Test Equipment Solutions Datasheet

Test Equipment Solutions Ltd specialise in the second user sale, rental and distribution of quality test & measurement (T&M) equipment. We stock all major equipment types such as Spectrum Analyzers, Signal Generators, Oscilloscopes, Power Meters, Network Analyzers etc from all the major suppliers such as Keysight, Tektronix, Anritsu and Rohde & Schwarz.

We are focused at the professional end of the marketplace, primarily working with customers for whom high performance, quality and service are key, whilst realising the cost savings that second user equipment offers. We fully test & refurbish equipment in our in-house, traceable Lab. Items are supplied with manuals, accessories and typically a full no-quibble 1 year warranty. Our staff have extensive backgrounds in T&M which enables us to deliver industry-leading service and support. We endeavour to be customer focused in every way right down to the detail, such as offering free delivery on sales, presenting flexible technical + commercial solutions and supplying a loan unit during warranty repair, if available.

As well as the headline benefit of cost saving, second user offers shorter lead times, higher reliability and multivendor solutions. Rental, of course, is ideal for shorter term needs and offers fast delivery, flexibility, try-before-you-buy, zero capital expenditure, lower risk and off balance sheet accounting. Both second user and rental improve the key business measure of Return On Capital Employed.

We are based in at Oakley, Bedfordshire in the UK from where we supply test equipment worldwide. Our facility incorporates Sales, Support, Admin, Logistics and our own in-house Lab.

All products supplied by Test Equipment Solutions include:

- No-quibble parts & labour warranty (we provide transport for UK mainland addresses).
- Free loan equipment during warranty repair, if available.
- Full electrical, mechanical and safety refurbishment in our 40GHz in-house Lab.
- Certificate of Conformance (calibration available on request).
- Manuals and accessories required for normal operation.
- Free insured delivery to your UK mainland address (sales).
- Support from our team of seasoned Test & Measurement engineers.
- ISO9001 quality assurance.

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Radiocommunication Service Monitors of CMS Family

0.4 to 1000 MHz

Radio testers for service, production and development

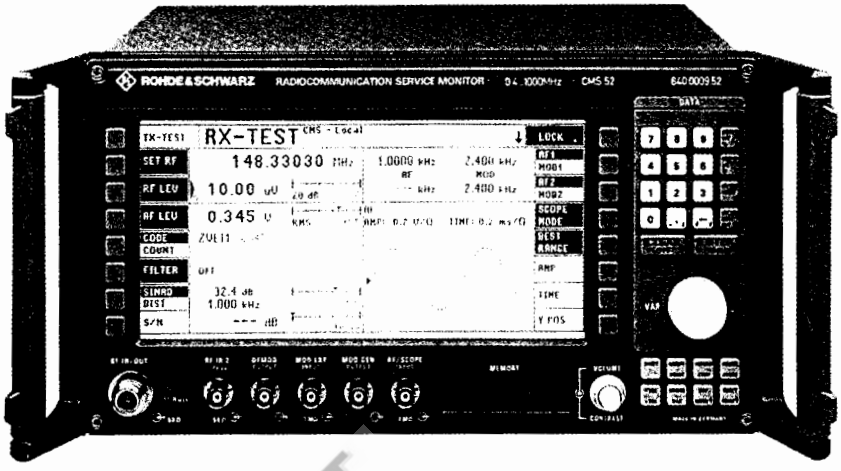
Brief description

The family of Radiocommunication Service Monitors CMS comprises four models. These radio testers allow transmitter, receiver and duplex measurements to be performed on mobile radios, base stations or RF modules. CMS Radiocommunication Service Monitors are ideal radio testers for service, maintenance and test departments.

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.

