



Version  
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## R&S® CMS Radiocommunication Service Monitor

Radio testers for service, production, and development

- ◆ Frequency range from 0.4 MHz to 1000 MHz
- ◆ Radio tester family including two 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 signaling
- ◆ Simultaneous display of settings and results
- ◆ Manual and automatic measurements
- ◆ Tracking generator
- ◆ Spectrum monitor
- ◆ Stationary and mobile use
- ◆ Cable fault finder



**ROHDE & SCHWARZ**

# Two radio tester models to suit every application



The R&S®CMS radiocommunication service monitor is the ideal radio tester for use in **service, maintenance, and test departments**. It is suitable for all transceivers using AM, FM or,  $\phi$ M as well as SSB.

Optional extensions enable the R&S®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 R&S®CMS with its extensive test facilities always provides a valuable service.

The R&S®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.

## R&S®CMS54 The high-end tester for demanding requirements

- ◆ Transmitter and receiver testing
- ◆ 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

## R&S®CMS57 The specialist for avionics

- ◆ Transmitter and receiver testing
- ◆ 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

## 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 R&S®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 R&S®CMS can also be integrated into larger test systems via the IEC/IEEE bus, which results in short measurement times in pre- and final testing.

### ... on-site

The R&S®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 due 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 R&S®CMS offers great benefits to the development engineer: In a minimum of space it combines RF and AF generators as well as analyzers with high accuracy and wide dynamic range. The R&S®CMS54 in particular 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.

## R&S®CMS

### A test set replacing many individual measuring instruments

Due to the comprehensive standard configuration of the individual R&S®CMS models and the optional extensions tailored to specific applications, additional external measuring instruments are not required.

#### Signal sources

- ◆ RF synthesizer from 0.4 MHz to 1000 MHz, resolution 10 Hz, with AM, FM,  $\phi$ M, 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

#### 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 that also allow modulation analysis (AM, FM, SSB)
- ◆ Tracking generator in frequency range from 400 kHz to 1000 MHz
- ◆ Adjacent-channel power meter with standard ETSI filters
- ◆ Modulation meter for AM, FM, and  $\phi$ M; detectors: +PK, -PK, PK HOLD,  $\pm$ PK/2, RMS, RMS  $\sqrt{2}$
- ◆ 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 in line with 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 sub-audio tones

#### Other facilities

- ◆ Second RF input with high sensitivity for off-air measurements, can be used independently for module testing
- ◆ Connector for battery
- ◆ 13 dBm RF output for off-air measurements
- ◆ Memory for storing complete instrument setups
- ◆ Carrying bag

### Automatic tests

Automatic test routines are indispensable for high throughput and reproducible results in service and production: In the learn mode, the R&S®CMS radio-communication service monitor stores all manual settings and measurements and produces from them ready-to-start automatic test routines.

The user does not require any programming knowledge or have to 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.

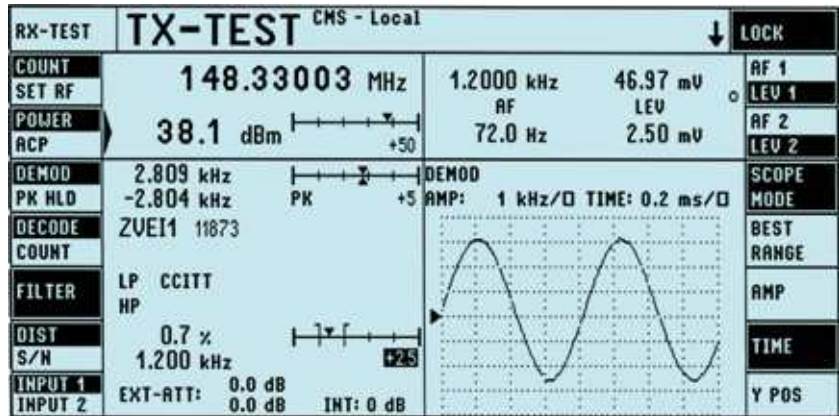
The test report format may be user-specified and can be clearly structured by transferring control characters to the printer, such as blank line, paragraph, and boldface.

# R&S®CMS user prompting ...

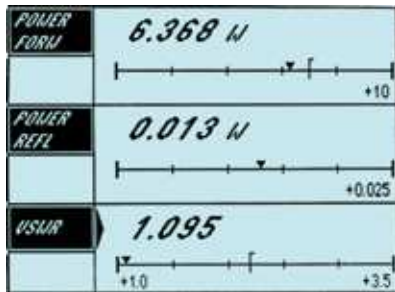
The user interface, which shows all important measurements and allows entry of the necessary parameters, is optimized for each application.

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

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



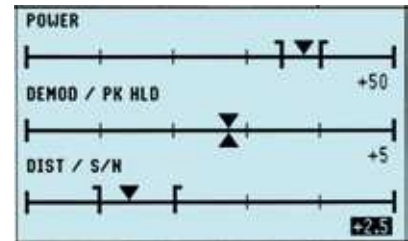
Transmitter test: RF measurements, evaluation of demodulated signals, and setting of modulation generators



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

PREV	No	Id	T[ms]	Frq[Hz]	Devi[%]
00	1	69	1060.1	0.0	
01	1	67	2596.7	-0.2	
02	8	70	1996.4	-0.2	
03	7	72	1828.4	-0.1	
04	0	72	2400.3	0.0	

Contents, duration, and frequency deviation of selective call signals

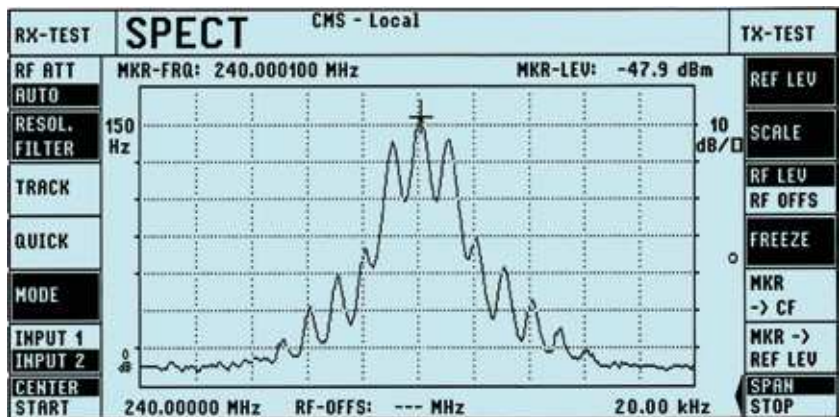


Zoom function for alignment

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.

