable service.

The CMS uses a high-contrast, backlit **LCD screen** with high resolution and is operated via softkeys. A clear menu structure allows fast and direct access to all measurement facilities.

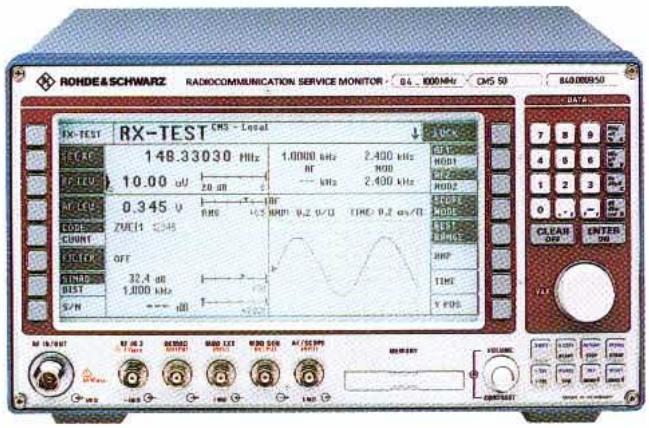
With the **autorun control** and **printer interface**, automatic test routines can easily be configured and stored via the front-panel keypad. Tolerances can be inserted into these test routines to determine and log pass/fail limits.

Battery-backed memory cards are used as program and test report library. Test reports, program lists and screen hardcopies can be output on a printer.

... three radio tester models to suit every application

CMS50 – the budget-priced model for service applications

- Transmitter and receiver testing
- Spectrum monitor
- Fully automatic testing



CMS57 – the specialist for avionics

- Transmitter and receiver testing with enhanced capabilities of CMS50 (see specifications)
- RF spectrum monitor with zero-span to full-span display
- Extremely sensitive RF frequency counter
- Transient recorder for
  – frequency versus time
  – power versus time
- Fully automatic testing

Additional equipment:

- VOR/ILS signal generator

CMS54 – the high-end tester for demanding requirements

- Transmitter and receiver testing with enhanced capabilities of CMS50 (see specifications)
- RF spectrum monitor with zero-span to full-span display
- Extremely sensitive RF frequency counter
- Transient recorder for
  – frequency versus time
  – power versus time
- Fully automatic testing

Additional equipment:

- Full-span tracking generator from 0.4 MHz to 1000 MHz
- Adjacent-channel power meter with standard ETSI filters
- Duplex modulation meter
- Automatic harmonic measurements
- Cable fault finder

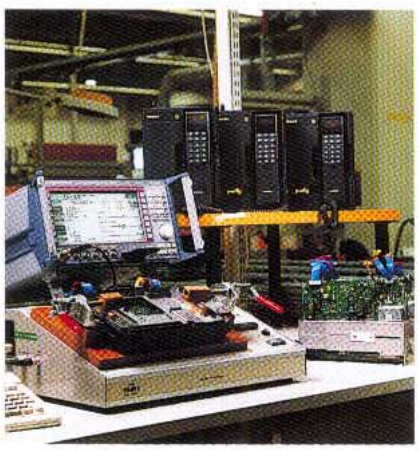
Versatile fields of application ...

... in service

Ease of operation, automatic presettings and test routines as well as clear display of all parameters ensure efficient measurements.

... in production

The CMS can be used in production environments both for module testing and for final system testing without any restriction. The built-in autorun control allows modules to be tested and adjusted without the need for an external controller, the results being logged at the same time. The CMS can also be integrated into larger test systems via the IEC/IEEE bus, short measurement times in pre- and final testing being obtained as a result.



... on-site

The Radiocommunication Service Monitor CMS is a rugged and handy unit that is particularly suitable for mobile use. It can be supplied from the local DC voltage (long operating times thanks to low power consumption). The results of the automatic transceiver test can be stored on a memory card for later analysis and printout.

... in development

The CMS offers great benefits to the development engineer: it combines in a minimum of space RF and AF generators as well as analyzers with high accuracy and wide dynamic range. In particular the CMS54 features measurement capabilities, such as measurement of frequency/power transients of mobile phones, base stations or RF modules, which usually require a comprehensive set of measuring instruments.

CMS – a test set replacing many individual measuring instruments

Due to the comprehensive standard configuration of the individual models and the optional extensions tailored to specific applications, external measuring instruments in addition to the CMS are not required.

Signal sources

- RF synthesizer from 0.4 tMHz o 1000 MHz, resolution 10 Hz, with AM, FM, jM and multitone modulation capabilities
- Two independent modulation generators, 20 Hz to 30 kHz each, resolution 0.1 Hz
- Selective-call coder for all standards (also user-programmable)
- CDCSS coder
- DTMF coder
- 10-MHz reference frequency input/output
- VOR/ILS signal generator

Signalling unit

- NMT 450, NMT 900 (SIS), NMT 450 I, E-TACS, J-TACS, N-TACS, TACS II, C-Net, N-AMPS, E-AMPS, Radiocom 2000, POCSAG

Measuring facilities

- RF frequency counter, RF frequency-offset counter
- RF power meter from 1 mW to 100 W
- Selective RF power meter down to –100 dBm
- RF spectrum monitor with wide dynamic range and filters which also allow modulation analysis (AM, FM, SSB)
- Tracking generator in frequency range 400 kHz to 1000 MHz
- Adjacent-channel power meter with standard ETSI filters
- Modulation meter for AM, FM and φM; detectors: +PK, -PK, PK HOLD, ±PK/2, RMS, RMS √2

- Duplex modulation meter for duplex spacings of any size
- AF voltmeter with peak and true RMS weighting
- SINAD meter with variable test frequency
- S/N meter
- Distortion meter with variable test frequency
- AF frequency counter with period and gate-time counting
- Selective-call decoder for all standards (also user-programmable)
- DTMF decoder
- Oscilloscope
- DC ammeter/voltmeter
- Transient recorder for analysis of power and frequency transients
- SSB menus
- Harmonic measurements
- Cable fault finder

Filters

- CCITT or C-message filter for weighting to relevant standards
- Continuously tunable bandpass filter from 50 Hz to 5 kHz with high skirt selectivity for selective modulation and AF measurements
- Continuously tunable notch filter from 100 Hz to 5 kHz for signal suppression
- Highpass and lowpass filters for band limiting and measurement of subaudio tones

Other facilities

- Second RF input with high sensitivity for off-air measurements, can be used independently for module testing
- Built-in 600-Ω AF transformers for modulation generator and AF voltmeter
- Connector for battery (11 V to 32 V)
- 13-dBm RF output for off-air measurements
- Memory for storing complete instrument setups
- Carrier bag

Automatic tests

Automatic test routines are indispensable for high throughput and reproducible results in service and production: in the learn mode, the Radiocommunication Service Monitor 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. Programs can also be activated directly from the memory card.

The test report format may be user-specified and can be clearly structured by transferring control characters to the printer, such as blank line, paragraph and bold-face.

Test routines, results and memory card contents can be logged on a directly connectible printer

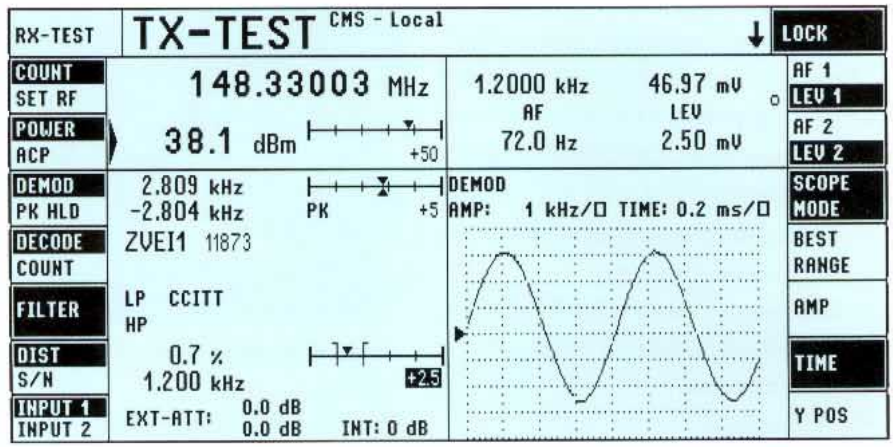
CMS user prompting – all settings and test parameters at a glance

The user interface, which shows all important measurements and allows entry of the necessary parameters, is optimized for each application.