Main features

- AM, FM or φM and SSB
- Analog and digital signalling
- Large, high-contrast LCD
- Operation via softkeys
- Clear menu structure
- Simultaneous and easy-to-read display of settings and results
- Manual and automatic measurements
- Tracking generator
- Cable fault test
- Spectrum monitor
- Optional extensions to cover measurements in related fields
- Stationary and mobile use
- Low weight, compact size



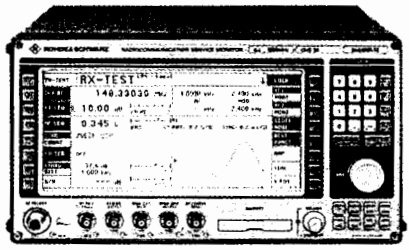
CMS52 (photo 39829)

Overview of models

CMS50 – the budget-priced model for service applications
- Transmitter and receiver testing
- Spectrum monitor
- Fully automatic testing
- SSB test
- ERMES coder

CMS52 – the allround model for service, production, development
- Enhanced capabilities of CMS50 (see specifications in brief)

Basic model additionally with:
- RF spectrum monitor with zero-span to full-span display



CMS50 (photo 39831)

- Extremely sensitive RF frequency counter
- Transient recorder for
  - frequency versus time
  - power versus time

CMS54 – the high-end tester for demanding requirements (see page 14)
- Radio measurements and optional extensions same as CMS52

Basic model additionally with:
- Full-span tracking generator from 0.4 to 1000 MHz
- Adjacent-channel power meter with standard ETSI filters
- Duplex modulation meter
- Automatic harmonic measurement
- Cable fault test

CMS57 – the specialist for avionics (see page 16)
- Radio measurements and optional extensions same as CMS52

Basic model additionally with:
- VOR/ILS signal generator

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Mobile Radio Measurements

Overview of configurations (model-dependent or optional)

Signal sources

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

Measuring facilities

- RF frequency counter, RF frequency-offset counter
- Power meter from 5 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 from 400 kHz to 1000 MHz
- Adjacent-channel power meter with standard ETSI filters
- Modulation meter for AM, FM and φM; weighting: +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
- CDCSS decoder
- Oscilloscope
- DC ammeter/voltmeter
- Transient recorder for analysis of power and frequency transients
- Cable fault test

Filters

- CCITT or C-message filters for weighting to relevant standards
- Continuously tunable bandpass filter from 50 Hz to 5 kHz with high skirt selectivity for selective modulation and AF measurement
- 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 to 32 V)
- 13-dBm RF output for off-air measurements
- Memory for storing complete instrument setups

Signalling

The CMS features built-in signalling units combining signalling measurements and receiver/transmitter tests on mobile stations as well as partly on base stations. The signalling units support all main radio networks including their country-specific versions:

- Selective call to all international standards
- MPT 1327/1343 (trunked radio)
- POCSAG/Cityruf/Euromessage
- ZVEI digital, VDEW digital
- FMS-BOS
- User-programmable FFSK modem
- ERMES pager test
- ATIS coder/decoder (Rheinfunk)

The following signalling routines are available for cellular networks:

- C Net
- NMT 450 (SIS), NMT 450 I
- NMT 900 (SIS)
- AMPS, E-AMPS, N-AMPS
- TACS, E-TACS, N-TACS, TACS II
- Radiocom 2000
- NMT base station test

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

Trunked radio as an example

Trunked radio to MPT1327/MPT1343 is an intelligent analog radio system which uses digital signalling to organize a few physical channels for a large number of mobile subscribers and additionally allows user-specific applications. The extremely flexible CMS design fully supports the high versatility of the trunked radio system.

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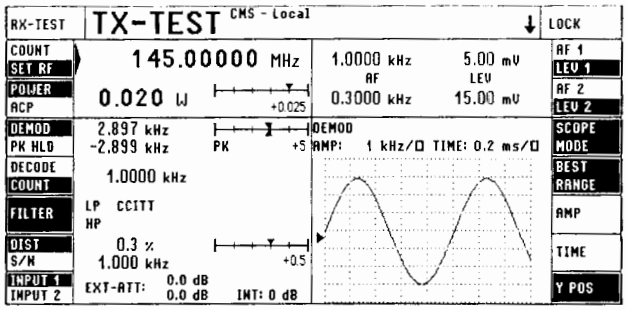
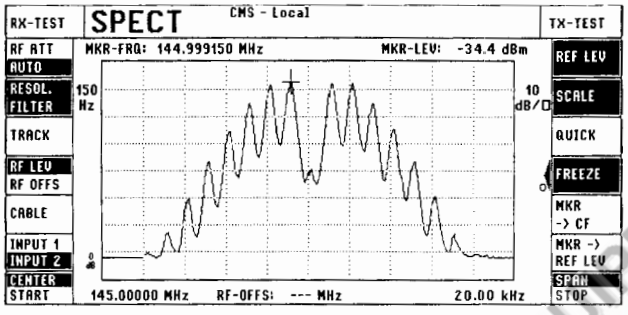
Mobile Radio Measurements





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

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

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

Operation

- 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

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 the 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.