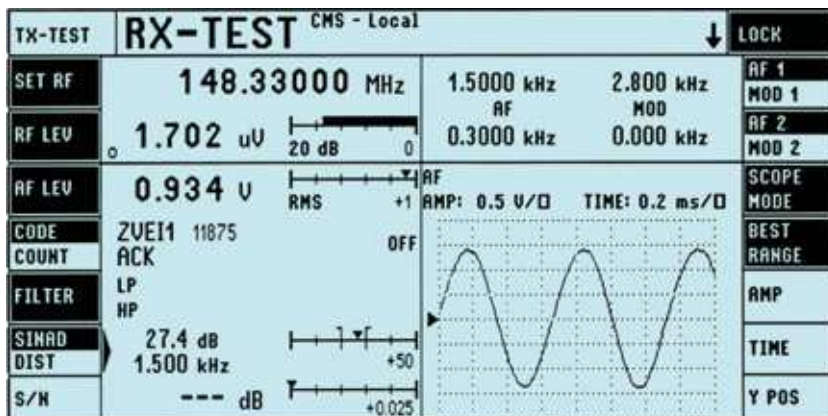
Instrument settings and frequencies can be saved in an internal nonvolatile memory and recalled as required.



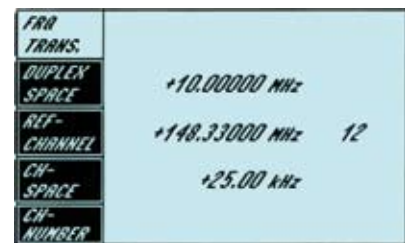
Spectrum monitor/tracking generator: 150 Hz filter allowing direct modulation analysis for AM, FM, and SSB



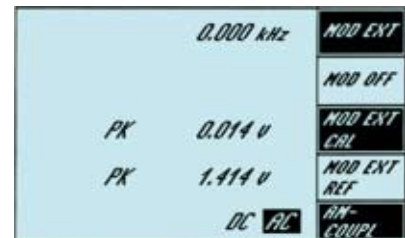
## ... all settings and test parameters at a glance



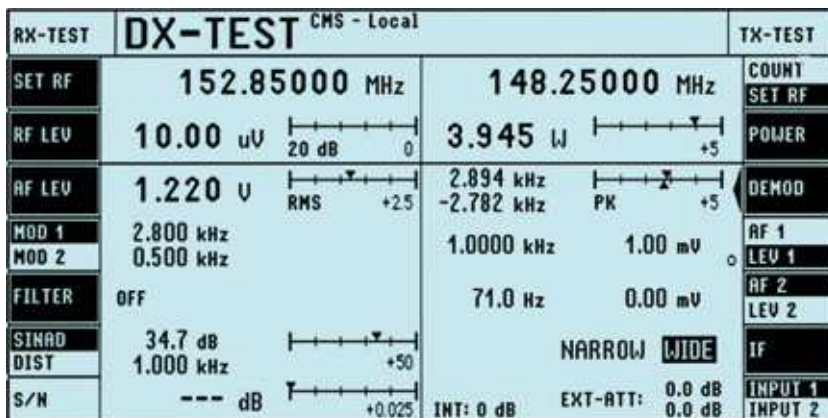
Receiver test: generator settings, evaluation of receiver AF, and carrier modulation setting



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



Duplex test: transmitter and receiver parameters at a glance; efficient measurements on duplex radio equipment and modules



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

## Signaling

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

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

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

The following standards can be simulated:

- ◆ Selective call in line with all international standards
- ◆ DTMF coding and decoding
- ◆ CDCSS (continuous digital coded squelch system)

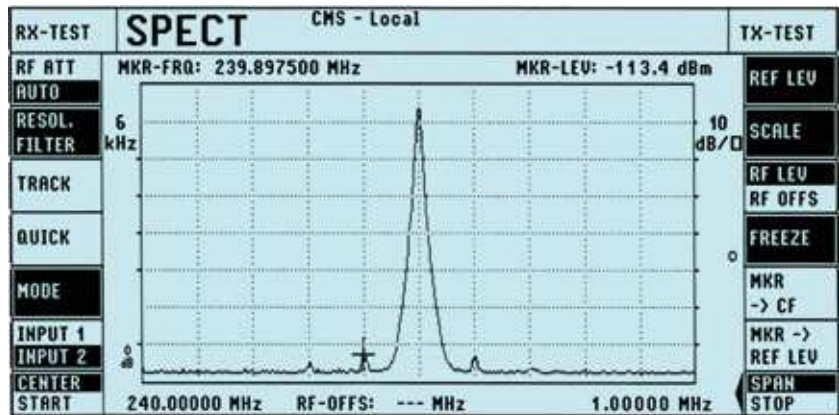
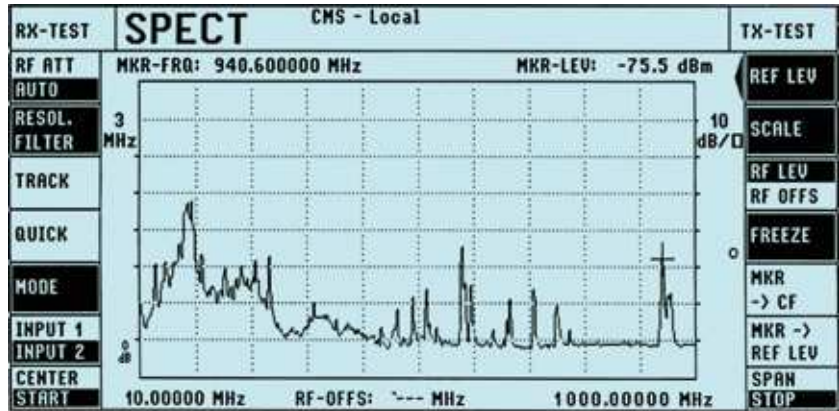
# R&S®CMS54 – the radio tester for the high-end service