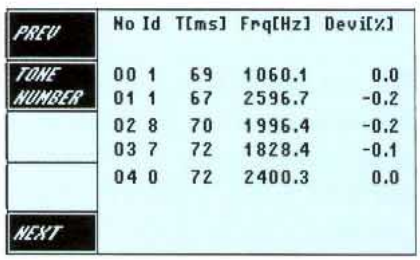
Erroneous settings immediately result in a prompt for clarification from the user.

Submenus can be called up for setting or evaluating specific individual parameters.

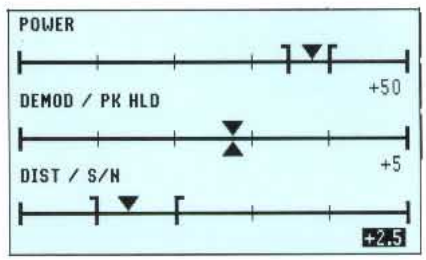
Transmitter test



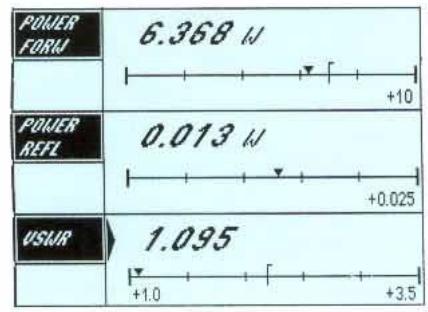
RF measurements, evaluation of demodulated signals and setting of modulation generators



Contents, duration and frequency deviation of selective call signals

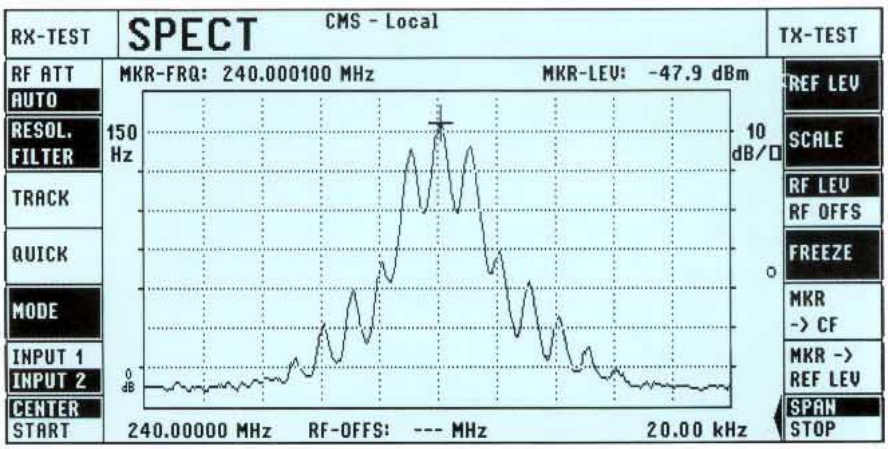


Zoom function for alignment



Using the insertion units of the NAS family, VSWR, forward and reflected power can be indicated

Spectrum monitor/Tracking generator



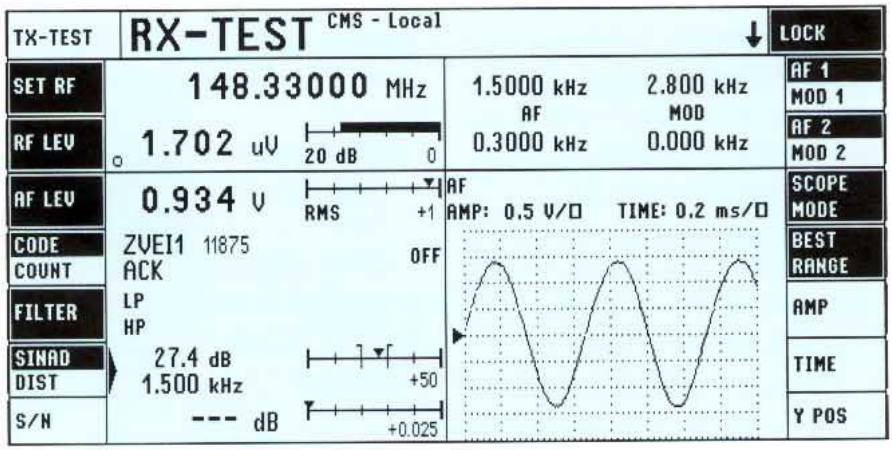
150-Hz filter allowing direct modulation analysis for AM, FM and SSB

Settings made are shown in the main menu so that erroneous measurements due to unknown background settings are impossible.

The user interface may be selected in English, French, German, Italian, Spanish or Swedish.

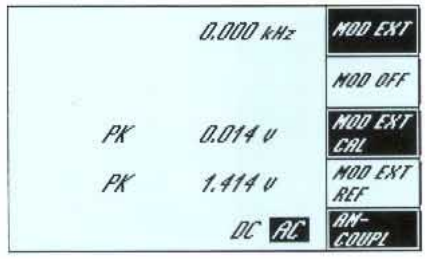
Instrument settings and frequencies can be saved in an internal nonvolatile memory and recalled as required.

Receiver test



Generator settings, evaluation of receiver AF and carrier modulation setting

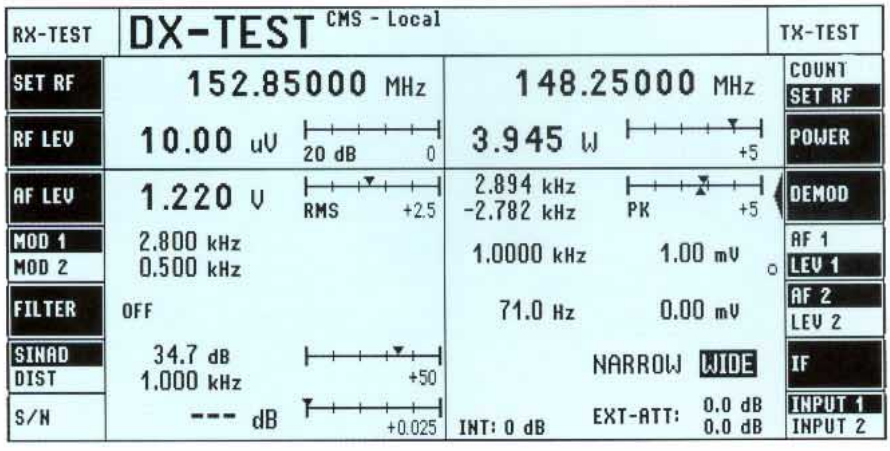
Channel numbers and duplex spacing can be defined and used instead of frequencies



External modulation can be used e.g. for modulating several tones or data signals for various systems

Semi-automatic search routines for squelch level, receiver bandwidth and sensitivity perform elaborate measurements within a few seconds

Duplex test



Transmitter and receiver parameters at a glance; efficient measurements on duplex radio equipment and modules

Signalling

The CMS features built-in signalling units combining signalling measurements and receiver/transmitter tests on mobile stations as well as, to a certain extent, on base stations.

The signalling units support all main radio networks including their country-specific versions.

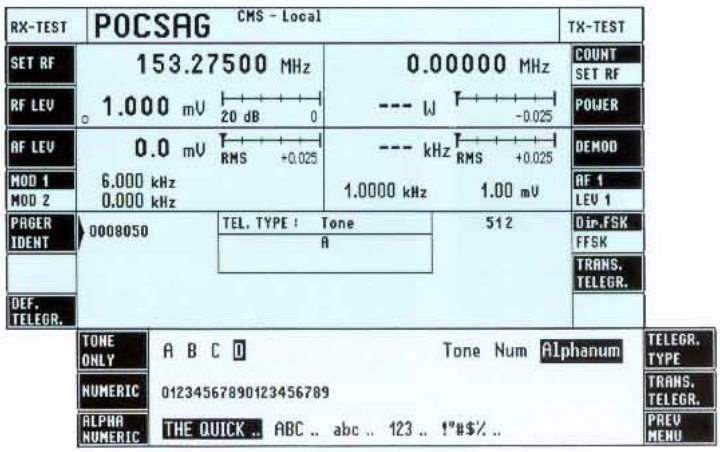
No external equipment is required for testing. All signalling routines are permanently available (no loading or reloading of software is required).