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Specifications in brief (all CMS models)

Bold-faced values in brackets refer to CMS 50

Timebase

Standard

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

Options CMS-B1 and -B2

Temperature effect 0 to 50 °C	≤1 x 10^{-7}
Aging	≤2 x 10^{-7}/year (CMS-B2: ≤1 x 10^{-7})

Receiver measurements

Signal generator

Frequency range	0.4 to 1000 MHz
Frequency resolution	10 Hz **(50 Hz)**
Level	
FM, φM, CW	−134 to 0 dBm
AM	−134 to −3 dBm
Level resolution	0.1 dB
Accuracy	±2 dB
Harmonics	≤−25 dBc **(≤−20 dBc)**
Nonharmonics	≤−50 dBc
Phase noise	≤−110 dBc (20 kHz from carrier, referred to 1-Hz test bandwidth)

Modulation

Frequency range	0.4 to 1000 MHz **(2 to 500 MHz)**
AM depth	0 to 99%
Mod. frequency range	DC to 20 kHz
FM deviation	0 to 100 kHz **(50 Hz to 50 kHz)**
Resolution	1 Hz
Mod. frequency range	20 Hz to 20 kHz
Mod. distortion	≤1%
φM deviation(internal)/resolution	0 to 10 rad/1 mrad
Mod. frequency range	100 Hz to 6 kHz
Mod. distortion	≤1%

Mobile Radio Measurements

AF voltmeter

Frequency range	50 Hz to 20 kHz
Measurement range/resolution	0.1 mV to 30 V/100 µV
Input impedance	approx. 1 MΩ

Transmitter measurements

RF power meter

Frequency range	1.5 to 1000 MHz **(2 to 1000 MHz)**
Measurement range	5 mW to 50 W (100 W optional)
Accuracy (P >20 mW, AM=0%)	0.4 dB + resolution
Selective level measurement	in frequency range 1 to 1000 MHz
Level range	–60 to +47 dBm without weighting filter, –80 to +47 dBm with 2-kHz resonance filter

RF frequency counter

Frequency range	0.5 to 1000 MHz

Frequency deviation meter

Operating modes	+PK, –PK, ±PK/2, PK HOLD, RMS, RMS√2
Measurement range	0 Hz to 100 kHz **(0 Hz to 50 kHz)**
AF frequency range	20 Hz to 20 kHz **(20 Hz to 15 kHz)** (DC-coupled at demodulator output)
Resolution	1 Hz

Phase deviation meter

Operating modes	+PK, –PK, ±PK/2, RMS, RMS√2
Measurement range/resolution	0.001 to 5 rad/0.001 rad
AF frequency range	300 Hz to 6 kHz

AM depth meter

Operating modes	+PK, –PK, ±PK/2, RMS, RMS√2
Measurement range/resolution	0.01 to 99%/0.01%
AF frequency range	50 Hz to 20 kHz **(50 Hz to 10 kHz)**

RF spectrum monitor

	1 to 1000 MHz
Display dynamic range	>60 dB
Span	0 (zero span) to 50 MHz
Filter (3-dB bandwidth)	150 Hz, 6/16/50/300 kHz, 1/3 MHz (coupled to span)

Tracking generator (with CMS-B59/-B9)

Frequency range	400 kHz to 1000 MHz
Reference level	–67 to –27 dBm
Display dynamic range	50 dB
Span	0 to 50 MHz (full span for CMS52, CMS54 and CMS57)
Output level	–128 to 0 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, eg in off-air or module measurements, for input levels from approximately