## 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, mobile phones
- ◆ Duplex modulation meter with any frequency offset
- ◆ Direct measurement of transmitter harmonic suppression

## Full-span spectrum monitor

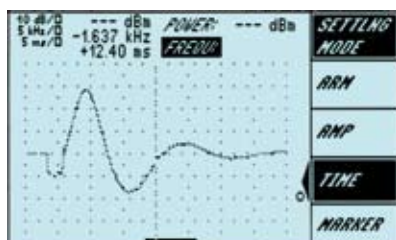
- ◆ Full-span spectrum display from 10 MHz to 1000 MHz
- ◆ Display range 80 dB
- ◆ Analysis bandwidths from 150 Hz (modulation spectra AM/FM/SSB) to 3 MHz
- ◆ Sensitivity down to -110 dBm
- ◆ Markers for synthesizer-accurate frequency measurements and selective level measurements
- ◆ Reference marker



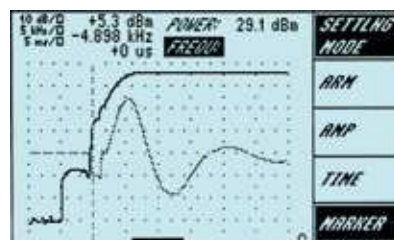
- ◆ Storage of spectrum displays and demodulation of displayed spectral lines (FREEZE & LISTEN)
- ◆ Quick mode for fast alignment of RF components
- ◆ Built-in tracking generator with selectable level and frequency offset; for measurements on filters, modules, and antenna systems
- ◆ Cable fault finder

## Transient frequency and power measurements

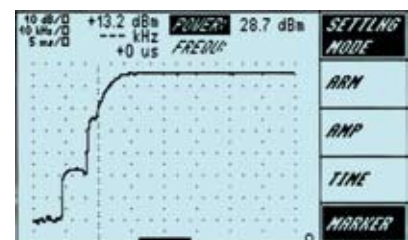
Display of frequency transients when switching transceivers on/off or when changing channel



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 in line with ETSI recommendations are integrated in the R&S®CMS.

### Harmonic measurements

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

### Additional data of the R&S®CMS54

Specifications of Base Unit (pages 13 and 14) are fully applicable.

#### RF spectrum monitor (also for R&S®CMS57)

Frequency range	1 MHz to 1000 MHz
Span	0 Hz (zero span) to 50 MHz; full span for frequency range 10 MHz to 1000 MHz
Reference level	+47 dB to -47 dBm (input 1)
Sensitivity	<-110 dBm (for resolution filter ≤6 kHz and reference level ≤-37 dBm at input 2, f ≥ 10 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

#### Tracking generator (with R&S®CMS-B9 also for the R&S®CMS57)

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 dBm to -128 dBm
Frequency offset	0 Hz to ±999 MHz (depending on span and center frequency)

#### Transient recorder (also for the R&S®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
<b>Frequency transients</b>	
RF measurement range	1 MHz to 1000 MHz
FM deviation measurement range	0 kHz to ±100 kHz
Scaling	0.5 kHz to 50 kHz/div
Triggering	internal, automatic (frequency changes >8 kHz)
<b>Power transients</b>	
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 the R&S®CMS-B9 also for the R&S®CMS57)

Filter ETSI recommendation

Channel spacings	10/12.5/20/25 kHz and user selectable up to 1 MHz
<b>Frequency transients</b>	
Dynamic range (CW, FM)	1 MHz to 1000 MHz
25 kHz	70 dB
20 kHz	69 dB
12.5 kHz	68 dB
10 kHz	66 dB