The following standards can be simulated:

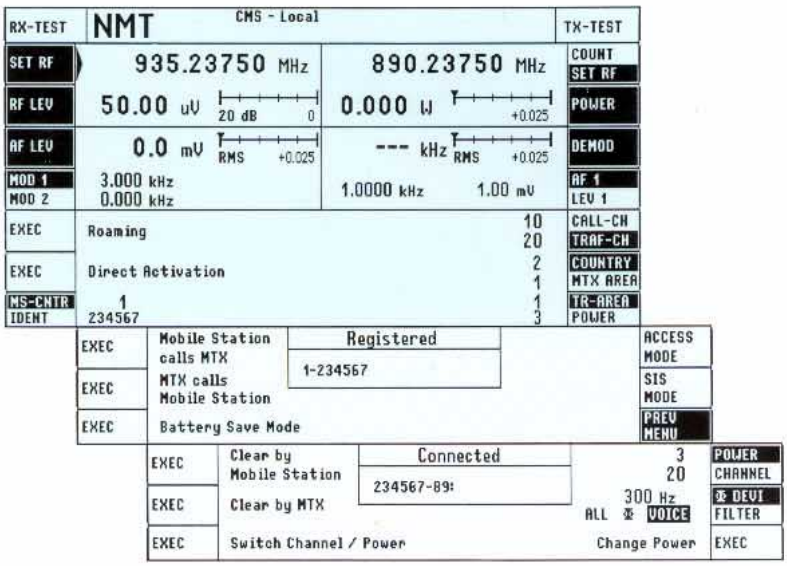
- Selective call to all international standards
- DTMF coding and decoding
- POCSAG/Cityruf/Euromessage
- CDCSS (Continuous Digital Coded Squelch System)

The following signalling routines are available for cellular networks:

- C-Net
- NMT 450 (SIS), NMT 450 I
- NMT 900 (SIS)
- AMPS, E-AMPS
- TACS, E-TACS, J-TACS, TACS II
- Radiocom 2000

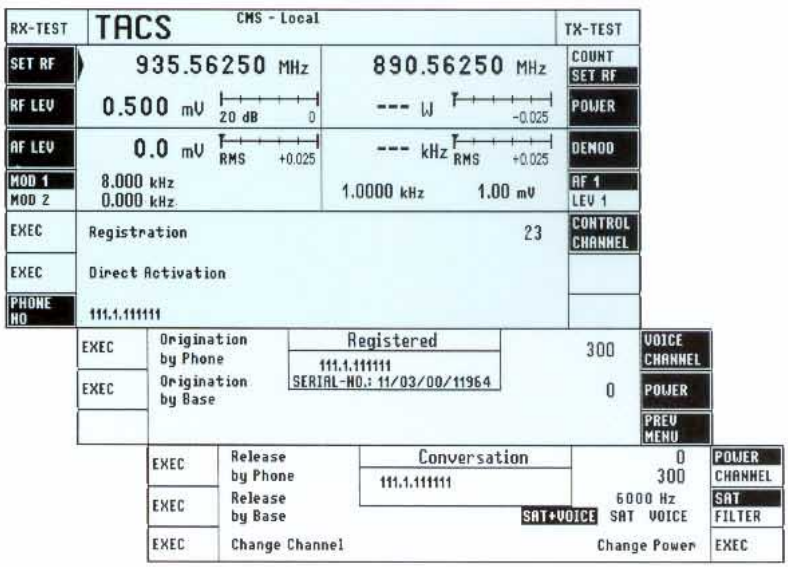


POCSAG (Post Office Code Standardization Advisory Group) signalling allows extremely simple addressing of and test calls to all paging systems currently on the market and operating according to this standard, e.g. Cityruf, Euromessage, tone call as well as numeric and alphanumeric pagers.

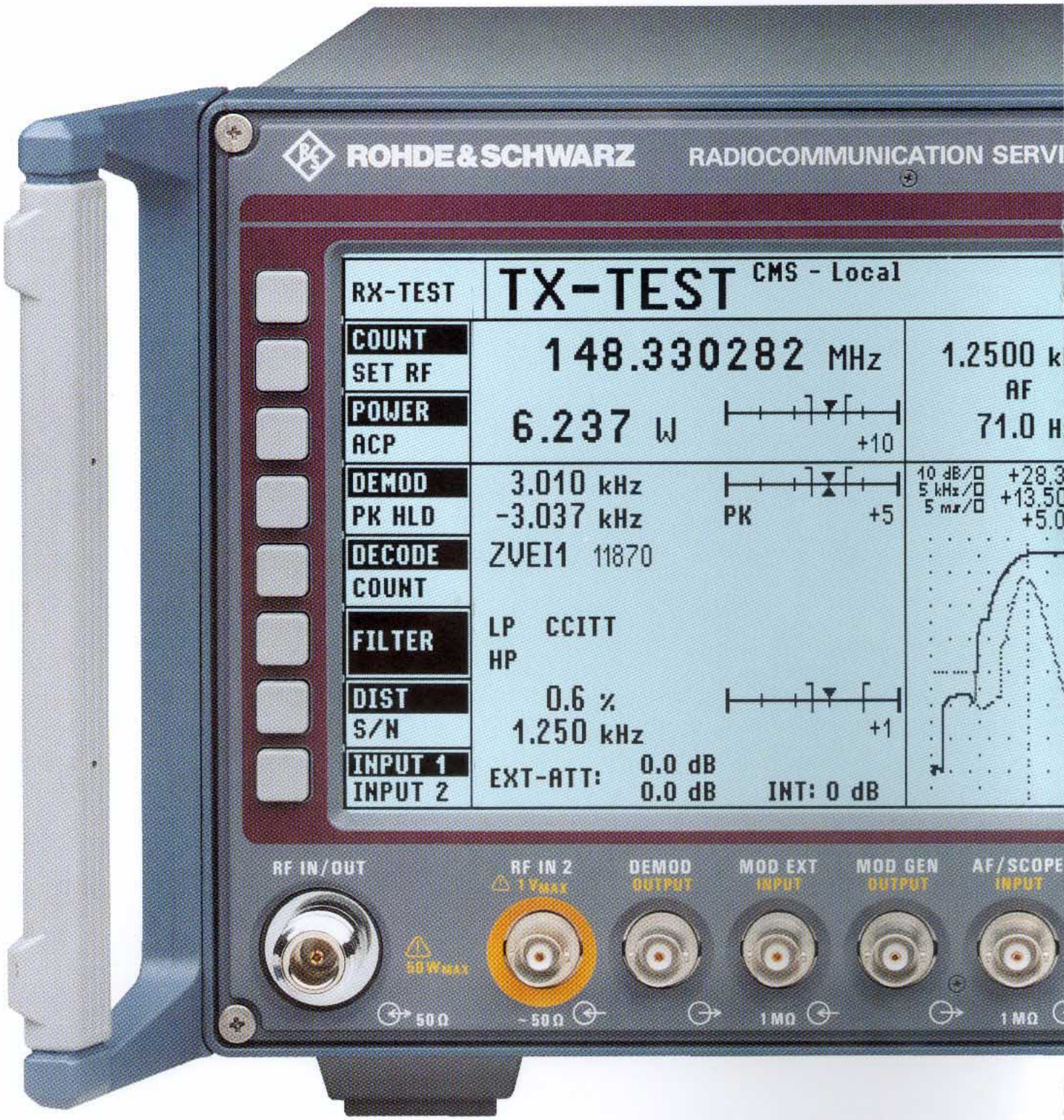


NMT is operated in several countries with different frequencies, duplex and channel spacings. The CMS takes account of this fact by allowing free selection and country-specific definition of each parameter. This basic setting is retained for further measurements after the instrument is switched off and on. 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.

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



The test configuration for **TACS/AMPS** phones is similar to other standards, but the signalling is completely different. However, the user need not refer to the specifications, but is conveniently menu-guided through the mobile phone test as with all other tests.