RF frequency counter	30 µV (selective frequency counter with presetting)
Modulation meter	5 µV (IF narrow) 1 µV (IF narrow, selective meas.)
Selective level measurement	–75 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	0.1 Hz
Output voltage range	10 µV to 5 V
Output impedance	≤4 Ω

Distortion meter

Frequency	100 Hz to 5 kHz **(100 Hz to 3 kHz)**
Measurement range	0.1 to 50%

SINAD meter

Frequency	100 Hz to 5 kHz **(1 kHz ±10Hz)**
Measurement range	1 to 46 dB

AF frequency counter

Operating modes	demodulation, AF, beat (frequency offset)
Frequency range	20 Hz to 500 kHz **(20 Hz to 20 kHz)** (superimposed RF)
Resolution	1 Hz/0.1 Hz

Oscilloscope

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

AF filters

Highpass	f_{cutoff}=300 Hz
Lowpass	f_{cutoff}=3.4 Hz
Bandpass	
broadband	highpass + lowpass
narrowband	50 Hz to 5 kHz **(100 Hz to 3 kHz)**
Notch filter	100 Hz to 5 kHz **(100 Hz to 3 kHz)**
CCITT filter	see option CMS-B5 or CMS-B20

Selective-call coder/decoder

Tone sequences	ZVEI1/ZVEI2/CCIR/EIA/EEA/EURO/NATEL/CCITT/VDEW/DTMF/VDEW direct dialling/user-defined sequences (DTMF decoding see Control Interfaces CMS-B5 and -B55); CDCSS decoder and ATIS see option CMS-B27
CDCSS coder	entry of 3-digit code number of mobile radio, setting 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

Power supply AC	100/120/220/240 V ±10%, 47 to 420 Hz (50 VA)
DC	11 to 32 V
Dimensions (W x H x D)	320 mm x 175 mm x 375 mm
Weight	
without options	approx. 13 kg
with options	approx. 15 kg

Ordering information

Radiocommunication Service Monitor	CMS50	0840.0009.50
	CMS52	0840.0009.52
	CMS54	0840.0009.54
	CMS57	0840.0009.57

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Options for radio testers of the CMS family

Extensions for basic model	Option	Order No.	Specifications
OCXO Reference Oscillator For long-term stability	**CMS-B1**	**0840.9406.02**	See timebase Aging: 2×10^{-7}/year
OCXO Reference Oscillator For extremely high long-term stability	**CMS-B2**	**1001.6809.02**	Specs same as CMS-B1, except for aging: $\leq 1 \times 10^{-7}$/year
Duplex Modulation Meter For operation of RF frequency counter and modulation meter independent of RF generator (two-port measurements, also on frequency-converting modules)	**CMS-B59**	**1032.0990.02** **(not for CMS54)**	Specs same as basic model, except residual FM: ≤10 Hz
Duplex Modulation Meter Same as CMS-B59, plus adjacent-channel power meter for measurements on duplex radio, cellular mobile phones and frequency-converting modules	**CMS-B9**	**0840.9506.02** **(not for CMS50; standard in CMS54)**	Specs same as basic model Adjacent-channel power meter with ETSI filters Channel spacings: 10/12.5/20/25 kHz and user-selectable up to 1 MHz Dynamic range: ≥70 dB (chan. spacing 25 kHz)
10-MHz Reference Frequency Input/Output External synchronization for measuring systems	**CMS-B22**	**1001.6750.02**	Output: TTL signal, $Z_{out} \approx 50\,\Omega$, f=10 MHz Input: level >1.5 V (V_{pp}), $Z_{in} \approx 50\,\Omega$, f=10 MHz ±500 Hz
Additional RF Input/Output Two-signal measurements and connection of further measuring instruments (eg spectrum analyzer); bidirectional RF connector for additional measuring instruments	**CMS-B31**	**1001.7005.02** **(not for CMS57)**	Maximum input power 20 mW Attenuation betw. $RF_{in} \rightarrow RF_{out}$ 32 dB Measurement sensitivity at input 1 for RF counter/transient recorder and demodulation reduced by 6 dB
100-W RF Power Meter Measurement of high RF input power	**CMS-B32**	**1001.7905.02**	Maximum 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
Autopilot Generator for ILS Operation (CMS57)	**CMS-B38**	**1065.5003.02** **(for CMS57 only)**	Second RF output; not in conjunction with CMS-B31 and -B34
IEC/IEEE-Bus Interface	**CMS-B54**	**1032.0748.02** **(for CMS50 only)**	Use of CMS50 in automatic test systems