#### Harmonic measurements (with the R&S®CMS-B9 also for the R&S®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)

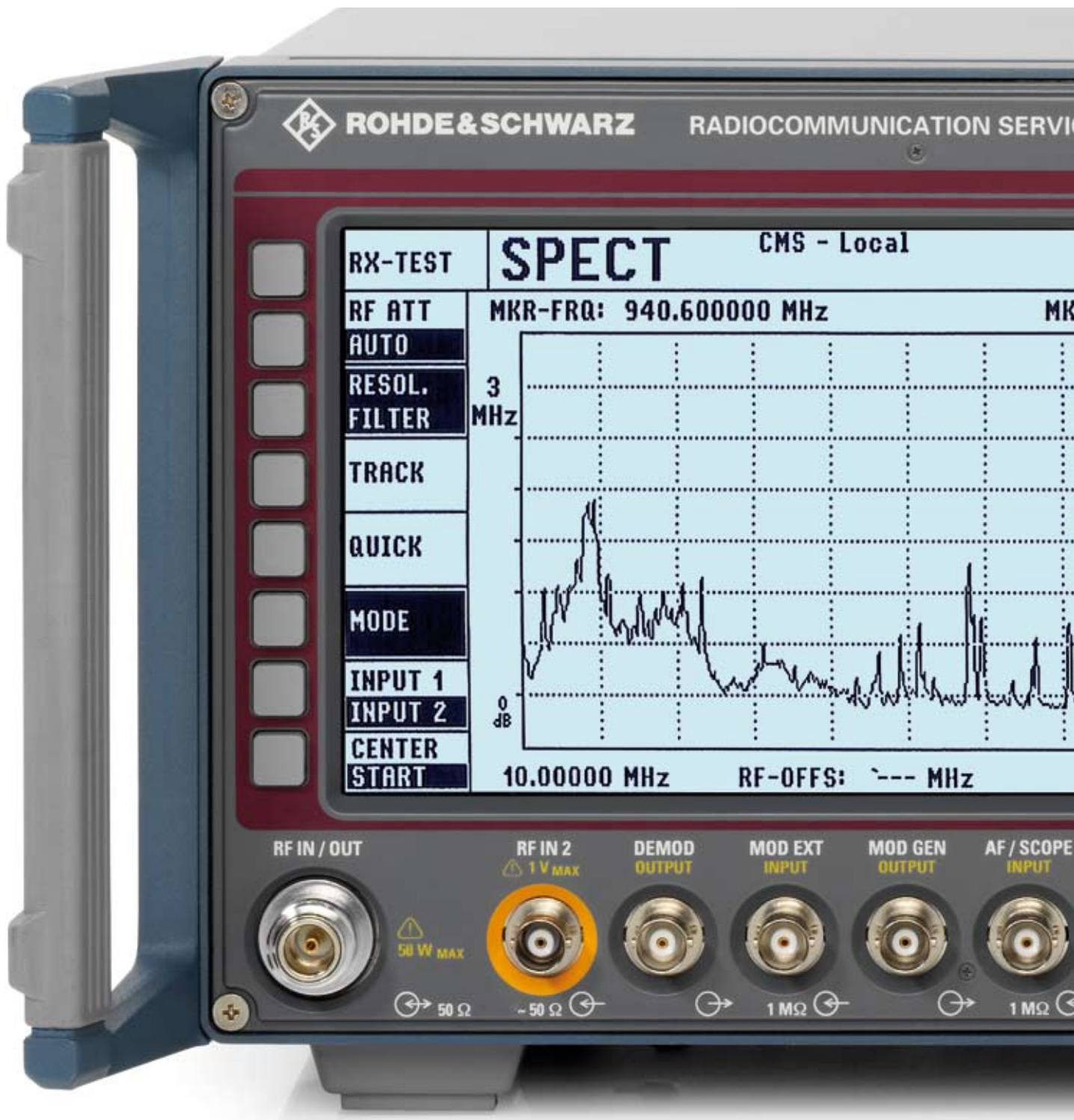
#### RF frequency counter (also for the R&S®CMS57)

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

#### Transmitter measurement, 2nd RF input (also for the R&S®CMS57)

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

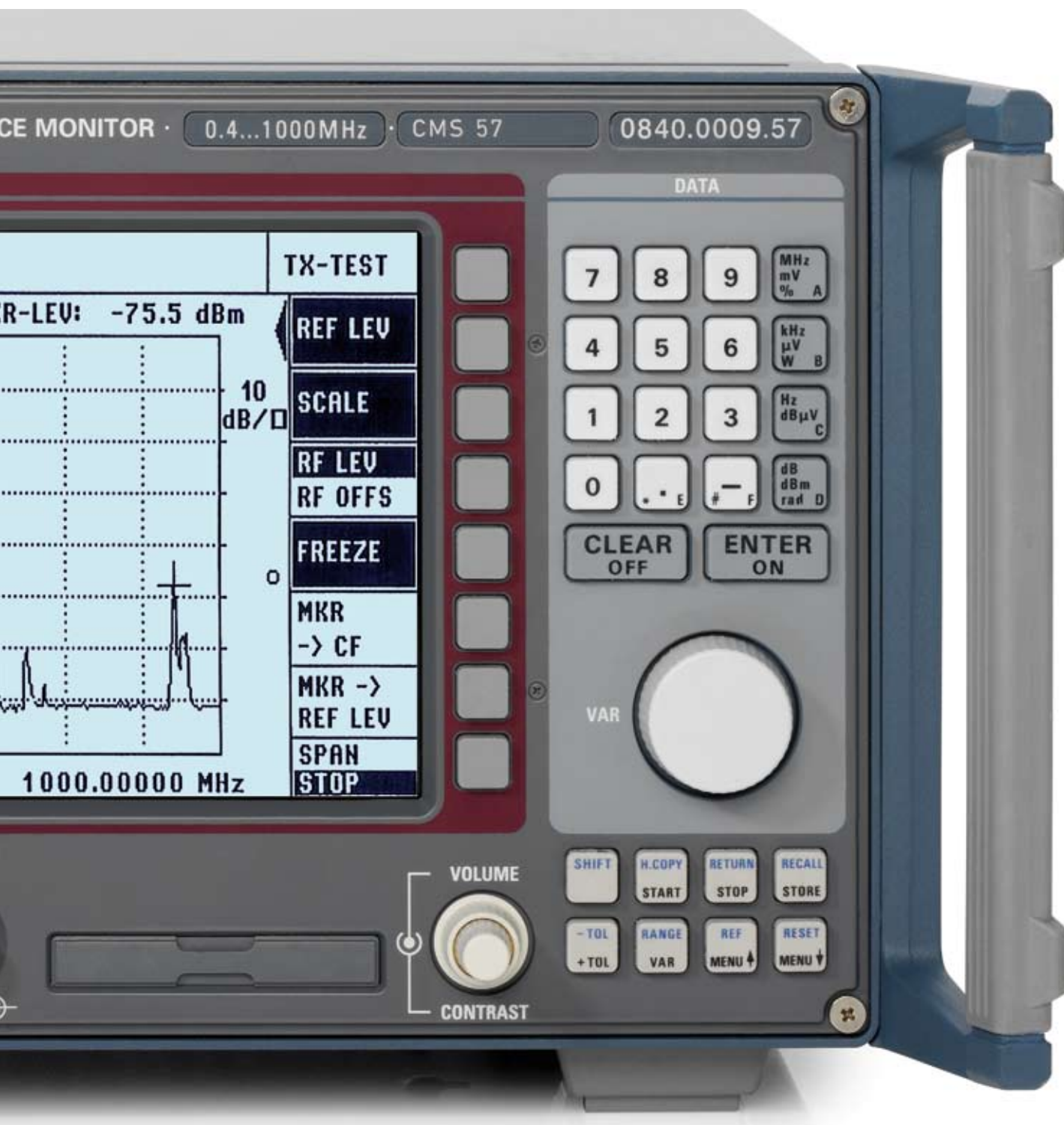




*Unit in original size*

- ◆ 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 rotary knob
- ◆ 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