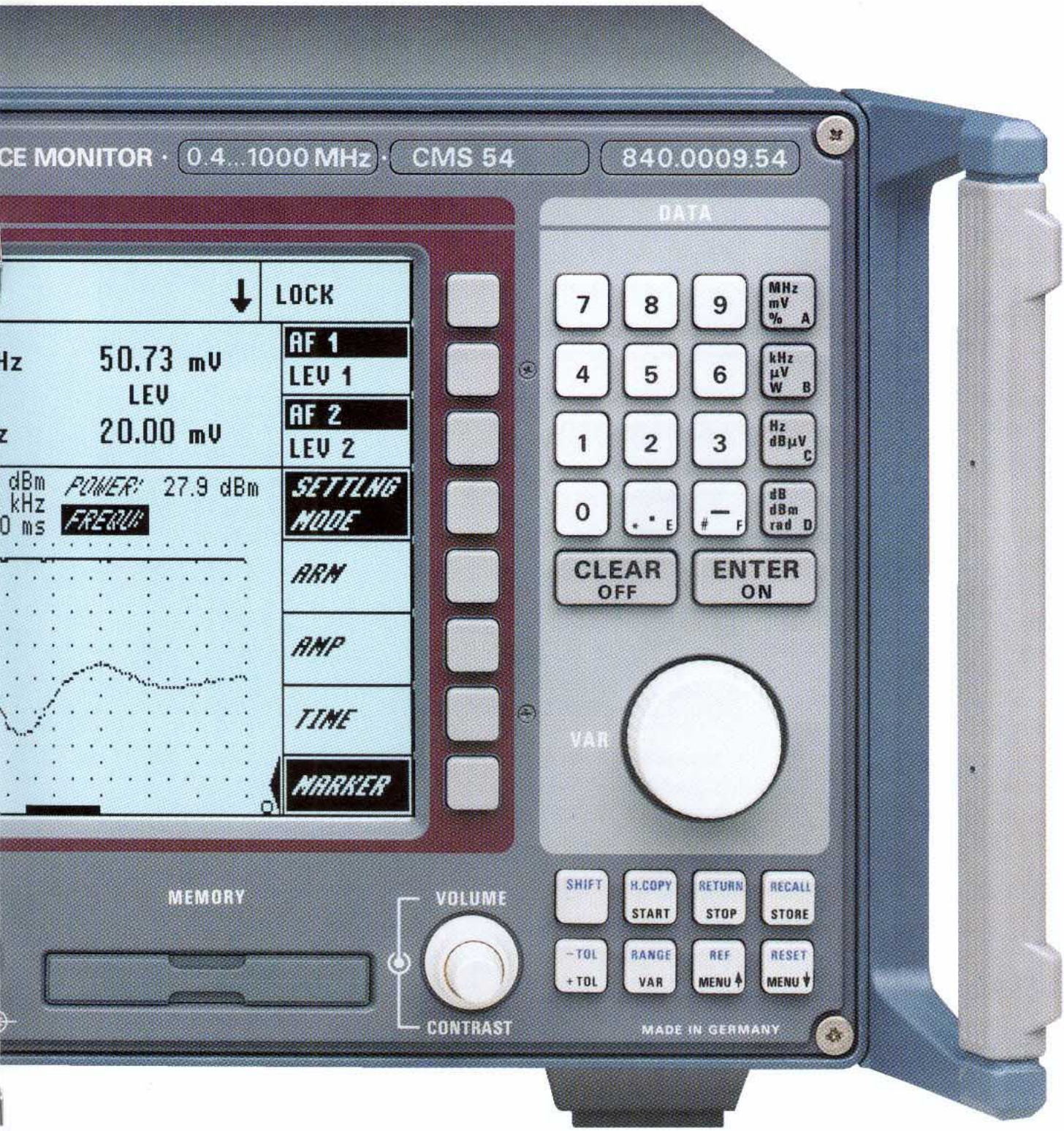


Unit in original size

All functions are clearly displayed; 16 softkeys allow direct access to individual parameters.

The large, backlit LCD screen provides clear and simultaneous readout of all test results, entries and functions.

Hardcopy of screen display, entry of tolerance and reference values are made at a keystroke.



Settings can be varied in selectable steps using the spinwheel.

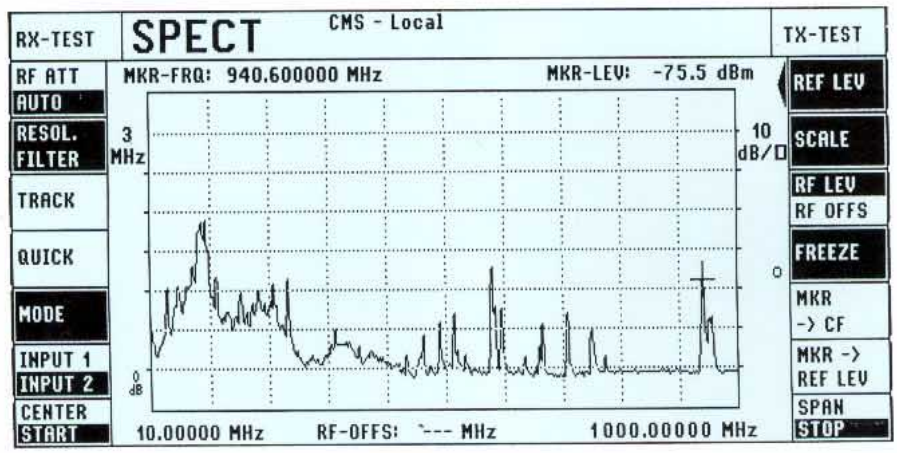
Programs, instrument settings and test results can be stored on memory cards.

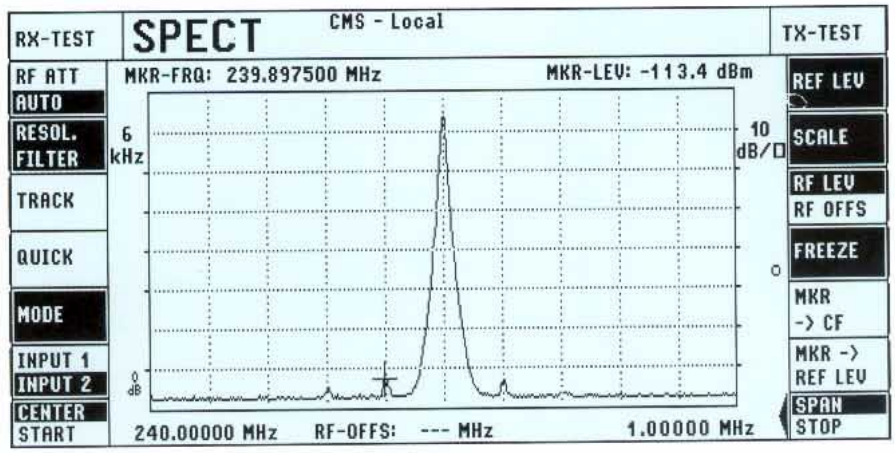
Additional inputs and outputs allow independent and versatile use of signal sources and test facilities.

CMS54 – the radio tester for the high-end service

For all fields of radiocommunications:

- Base-station testing and monitoring
- Development of RF modules for any application such as
  - radio remote control
  - cordless telephones
  - door-closing systems
- Production and installation of systems with high or low transmitter power, such as
  - high-power transmitters
  - radio telephones, handies
- Duplex modulation meter with any frequency offset
- Direct measurement of transmitter harmonic suppression

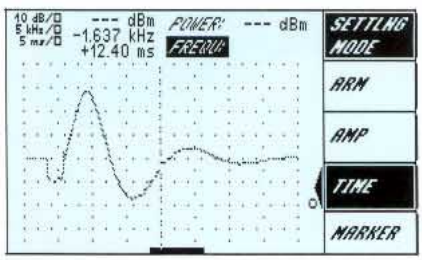




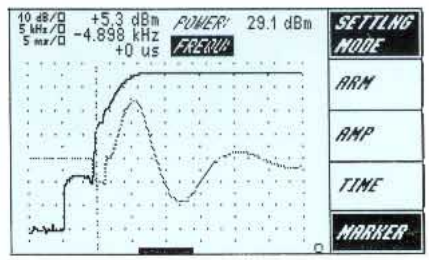
Full-span spectrum monitor

- Full-span spectrum display from 10 MHz to 1000 MHz
- Display range 80 dB
- Analysis bandwidths from 150 Hz (modulation spectra AM/FM/SSB) to 3 MHz
- Sensitivity down to –110 dBm
- Markers for synthesizer-accurate frequency and selective level measurements
- Reference marker
- Storage of spectrum displays and demodulation of displayed spectral lines (FREEZE & LISTEN)
- Quick mode for fast alignment of RF components
- Built-in tracking generator with selectable level and frequency offset; for measurements on filters, modules and antenna systems
- Cable fault finder

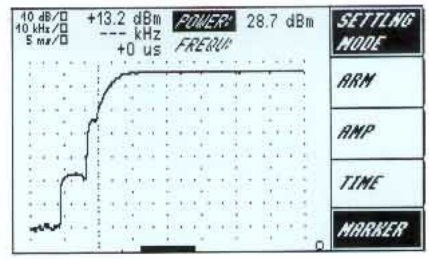
Transient frequency and power measurements



Display of frequency transients when switching transceivers on/off or when changing channel



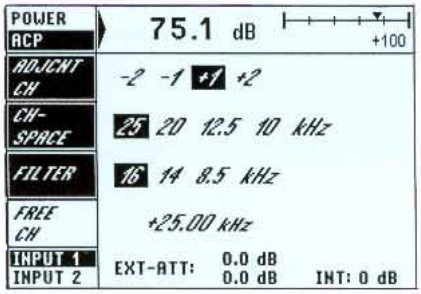
Combined display of power and frequency transients



Measurement of power levels upon switching a transmitter on and off or of power ramps (data transmission system)

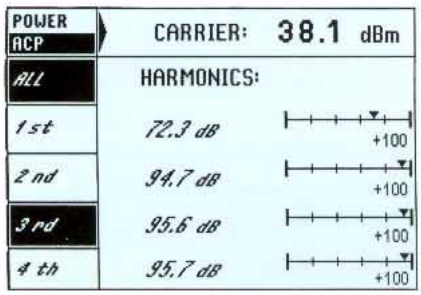
Adjacent-channel power measurement

Adjacent-channel power can be measured directly without external filters. The filters required to ETSI recommendations are integrated in the CMS.



Harmonic measurements

Harmonics in the range up to 1 GHz are measured at a keystroke and displayed in digital and analog form.



Additional data of CMS54

Specifications of Base Unit (pages 18 and 19) are fully applicable.

RF spectrum monitor (also for CMS57)

Frequency range	1 MHz to 1000 MHz
Span	0 (zero span) to 50 MHz; full span for frequency range 10MHz to 1000 MHz
Reference level	+47dB to -47 dBm (input 1)
Sensitivity	<-110 dBm (for resolution filter ≤6 kHz and reference level ≤-37 dBm at input 2, f ≥10 MHz)
Inherent spurious responses	<-50 dBc (for reference level >10 dBm and f >50 MHz)
Display dynamic range	>65 dB (for reference level >-7 dBm at input 1)
Scaling	2/5/10 dB/div
Display range	≤80 dB
Resolution filter (3-dB bandwidth)	150 Hz (for modulation analysis), 6/16/50/300 kHz/1/3 MHz (for full span), coupled to span
Error	<3 dB + resolution
Resolution	0.4 dB

Transient recorder (also for CMS57)

Measurement of power and frequency as a function of time with graphical display and selectable zoom

Time scale	50 µs/div to 1 s/div, max. recording time 40 s
Frequency transients	
RF measurement range	1 MHz to 1000 MHz
FM deviation measurement range	0 to ±100 kHz
Scaling	0.5 kHz to 50 kHz/div
Triggering	internal, automatic (frequency changes >8 kHz)
Power transients	
RF measurement range	1 MHz to 1000 MHz
Display dynamic range	60 dB (for 47 dBm at input 1)
Scaling	2/5/10/20 dB/div
Triggering	internal, automatic (power 10%)

Adjacent-channel power measurements (with CMS-B9 also for CMS57)

Filter conform to ETSI recommendation

Channel spacings	10/12.5/20/25 kHz and freely selectable up to 1 MHz
Dynamic range (CW, FM)	
25 kHz	70 dB
20 kHz	69 dB
12.5 kHz	68 dB
10 kHz	66 dB

Harmonic measurements (with CMS-B9 also for CMS57)

Display of 1st to 4th harmonic	
Max. harmonic frequency	1000 MHz
Dynamic range	>60 dB >90 dB in frequency range 26.965 MHz to 27.405 MHz (CB radio)

RF frequency counter (also for CMS57)

Frequency range	0.5 MHz to 1000 MHz (usable from 100 kHz, IF narrow)
Input level range (CW, FM)	
Input 1	0 to +47 dBm
Input 2	-40 dBm to +7 dBm

Transmitter measurement, 2nd RF input (also for CMS57)

Additional internal switch-selectable 0/24-dB attenuator pad for measurements with higher levels at input 2

CMS57 – the avionics specialist

The Radiocommunication Service Monitor CMS57 is the ideal radio tester for service and maintenance in the field of avionics. A built-in VOR/ILS signal generator generates all test signals for

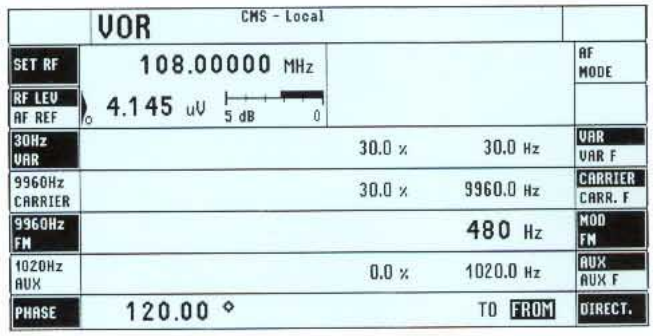
- **VOR** (VHF Omnidirectional Range),
- **ILS** (Instrument Landing System),
- **MB** (Marker Beacon),
- Autopilot.

The CMS57 features the same characteristics and optional extension facilities as the CMS52.

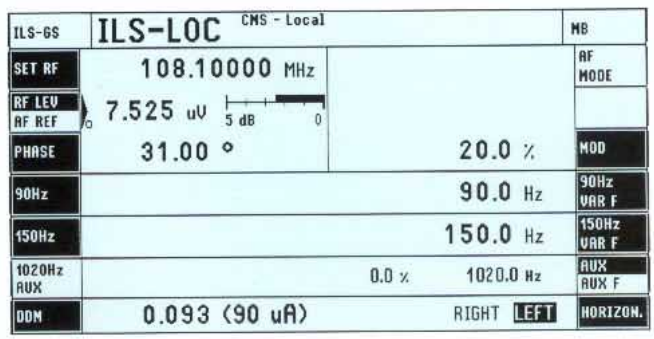
The VOR/ILS test signals are available as RF and AF signals at different outputs.

The RF is not limited to the defined receiving ranges, but can be user-selected for versatile applications (e.g. IF module testing). Since the VOR/ILS AF signal is provided separately, it can be fed into demodulators, filters or rectifiers of the receiver or be used as the modulation source of a second signal generator for use as a jammer in the adjacent channels.