# R&S®CMS57 – the avionics specialist

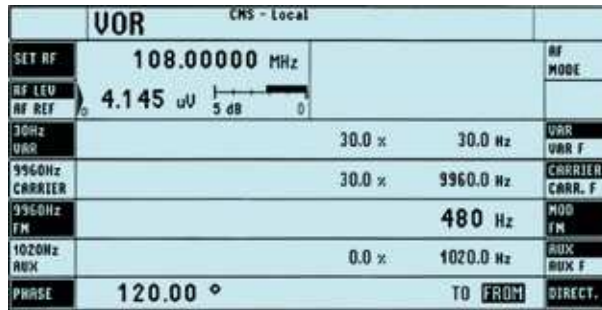
The R&S®CMS57 radiocommunication service monitor is the ideal radio tester for service and maintenance in the field of avionics. A built-in VOR/ILS signal generator generates all test signals for

- ◆ VOR (VHF omnidirectional range)
- ◆ ILS (instrument landing system)
- ◆ MB (marker beacon)
- ◆ Autopilot

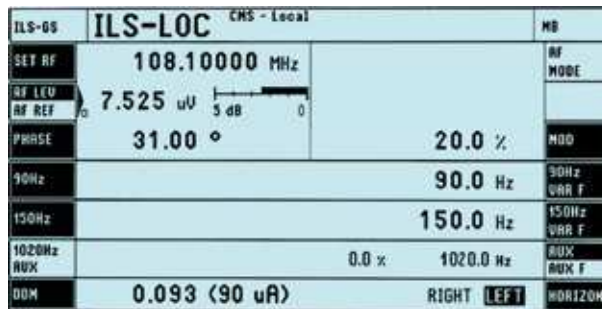
The VOR/ILS test signals are available as RF and AF signals at different outputs.

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.

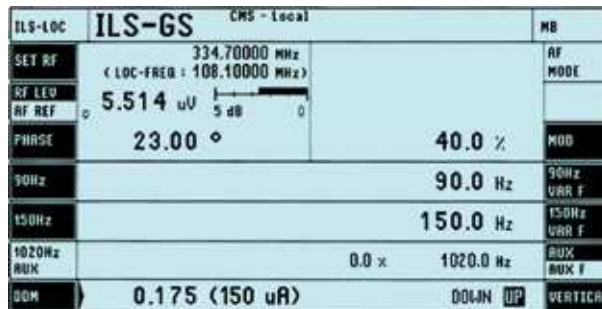
The R&S®CMS57 combines conventional radiocommunication and radionavigation measurement facilities so that avionics measurements can be performed by a single instrument. Typical features such as selectivity and sensitivity of the VOR/ILS receiver can be checked. A second, switchable RF input plus the 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.



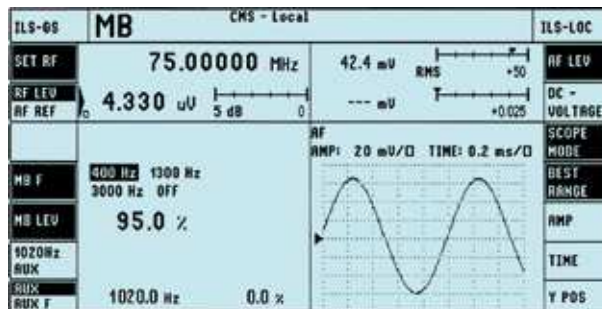
*Frequencies and deviations adjustable over a wide range allow receiver testing in line with standards*



*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, simultaneous display of the signal demodulated by the device under test*



*A menu is also available for the generation of marker beacons*

## Specific data of the R&S®CMS57

The operating concept of the R&S®CMS57 is designed in such a way 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 rotary knob

or

- ◆ recall of preset standard RF frequencies
- ◆ fixed coupling of ILS glideslope and ILS localizer frequencies in line with the specification
- ◆ recall of preset test parameters such as 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 in line with ARINC 578, 579.

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

**VOR/ILS generator** (specifications of base unit, pages 13 and 14, are fully applicable.)

	Range	Resolution	Error
<b>VOR</b>			
Phase RF output	0° to 360°	0.01°	typ. 0.05°
Phase 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
<b>ILS</b>			
90 Hz and 150 Hz phase	0° to 180°, 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
<b>ILS localizer</b>			
Amplitude modulation			
–128 dBm to –9 dBm	0% to 50%	0.1% AM	typ. <2% for 20% AM
–85 dBm to –45 dBm	0% to 50%	0.1% AM	<2% for 20% AM
DDM <sup>1)</sup> RF output			
On-course error, –128 dBm to –9 dBm	±0 to 0.4 DDM for 20% AM	0.001 DDM	<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
<b>ILS glidescope</b>			
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			
On-course error, –128 dBm to –9 dBm	±0 to 0.8 DDM for 40% AM	0.001 DDM	<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
<b>Marker beacon (MB)</b>			
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

<sup>1)</sup> Difference in Depth of Modulation; describes the modulation depth difference between the 90 Hz and the 150 Hz tone;  $|DDM| = |(90 \text{ Hz modulation in } \% - 150 \text{ Hz modulation in } \%)|/100\%$ .