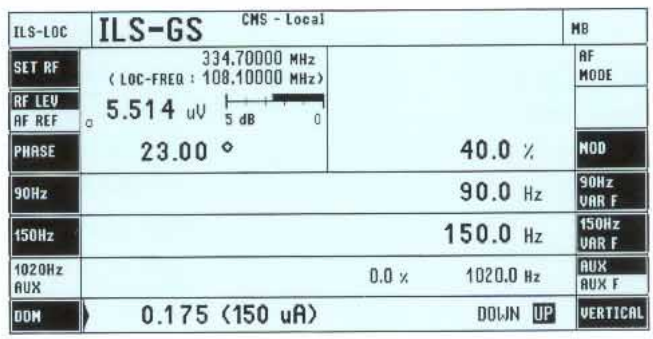
The CMS57 combines conventional radiocommunication and radionavigation measurement facilities so that avionics measurements can be performed by a single instrument. Typical



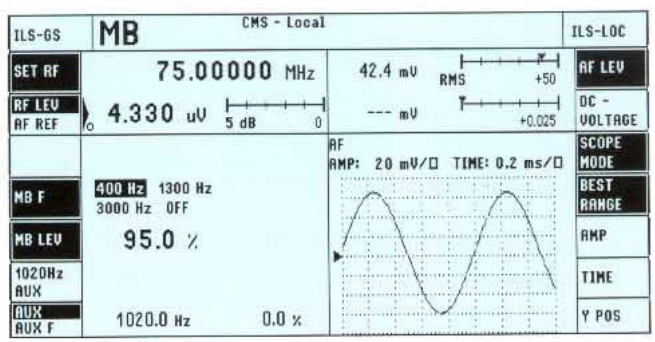
Frequencies and deviations adjustable over a wide range allow receiver testing in line with standards



Fine variation of the DDM value in steps of 0.001 DDM for ILS and of phase in steps of 0.01° for VOR ensure accurate adjustment of onboard monitor



The AF oscilloscope can be used in all operating modes, allowing for instance a simultaneous display of the signal demodulated by the device under test



A menu is also available for the generation of marker beacons

features such as selectivity and sensitivity of the VOR/ILS receiver can be checked. A second, switchable RF input together with the selective RF level meter and spectrum monitor meet all requirements even for measurements on frequency-converting modules. Parallel utilization of all capabilities offered results in additional advantages for VOR/ILS applications. The AF voltmeter and the oscilloscope are for instance simultaneously available for AF measurements.

The operating concept of the Radiocommunication Service Monitor CMS57 is so that only a few settings are required for testing all characteristics of VOR/ILS receivers.

Signal parameters are defined either by
- direct keyboard entry,
- fine variation via spinwheel

or
- recall of preset standard RF frequencies,
- fixed coupling of ILS glideslope and ILS localizer frequencies according to the specification,
- recall of preset test parameters like phase or DDM (Difference in Depth of Modulation).

By varying all test parameters an in-depth analysis of all functions is possible. In addition, a fast functional test may be carried out by simply recalling the standard settings to ARINC 578, 579.

Small size, low weight and battery operation enable the CMS57 to be used in the cockpit or outside the aircraft for fast go/nogo testing based on off-air measurements (RAMP test).

Specific data of CMS57

Specifications of Base Unit (pages 18 and 19) are fully applicable

VOR/ILS generator

	Range	Resolution	Error
VOR			
Phase RF output	0 to 360°	0.01°	typ. 0.05°
AF output	0 to 360°	0.01°	≤0.04°
9960-Hz carrier			
Modulation frequency	7.9 kHz to 12 kHz		
Amplitude modulation			
–128 dBm to –9 dBm	0 to 100%	0.1% AM	typ. <2% for 30% AM
–85 dBm to –45 dBm	0 to 100%	0.1% AM	<2% for 30% AM
FM deviation	384 Hz to 576 Hz	1 Hz	≤1 Hz
30-Hz VAR			
Modulation frequency	24 Hz to 36 Hz		
Amplitude modulation			
–128 dBm to –9 dBm	0 to 100%	0.1% AM	typ. <2% for 30% AM
–85 dBm to –45 dBm	0 to 100%	0.1% AM	<2% for 30% AM
1020-Hz AUX			
Modulation frequency	50 Hz to 20 kHz		
Amplitude modulation	0 to 100%	0.1% AM	≤3%, for 1020 Hz and 10% to 20% AM
ILS			
90-Hz and 150-Hz phase	0 to180°, referred to 150 Hz	0.01°	≤1°
90-Hz tone			
Modulation frequency	72 Hz to 108 Hz		
150-Hz tone			
Modulation frequency	120 Hz to 180 Hz		
1020-Hz tone (AUX)			
Modulation frequency	50 Hz to 20 kHz		
Amplitude modulation	0 to 100%	0.1% AM	≤3%, for 1020 Hz and 10% to 20% AM
ILS localizer			
Amplitude modulation			
–128dBm to –9 dBm	0 to 50%	0.1% AM	typ. <2% for 20% AM
–85dBm to –45 dBm	0 to 50%	0.1% AM	<2% for 20% AM
DDM[1] RF output	±0 to 0.4 DDM for 20% AM	0.001 DDM	
On-course error, –128 dBm to –9 dBm			<0.0004 DDM
Off-course error, –128 dBm to –9 dBm			<2% + 0.0004 DDM for |DDM| ≤0.2
DDM AF output	±0 to 0.4 DDM for 20% AM	0.001 DDM	≤3% + 0.0002 DDM for |DDM| ≤0.4, AF level 0.5 V to 5 V
ILS glideslope			
Amplitude modulation			
–128 dBm to –9 dBm	0 to 50%	0.1% AM	typ. <2% for 40% AM
–85 dBm to –45 dBm	0 to 50%	0.1% AM	<2% for 40% AM
DDM RF output	±0 to 0.8 DDM for 40% AM	0.001 DDM	
On-course error, –128 dBm to –9 dBm			<0.001 DDM
Off-course error, –128 dBm to –9 dBm			<2% + 0.001 DDM for |DDM| ≤0.4
DDM AF output	±0 to 0.8 DDM for 40% AM	0.001 DDM	≤3% + 0.002 DDM for |DDM| ≤0.4, AF level 0.5 V to 5 V
Marker beacon (MB)			
Modulation frequency	400, 1300, 3000 Hz		
Amplitude modulation	0 to 100%	0.1% AM	≤5% for 95% AM
1020-Hz tone (AUX)			
Modulation frequency	50 Hz to 20 kHz		
Amplitude modulation	0 to 100%	0.1% AM	same as base unit

[1] **D**ifference in **D**epth of **M**odulation; describes the modulation depth difference between the 90-Hz and the 150-Hz tone; |DDM| = |(90-Hz modulation in % – 150-Hz modulation in %)|/100%.

Options and their applications

Option cannot be used

Option already included in basic model

Extensions for basic model

	Option	Order No.	Specifications
OCXO Reference Oscillator For long-term stability	**CMS-B1**	**0840.9406.02**	see time base Aging 2x10^{-7}/year
OCXO Reference Oscillator For extremely high long-term stability	**CMS-B2**	**1001.6809.02**	Specs same as CMS-B1, except for aging ≤1x10^{-7}/year
Duplex Modulation Meter Allows operation of RF frequency counter and modulation meter independent of RF signal generator (two-port measurements, also on frequency-converting modules); provides tracking generator and cable fault finder	**CMS-B59**	**1032.0990.02** ~~CMS54~~	Specs see basic model, except residual FM (does not apply to CMS54, since CMS-B9 is already built-in) ≤10 Hz
Duplex Modulation Meter Same as CMS-B59, plus adjacent-channel power meter, harmonic measurements	**CMS-B9**	**0840.9506.02** ~~CMS50~~ CMS54	Specs see basic model, specs for ACP-meter and harmonic measurements please refer to page 13
10-MHz Reference Frequency Input/Output External synchronization for measuring systems	**CMS-B22**	**1001.6750.02**	Output TTL levels, Z_{out}≈50 Ω, f=10 MHz Input level >1.5 V_{pp}, Z_{in}≈50 Ω, f=10 MHz ± 500 Hz
100-W RF Power Meter Measurement of high RF input power	**CMS-B32**	**1001.7905.02**	Max. input power: 100 W for 3 min, then 10 min power off; continuous power: 80 W, max. output level and measurement sensitivity at input 1 reduced by 3 dB; additional error ≤0.15 dB (P >40 mW, AM=0%)
13-dBm Output	**CMS-B34**	**1032.1350.02**	Additional power output for off-air measurements
IEC/IEEE-Bus Interface	**CMS-B54**	**1032.0748.02** CMS54 CMS57	Optional for CMS50; interface to IEC625-1/IEEE488 with listener/talker function
Protection for Input 2	**CMS-B60**	**1075.5006.02** ~~CMS50~~	BNC connector with exchangeable fuse
Carrier Bag for CMS	**CMS-Z40**	**1065.5603.02**	Bag for basic unit CMS and accessories

Signalling units for models with Duplex Modulation Meter CMS-B9 or CMS-B59

	Option	Order No.	Specifications
Signalling Unit for Cellular Radio NMT450 (SIS), NMT450I, NMT900 (SIS), E-AMPS, E-TACS, J-TACS, TACS II, R 2000	**CMS-B53**	**1032.0890.02**	Simulation of base station for testing cellular mobile phones, e.g. call setup, call cleardown, channel and power change
POCSAG For CMS-B53	**CMS-B26**	**1031.9993.10**	Testing of POCSAG radiopaging receivers

Extensions in conjunction with control interfaces

	Option	Order No.	Specifications
300-Hz Lowpass Filter For CMS-B5/-B55; fast frequency and deviation measurement of subaudio tones with simultaneous audio modulation	**CMS-B33**	**1032.0290.02**	f_{cutoff}=200 Hz, attenuation >50 dB for frequencies above 300 Hz
Adapter for VSWR Measurements In conjunction with CMS-B5 or -B39	**CMS-Z37**[1)]	**1065.4907.02**	Connection of Insertion Units NAS-Z1, -Z3, -Z5, -Z6, -Z7 with direct reading of VSWR as well as forward and reflected power

[1)] CMS-B5 or CMS-B39 required for Insertion Units NAS-Z1/-Z3/-Z5/-Z6/-Z7.

Optional Control Interfaces [1)]

Order No.	CMS-B5 0841.0502.10	CMS-B55 1032.0790.02	CMS-B20 0841.1209.02	CMS-B39 1032.0090.02	Specifications
DTMF Decoder	•	•	•	•	Decoding of DTMF dual tones and VDEW direct dialling
CCITT Filter	•	•	•	•	
C-Message Filter	–	–	–	–	
Centronics Interface	•	•	•	•	Direct printer connection
Relays	8	–	–	4	Switching relays with max. 1 W switching power, V_{max}=30 V, I_{max}=0.1 A
TTL Input/Output	12	–	–	8	Outputs: 25 mA driver power
DC Ammeter/Voltmeter, floating	–	–	•	–	Voltage measurement Range 0 to ±30 V Resolution 0.1 mV to 100 mV Error ±1% + resolution Current measurement Range 0 to ±10 A Resolution 1mA to 100 mA Error ≤4% ± 3 mA
600-Ω AF Transformers	–	–	–	•	Output impedance of AF generator and input impedance of AF voltmeter switchable to 600 Ω ± 10% Frequency range: 100 Hz to 6 kHz Output level: 10 µV to 2.5 V Max. output current: 4 mA
300-Hz Lowpass Filter	CMS-B33	CMS-B33	–	–	see option CMS-B33
Adapter for VSWR Measurements	CMS-Z37	–	–	CMS-Z37	see option CMS-Z37

[1)] Choice of one option.

Specifications (Base Unit)

Valid for all models; values in **bold** enclosed by brackets refer to CMS50

Timebase

Standard

Temperature effect 0 to 35°C	≤1 x 10^{-6}
Aging	≤1 x 10^{-7}/day ≤1 x 10^{-6} /month ≤2 x 10^{-6} /year

Options CMS-B1 and -B2

Temperature effect 0 to 50°C	≤1 x 10^{-7}
Aging	≤5 x 10^{-9}/day after 30 days of operation ≤2 x 10^{-7}/year (CMS-B2: ≤1 x 10^{-7})
Warmup time (25°C)	approx. 10 min

Receiver measurements

Signal generator

Frequency range	0.4 MHz to 1000 MHz
CMS54, CMS57	usable from 100 kHz
Frequency resolution	10 Hz
Frequency error	same as timebase
Level	
FM, φM, CW	–134 dBm to 0 dBm
AM	–134 dBm to –3 dBm (depending on modulation depth)
Level resolution	0.1 dB
Fine variation of level	
FM, φM, CW	0 to –19.9 dB, non-interrupting
AM	0 to –4.9 dB, non-interrupting
Level error	≤2 dB (for levels –128 dBm to –3 dBm, f >1 MHz)[1]
Harmonics	≤–25 dBc
Nonharmonics	≤–50 dBc (>5 kHz from carrier, level –3 dBm)
Residual AM (CCITT, RMS)	≤0.03% **(≤0.1%)**
Residual FM (CCITT, RMS)	
0.4 to 250, 500 to 1000 MHz	≤10 Hz **(≤10 Hz)**
250 MHz to 500 MHz	≤5 Hz **(≤10 Hz)**
Phase noise	≤–110 dBc/Hz (20 kHz from carrier)

Modulation

Frequency range	0.4 MHz to 1000 MHz
AM modulation depth	0 to 99%
Resolution	0.5%
Mod. frequency range	DC to 10 kHz, **(15 Hz to 10 kHz)** f <8 MHz; DC to 20 kHz, f ≥8 MHz
Mod. distortion (m <0.8)[1]	≤2%, f_{AF} = 1 kHz
Mod. error (m <0.8)[1]	≤5% + resolution + residual AM, f_{AF} = 300 Hz to 3 kHz
FM deviation	0 to 100 kHz **(50 Hz to 50 kHz)** (f_{RF} = 250 to 500 MHz, 0 to 50 kHz)
Resolution	1 Hz, Δf <100 Hz 1%, Δf ≥100 Hz
Mod. frequency range	20 Hz to 20 kHz (suitable for POCSAG)
Mod. distortion	≤1% (f_{AF} = 1 kHz; Δf = 10 kHz)
Mod. error	≤5% + resolution + residual FM
φM deviation (internal)	0 to 10 rad (f_{RF} = 250 to 500 MHz, 0 to 5 rad)
Resolution	1 mrad, Δφ <0.1 rad 1%, Δφ ≥0.1 rad
Mod. frequency range	100 Hz to 6 kHz
Mod. distortion	≤1% (f_{AF} = 1 kHz; Δφ = 1 rad)
Mod. error	≤5% + resolution + residual φM
Modulation modes	internal (single-tone/two-tone), external, internal + external

AF voltmeter

Frequency range	50 Hz to 20 kHz
Measurement range	0.1 mV to 30 V
Resolution	100 µV, V <10 mV 1%, V ≥10 mV
Error[2]	<5% + resolution
Input impedance	approx. 1 MΩ
Distortion meter, SINAD meter, AF frequency counter	see transmitter and receiver measurements

Transmitter measurements

RF power meter

Frequency range	1.5 MHz to 1000 MHz
Measurement range	5 mW to 50 W[3] (100 W optionally)
Error (P >20 mW, AM = 0%)	≤0.4 dB of rdg + resolution
Resolution	1 mW, P <100 mW 1%, P ≥100 mW
Selective level measurement	in frequency range 1 MHz to 1000 MHz
Level range	–60 dBm to +47 dBm without weighting filter, –80dBm to +47 dBm with 2-kHz resonance filter

RF frequency counter

Frequency range	0.5 MHz to 1000 MHz
Input level range	5 mW to 50 W[3]
Resolution	10 Hz, 1 Hz
Error	same as timebase + resolution

Frequency deviation meter

Operating modes	+PK, –PK, ±PK/2, PK HOLD, RMS, RMS√2
Input level range	5 mW to 50 W[3]
RF frequency range	1.5 MHz to 1000 MHz
Deviation measurement range	0 to 100 kHz **(0 to 50 kHz)**
AF frequency range	20 to 20 kHz **(20 to 15 kHz)** (DC-coupled at demodulator output)
Resolution	1 Hz, Δf <1 kHz 1%, Δf ≥1 kHz
Residual FM (CCITT, RMS)	
0.4 to 250, 500 to 1000 MHz	≤10 Hz
250MHz to 500 MHz	≤5 Hz (≤**10 Hz**)
Error[2]	≤5% + resolution + residual FM

Phase deviation meter

Operating modes	+PK, –PK, ±PK/2, RMS, RMS√2
Input level range	5 mW to 50 W[3]
RF frequency range	1.5 MHz to 1000 MHz
Phase deviation measurement range	0.001 rad to 5 rad
AF frequency range	300 Hz to 6 kHz
Resolution	0.001 rad, Δφ ≤0.1 rad 1%, Δφ >0.1 rad
Error[2]	same as frequency deviation meter + 2% frequency response