## Options and their applications

### Extensions for base unit

	Option	Order No.	Specifications
<b>OCXO Reference Oscillator</b> For long-term stability	<b>R&amp;S® CMS-B1</b>	<b>0840.9406.02</b>	see time base Aging $2 \times 10^{-7}/\text{year}$
<b>OCXO Reference Oscillator</b> For extremely high long-term stability	<b>R&amp;S® CMS-B2</b>	<b>1001.6809.02</b>	Specs same as R&S® CMS-B1, except for aging $\leq 1 \times 10^{-7}/\text{year}$
<b>Duplex Modulation Meter</b> Allows operation of RF frequency counter and modulation meter independent of RF signal generator (two-part measurements, also on frequency-converting modules); provides tracking generator, cable fault finder, adjacent-channel power meter, harmonic measurements	<b>R&amp;S® CMS-B9</b>	<b>0840.9506.02<sup>1)</sup></b>	For specs see base unit, specs for ACP meter and harmonic measurements on page 7
<b>10 MHz Reference Frequency Input/Output</b> External synchronization for measuring systems	<b>R&amp;S® CMS-B22</b>	<b>1001.6750.02</b>	Output TTL levels, $Z_{\text{out}} \approx 50 \Omega$ , $f = 10 \text{ MHz}$ Input level $> 1.5 \text{ V}(V_{\text{pp}})$ , $Z_{\text{in}} \approx 50 \Omega$ , $f = 10 \text{ MHz} \pm 500 \text{ Hz}$
<b>Additional RF Input/Output</b> Two-signal measurements and connection of further measuring instruments	<b>R&amp;S® CMS-B31</b>	<b>1001.7005.02</b>	Maximum input power 20 mW Attenuation betw. $\text{RF}_{\text{in}}$ and $\text{RF}_{\text{out}}$ 32 dB Measurement sensitivity at input 1 for RF counter/transient recorder and demodulation reduced by 6 dB
<b>100 W RF Power Meter</b> Measurement of high RF input power	<b>R&amp;S® CMS-B32</b>	<b>1001.7905.02</b>	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 $\leq 0.2 \text{ dB}$ ( $P > 40 \text{ mW}$ , $\text{AM} = 0\%$ )
<b>13 dBm Output</b>	<b>R&amp;S® CMS-B34</b>	<b>1032.1350.02</b>	Additional power output for off-air measurements
<b>Protection for Input 2</b>	<b>R&amp;S® CMS-B60</b>	<b>1075.5006.02</b>	BNC connector with exchangeable fuse

### Optional control interfaces<sup>2)</sup>

Order No.	R&S® CMS-B5 0841.0502.10	R&S® CMS-B55 1032.0790.02	Specifications
DTMF Decoder	•	•	Decoding of DTMF dual tones and VDEW direct dialing
CCITT Filter	•	•	
Centronics Interface	•	•	Direct printer connection
Relays	<b>8</b>	—	Switching relays with max. 1 W switching power, $V_{\text{max}} = 30 \text{ V}$ , $I_{\text{max}} = 0.1 \text{ A}$
TTL Input/Output	<b>12</b>	—	Outputs: 25 mA driver power

### Extensions in conjunction with control interfaces

	Option	Order No.	Specifications
<b>ATIS Coder/Decoder</b> For R&S® CMS-B5	<b>R&amp;S® CMS-B27</b>	<b>1032.1250.02</b>	Coder – entry of 10-digit ATIS code – sending of ATIS message Decoder – decoding and display of 10-digit ATIS code
<b>CDSS Decoder</b> For R&S® CMS-B5	<b>R&amp;S® CMS-B27 with R&amp;S® CMS-B33</b>		Decoding of 3-digit mobile phone code number, measurement of data deviation; CDCSS coder fitted as standard in base unit
<b>300 Hz Lowpass Filter</b> For R&S® CMS-B5/-B55; fast frequency and deviation measurement of subaudio tones with simultaneous audio modulation	<b>R&amp;S® CMS-B33</b>	<b>1032.0290.02</b>	$f_{\text{cutoff}} = 200 \text{ Hz}$ , attenuation $> 50 \text{ dB}$ for frequencies above 300 Hz
<b>Adapter for VSWR Measurements</b> In conjunction with R&S® CMS-B5	<b>R&amp;S® CMS-Z37<sup>3)</sup></b>	<b>1065.4907.02</b>	Connection of R&S® NAS-Z1/-Z3/-Z5/-Z6/-Z7 insertion units with direct reading of VSWR as well as forward and reflected power

<sup>1)</sup> Option is already included in R&S® CMS54.

<sup>2)</sup> Choice of one option.

<sup>3)</sup> R&S® CMS-B5 required for R&S® NAS-Z1/-Z3/-Z5/-Z6/-Z7 insertion units.



## Specifications of the base unit

### Time base

Standard	
Temperature effect 0 ° to 35 °C	$\leq 1 \times 10^{-6}$
Aging	$\leq 1 \times 10^{-7}/\text{day}$ $\leq 1 \times 10^{-6}/\text{month}$ $\leq 2 \times 10^{-6}/\text{year}$
R&S® CMS-B1 and -B2 options	
Temperature effect 0 ° to +50 °C	$\leq 1 \times 10^{-7}$ $\leq 5 \times 10^{-9}/\text{day}$ after 30 days of operation
Aging	$\leq 2 \times 10^{-7}/\text{year}$ (R&S® CMS-B2: $\leq 1 \times 10^{-7}$ )
Warmup time (+25 °C)	approx. 10 min

### Receiver measurements

Signal generator	
Frequency range R&S® CMS54, R&S® CMS 57	0.4 MHz to 1000 MHz usable from 100 kHz
Frequency resolution	10 Hz
Frequency error	same as time base
Level FM, φM, CW AM	-134 dBm to 0 dBm -134 dBm to -3 dBm (depending on modulation depth)
Level resolution	0.1 dB
Fine variation of level FM, φM, CW AM	0 dB to -19.9 dB, non-interrupting 0 dB to -4.9 dB, non-interrupting
Level error	$\leq 2$ dB (for levels -128 dBm to -3 dBm, $f > 1$ MHz) <sup>1)</sup>
Harmonics	$\leq -25$ dBc
Nonharmonics	$\leq -50$ dBc ( $> 5$ kHz from carrier, level -3 dBm)
Residual AM (CCITT, RMS)	$\leq 0.03$ %
Residual FM (CCITT, RMS) 0.4 MHz to 250 MHz, 500 MHz to 1000 MHz 250 MHz to 500 MHz	$\leq 10$ Hz $\leq 5$ Hz
Phase noise	$\leq -110$ 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, $f < 8$ MHz, DC to 20 kHz, $f \geq 8$ MHz
Mod. distortion ( $m < 0.8$ ) <sup>1)</sup>	$\leq 2$ %, $f_{AF} = 1$ kHz
Mod. error ( $m < 0.8$ ) <sup>1)</sup>	$\leq 5$ % + resolution + residual AM, $f_{AF} = 300$ Hz to 3 kHz
FM deviation	0 Hz to 100 kHz ( $f_{RF} = 250$ MHz to 500 MHz, 0 kHz to 50 kHz)
Resolution	1 Hz, $\Delta f < 100$ Hz; 1% $\Delta f \geq 100$ Hz
Mod. frequency range	20 Hz to 20 kHz (suitable for POCSAG)
Mod. distortion	$\leq 1$ % ( $f_{AF} = 1$ kHz; $\Delta\phi = 10$ kHz)
Mod. error	$\leq 5$ % + resolution + residual φM
φM deviation (internal)	0 rad to 10 rad ( $f_{RF} = 250$ MHz to 500 MHz, 0 rad to 5 rad)
Resolution	1 mrad, $\Delta\phi < 0.1$ rad; 1% $\Delta\phi \geq 0.1$ rad
Mod. frequency range	100 Hz to 6 kHz
Mod. distortion	$\leq 1$ % ( $f_{AF} = 1$ kHz; $\Delta\phi = 10$ rad)
Mod. error	$\leq 5$ % + resolution + residual φM

<b>Modulation modes</b>	internal (single-tone/two-tone), external, internal + external
<b>AF voltmeter</b>	
Frequency range	50 Hz to 20 kHz
Measurement range	0.1 mV to 30 V
Resolution	100 μV, $V < 10$ mV; 1%, $V \geq 10$ mV
Error <sup>2)</sup>	$< 5$ % + resolution
Input impedance	approx. 1 MΩ
<b>Distortion meter, SINAD meter, AF frequency counter</b>	see transmitter and receiver measurements

### Transmitter measurements

<b>RF power meter</b>	
Frequency range	1.5 MHz to 1000 MHz
Measurement range	5 mW to 50 W <sup>3)</sup> (100 W optionally)
Error ( $P > 20$ mW, AM = 0%, $T_{\text{ambient}} = 0^\circ\text{C}$ to $40^\circ\text{C}$ )	$\leq 0.45$ dB of rdg + resolution
Resolution	1 mW, $P < 100$ mW; 1%, $P \geq 100$ mW
Selective level measurement Level range	in frequency range 1 MHz to 1000 MHz -60 dBm to +47 dBm without weighting filter, -80 dBm to +47 dBm with 2 kHz resonance filter
<b>RF frequency counter</b>	
Frequency range	0.5 MHz to 1000 MHz
Input level range	5 mW to 50 W <sup>3)</sup>
Resolution	10 Hz, 1 Hz
Error	same as time base + resolution
<b>Frequency deviation meter</b>	
Operating modes	+PK, -PK, ±PK/2, PK HOLD, RMS, RMS√2
Input level range	5 mW to 50 W <sup>3)</sup>
RF frequency range	1.5 MHz to 1000 MHz
Deviation measurement range	0 Hz to 100 kHz
AF frequency range	20 Hz to 20 kHz (DC-coupled at demodulator output)
Resolution	1 Hz, $\Delta f < 1$ kHz; 1%, $\Delta f \geq 1$ kHz
Residual FM (CCITT, RMS) 0.4 MHz to 250 MHz, 500 MHz to 1000 MHz 250 MHz to 500 MHz	$\leq 10$ Hz $\leq 5$ Hz
Error <sup>2)</sup>	$\leq 5$ % + resolution + residual FM

<sup>1)</sup> Fine variation of level 0 dB.

<sup>2)</sup> Without weighting filters.

<sup>3)</sup> Input level max. 30 W for any RF output level, max. 50 W for RF output level  $< -26$  dBm.

<b>Phase deviation meter</b>	
Operating modes	+PK, -PK, $\pm$ PK/2, RMS, RMS $\sqrt{2}$
Input level range	5 mW to 50 W <sup>1)</sup>
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, $\Delta\phi \leq 0.1$ rad; 1%, $\Delta\phi > 0.1$ rad
Error <sup>2)</sup>	same as frequency deviation meter + 2% frequency response
<b>AM depth meter</b>	
Operating modes	+PK, -PK, $\pm$ PK/2, RMS, RMS $\sqrt{2}$
Input level range	20 mW to 50 W <sup>1)</sup> (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
Resolution	0.01%, $m < 0.1$ , 0.1%; $m \geq 0.1$
Residual AM (CCITT, RMS)	$\leq 0.03\%$
Error ( $m \leq 0.8$ ) <sup>2)</sup>	$\leq 7\%$ + resolution + residual AM ( $f_{AF} = 0.3$ kHz to 3 kHz)
<b>Distortion meter, SINAD meter, AF frequency counter</b>	see transmitter and receiver measurements

#### Transmitter measurement at 2nd RF input

Measurement of RF frequency, modulation (AM, FM,  $\phi$ M), 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 R&S®CMS54, R&S®CMS57	30 $\mu$ V (select. counter with presetting) -40 dBm to +7 dBm (without presetting)
Modulation meter	5 $\mu$ V (IF narrow) 1 $\mu$ V (IF narrow, select. measurement)
Selective level measurement	-75 dBm to -35 dBm without weighting filter, -100 dBm to -35 dBm with 2 kHz resonance filter

<sup>1)</sup> Input level max. 30 W for any RF output level, max. 50 W for RF output level  $< -26$  dBm.