AM depth meter

Operating modes	+PK, –PK, ±PK/2, RMS, RMS√2
Input level range	20 mW to 50 W[3] (PEP)
RF frequency range	1.5 MHz to 1000 MHz
AM depth measurement range	0.01% to 99%
AF frequency range	50 Hz to 20 kHz **(50 Hz to 10 kHz)**
Resolution	0.01%, m <0.1 0.1%, m ≥0.1
Residual AM (CCITT, RMS)	≤0.03%
Error (m ≤0.8)[2]	≤7% + resolution + residual AM (f_{AF} = 0.3 to 3 kHz)
Distortion meter, SINAD meter, AF frequency counter	see transmitter and receiver measurements

RF spectrum monitor for CMS50 (for CMS54/CMS57 see page 13)

Frequency range	1 MHz to 1000 MHz
Reference level	+47dBm to –47 dBm (input 1)
Display dynamic range	>60 dB (for reference level >–7 dBm at input 1)
Span	0 (zero span) to 50 MHz
Filters (3-dB bandwidth)	150 Hz, 6/16/50/300 kHz (coupled to span)
Error	<3 dB + resolution
Resolution	0.4 dB

Tracking generator (with CMS-B59/-B9)

Frequency range	400 kHz to 1000 MHz
Reference level	–27 dBm to –67 dBm
Display dynamic range	50 dB (1 MHz to 500 MHz) 45 dB (500 MHz to 1000 MHz)
Span	0 (zero span) to full span
Filters (3-dB bandwidth)	150 Hz, 6/16/50/300 kHz, 1/3 MHz (coupled to span)
Error	<3 dB (relative measurement <0.5 dB)
Resolution	0.4 dB
Output level	0 to –128 dBm
Frequency offset	0 to ±999 MHz (depending on span and center frequency)

Transmitter measurements at 2nd RF input

Measurement of RF frequency, modulation (AM, FM, φM), modulation frequency and RF spectrum (level) of small RF signals, e.g. in off-air or module measurements, for input levels from approximately

RF frequency counter	30 µV (select. counter with presetting)
CMS54, CMS57	–40 dBm to +7 dBm (without presetting)
Modulation meter	5 µV (IF narrow)
	1 µV (IF narrow, select. measurement)
Selective level measurement	–75 dBm to –35 dBm without weighting filter, –100 to –35 dBm with 2-kHz resonance filter

Transmitter and receiver measurements

Modulation generator I and II

Frequency range	20 Hz to 30 kHz (usable from 1 Hz) **(20 Hz to 20 kHz)**
Frequency resolution	0.1 Hz
Error	same as timebase + $^1/_2$ resolution
Output level range	10 µV to 5 V, f_{AF}=20 Hz to 20 kHz
	10 µV to 2.5 V, f_{AF}=20 Hz to 30 kHz
Resolution	10 µV, V <1 mV
	1%, V ≥1 mV
Error	≤5%, V >1 mV
Output impedance	≤4 Ω
Max. output current (peak)	20 mA
Distortion	≤0.5%

Distortion meter

Frequency	100 Hz to 5 kHz **(100 Hz to 3 kHz)** (in 10-Hz steps)
Input level range	100 mV to 30 V
Measurement range	0.1% to 50%
Resolution	0.1%
Inherent distortion	≤0.5%
Weighting bandwidth	≤12 kHz
Error	≤5% + inherent distortion

SINAD meter

Frequency	100 Hz to 5 kHz **(1 kHz ±10 Hz)** ±10 Hz
Measurement range	1 dB to 46 dB
Input level range	100 mV to 30 V
Resolution	0.1 dB
Weighting bandwidth	≤12 kHz
Error	≤1 dB + inherent distortion

AF frequency counter

Operating modes	demodulation, AF, beat (frequency offset), external
Frequency range	20 Hz to 500 kHz **(20 Hz to 20 kHz)** (superimposed RF)
Input level range	10 mV to 30 V, f <20 kHz
Resolution	1 Hz/0.1 Hz
Error	same as timebase + resolution

Oscilloscope

Bandwidth	DC: DC to 20 kHz
	AC: 10 Hz to 20 kHz
Horizontal deflection	20 ms/div to 0.1 ms/div
Vertical deflection	scaled in kHz (FM), rad (φM), % (AM), mV/V (AF)
Input level range	0 V_p to 40 V_p
Input impedance	approx. 1 MΩ

AF filters

Highpass	f_{cutoff} = 300 Hz, attenuation at 200 Hz typ. 40 dB
Lowpass	f_{cutoff} = 3.4 kHz, attenuation at 10 kHz typ. 40 dB
Bandpass broadband	highpass + lowpass
narrowband	50 Hz to 5 kHz **(100 Hz to 3 kHz)** in 10-Hz steps, attenuation typ. 40 dB for 0.8f and 1.2f
Notch filter	100 Hz to 5 kHz **(100 Hz to 3 kHz)** in 10-Hz steps, attenuation typ. 40 dB
CCITT filter	see options CMS-B5 or CMS-B20

Selective call coder/decoder

Tone sequences	ZVEI1/ZVEI2/CCIR/EIA/EEA/ EURO/ NATEL/CCITT/VDEW/ DTMF/user-defined sequences (DTMF decoding see control interface)
CDCSS coder	entry of 3-digit code number of mobile radio, setting the times for turn-off code and RF level drop, setting the data deviation
Audio monitor (loudspeaker)	demodulated signal, AF signal, beat (frequency offset)

General data

IEC/IEEE bus (optional for CMS50)	interface to IEC 625-1/IEEE 488 with listener/talker function
Rated and operating temperature range	0 to +50°C
Storage temperature range	–40°C to +70°C
Environmental resistance	
Temperature	complies with IEC 68-2-1 and IEC 68-2-2
Climatic (damp heat)	+25°C/+40°C cyclically with 95% rel. humidity; complies with IEC 68-2-30
Mechanical resistance	
Sinusoidal vibration	5 Hz to 150 Hz, max. 2 g at 55 Hz, 0.5 g at 55Hz to 150 Hz
Standards complied with	IEC 68-2-6 and IEC 1010-1 as well as MIL-T-28800D class 5
Random vibration	10 Hz to 300 Hz, acceleration 1.2 g rms
Shock	40 g shock spectrum
Standards complied with	MIL-STD-810C and MIL-T-28800D class 3 and 5
EMC	complies with EMC directive of EU (89/336/EEC) and German EMC regulations
Safety	complies with EN 61010-1
Power supply	(100/120/220/240) V AC ±10%, 47 Hz to 420 Hz or 11 V to 32 V DC (50 W)
Dimensions (W x H x D)	320 mm x 175 mm x 375 mm (12.6" x 6.9" x 14.8")
Screen size	approx. 210 mm x 100 mm (9")
Weight	approx. 13 kg (28.6 lbs) without options
	approx. 15 kg (33 lbs) with options

Ordering information

Radiocommunication Service Monitor

CMS50	0840.0009.50	
CMS54	0840.0009.54	
CMS57	0840.0009.57	
Accessories supplied	power cable, spare fuses, manual	
Options	see pages 16 and 17	
Recommended extras		
Memory Card 32 Kbyte	CMS-Z1	0841.1609.02
128 Kbyte	CMS-Z2	0841.1509.02
19" Adapter	ZZA-99	0839.5775.00
Transit Case	ZZK-011	1013.9543.00
Service Manual		0840.8616.24
Carrier Bag	CMS-Z40	1065.5603.02

[1]) Fine variation of level 0 dB.
[2]) Without weighting filters.
[3]) Input level max. 30 W for any RF output level, max. 50 W for RF output level <–26 dBm.

Certified Environmental System
ISO 14001
REG. NO 1954

Certified Quality System
ISO 9001
DQS REG. NO 1954

ROHDE&SCHWARZ

ROHDE&SCHWARZ GmbH & Co. KG · Mühldorfstraße 15 · 81671 München · Germany · P.O.B. 80 14 69 · 81614 München · Germany
Telephone +49 89 41 29-0 · www.rohde-schwarz.com · CustomerSupport: Tel. +49 1805 12 42 42, Fax +49 89 41 29-13777, E-mail: CustomerSupport@rohde-schwarz.com

PD 0757.1031.24 · Radiocommunication Service Monitor CMS · Trade names are trademarks of the owners · Subject to change · Data without tolerances: typical values

Printed in Germany 0302 (Bi bb)