<sup>2)</sup> Without weighting filters.

#### Transmitter and receiver measurements

<b>Modulation generator I and II</b>	
Frequency range	20 Hz to 30 kHz (usable from 1 Hz)
Frequency resolution	0.1 Hz
Error	same as time base + $\frac{1}{2}$ resolution
Output level range	10 $\mu$ V to 5 V, $f_{AF} = 20$ Hz to 20 kHz 10 $\mu$ V to 2.5 V, $f_{AF} = 20$ Hz to 30 kHz
Resolution	10 $\mu$ V, $V < 1$ mV 1%, $V \geq 1$ mV
Error	$\leq 5\%$ , $V \geq 1$ mV
Output impedance	$\leq 4 \Omega$
Max. output current (peak)	20 mA
Distortion	$\leq 0.5\%$ , $f_{AF} = 20$ Hz to 20 kHz
<b>Distortion meter</b>	
Frequency	100 Hz to 5 kHz (in 10 Hz steps)
Input level range	100 mV to 30 V
Measurement range	0.1% to 50%
Resolution	0.1%
Inherent distortion	$\leq 0.5\%$
Weighting bandwidth	$\leq 12$ kHz
Error	$\leq 5\%$ + inherent distortion
<b>SINAD meter</b>	
Frequency	100 Hz to 5 kHz
Measurement range	1 dB to 46 dB
Input level range	100 mV to 30 V
Resolution	0.1 dB
Weighting bandwidth	$\leq 12$ kHz
Error	$\leq 1$ dB + inherent distortion
<b>AF frequency counter</b>	
Operating modes	demodulation, AF, beat (frequency offset), external
Frequency range	20 Hz to 500 kHz (superimposed RF)
Input level range	10 mV to 30 V, $f < 20$ kHz
Resolution	1 Hz/0.1 Hz
Error	same as time base + resolution
<b>Oscilloscope</b>	
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 ( $\phi$ M), % (AM), mV/V (AF)
Input level range	0 V to 40 V ( $V_p$ )
Input impedance	approx. 1 M $\Omega$

AF filters	
Highpass	$f_{\text{cutoff}} = 300 \text{ Hz}$ , attenuation at 200 Hz typ. 40 dB
Lowpass	$f_{\text{cutoff}} = 3.4 \text{ kHz}$ , attenuation at 10 kHz typ. 40 dB
Bandpass broadband narrowband	highpass + lowpass 50 Hz to 5 kHz in 10 Hz steps, attenuation typ. 40 dB for 0.8f and 1.2f
Notch filter	100 Hz to 5 kHz in 10 Hz steps, attenuation typ. 40 dB
CCITT filter	see R&S®CMS-B5 or R&S®CMS-B55 option
Selective call coder/decoder	
Tone sequences	ZVEI1/ZVEI2/CCIR/EIA/EEA/EURO/NATEL/CCITT/VDEW/DTMF/user-defined sequences (for DTMF decoding see control interface)
CDCSS coder	entry of 3-digit code number of mobile radio, setting of times for turn-off code and RF level drop, setting of data deviation
Audio monitor (loudspeaker)	demodulated signal, AF signal, beat (frequency offset)

#### General data

Operating temperature range	0 °C to +50 °C
Storage temperature range	-40 °C to +70 °C
Environmental resistance Temperature	in line with EN 60068-2-1 and EN 60068-2-2 +25 °C/+40 °C cyclically at 95 % rel. humidity; with EN 60068-2-30
Climatic (damp heat)	
Mechanical resistance Sinusoidal vibration	5 Hz to 150 Hz, max. 2 g at 55 Hz, 0.5 g at 55 Hz to 150 Hz
Standards complied with	EN 60068-2-6 and EN 61010-1 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	in line with EMC directive of EU (2004/108/EC) applied standard EN61326 (immunity for industrial environment; class A emissions) <sup>1)</sup>
Safety	in line with EN 61010-1
Power supply	(100/120/220/240) V AC ±10%, 47 Hz to 420 Hz or 11.5 V to 30 V DC (50 W)
Dimensions (W × H × D)	320 mm × 175 mm × 375 mm (12.6 in × 6.9 in × 14.8 in)
Screen size	approx. 210 mm × 100 mm (9") approx. 8.3 in × 3.9 in (9")
Weight	approx. 13 kg (28.6 lb) without options approx. 15 kg (33 lb) with options

<sup>1)</sup> The instrument complies with the emission requirements stipulated by EN 55011 class A. This means that the instrument is suitable for use in industrial environments. In line with EN 61000-6-4, operation is not covered in residential, commercial, and business areas nor in small-size companies. Thus, the instrument must not be operated in residential, commercial, and business areas nor in small-size companies, unless additional measures are taken to ensure that EN 61000-6-3 is met.

<sup>2)</sup> Battery operation approx.: 1 hour (+25 °C), weight: 4 kg (8.8 lb), Dimensions (W × H × D) 85 mm × 175 mm × 375 mm (3.35 in × 6.89 in × 14.76 in).

## Ordering information

Radiocommunication Service Monitor		
R&S®CMS54	0840.0009.54	
R&S®CMS57	0840.0009.57	
Accessories supplied	power cable, spare fuses, manual	
Options	see page 12	
Recommended extras		
Memory Card 128 kbyte	R&S®CMS-Z2	0841.1509.02
Battery Connector	R&S®CMS-Z7	0841.1350.02
Carrying Bag	R&S®CMS-Z40	1065.5603.02
Battery Pack with Charger <sup>2)</sup>	R&S®CMS-Z41	1065.5703.02
Printer Cable	R&S®CM-Z5	0835.6919.02
19" Adapter	R&S®ZZA-99	0839.5775.00
Service Manual		0840.8616.24



More information at  
[www.rohde-schwarz.com](http://www.rohde-schwarz.com)  
(search terms: CMS54, CMS57)



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