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

	Option	Order No.	Specifications
Signalling Unit for Cellular Radio NMT 450 (SIS), NMT 450, NMT 900 (SIS), E-AMPS, E-TACS, J-TACS, TACS II, R 2000	**CMS-B53** [1])	**1032.0890.02**	Simulation of base station for testing cellular mobile phones, eg call setup, call cleardown, channel and power change
Signalling Unit for Cellular Radio Same as CMS-B53, plus C-net signalling	**CMS-B13** [1])	**0841.1009.02** **(not for CMS50)**	Simulation of base station for testing cellular mobile phones, eg call setup, call cleardown, channel and power change
NMT Base Station Test For CMS-B13 in conjunction with CMS-B39	**CMS-B25**	**1032.0490.02** **(not for CMS50)**	Signalling for setting the base station and RF measurements on air interface
POCSAG, ZVEI/VDEW Digital Signalling For CMS-B13/-B53	**CMS-B26**	**1031.9993.10**	Testing of POCSAG radiopaging receivers and ZVEI/VDEW mobile and base stations
MPT 1327/1343 Signalling For CMS-B13/-B53, testing of trunked radio	**CMS-B28**	**1001.7205.02**	Additional free programming of signalling sequences via external computer
FMS-BOS Signalling For CMS-B13/-B53	**CMS-B29**	**1032.1550.02**	With CMS-B13 and -B39 signalling also at AF
Programmable Universal Modem for FFSK Signals (instead of CMS-B13/-B53), modulation and demodulation of any data	**CMS-B21** **(not for CMS50)**	**1001.6509.02**	Modulator and demodulator Frequency for logic 0: 50 to 3999 Hz Frequency for logic 1: 50 to 3999 Hz Bit rate: 10 to 2400 Hz

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Extensions in conjunction with control interfaces

	Option	Order No.	Specifications
ATIS Coder/Decoder (for CMS-B5)	**CMS-B27**[2])	**1032.1250.02**	Coder – entry of 10-digit ATIS code – sending of ATIS message – decoding and display of 10-digit ATIS message Decoder – measurement of data deviation
CDCSS Decoder (for CMS-B5)	**CMS-B27 with CMS-B33**		Decoding of 3-digit mobile phone code number, measurement of data deviation; CDCSS coder fitted as standard in basic model
RS-232-C Interface for CMS-B5	**CMS-B30**	**1001.6909.02**	Output and reception of any ASCII strings (max. 33 characters)
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
VSWR Meter in conjunction with CMS-B5 or -B39	**CMS-Z37**[3])	**1065.4907.02**	Connection of Insertion Units NAS-Z1, -Z3, -Z5, -Z6 (GSM), -Z7 (DCS 1800) with direct reading of VSWR as well as forward and reflected power

Optional control interfaces[4])

Order No.	CMS-B5 0841.0502.10	CMS-B5 0841.0502.12	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	•	•	•	•	•	
Relays	8	8	–	–	4	With max. 1 W switching power, V_{max} = 30 V, I_{max} = 0.1 A
TTL Input/Output	12	12	–	–	8	Outputs: 25 mA
DC Ammeter/ Voltmeter, floating	–	–	–	•	–	Voltage measurement Range 0 to ±30 V Resolution 0.1 to 100 mV Error ±1% + resolution Current measurement Range 0 to ±10 A Resolution 1 to 100 mA Error ≤4% ± 3 mA
600-Ω AF Transformers	–	–	–	–	•	Output impedance of AF generator switchable to 600 Ω ±10% Frequency range: 100 Hz to 6 kHz Output voltage: 10 µV to 2.5 V Max. output current: 4 mA Input impedance of AF voltmeter switchable to 600 Ω ± 10% Frequency range: 100 Hz to 6 kHz
ATIS Coder/ Decoder, CDCSS Decoder	**CMS-B27**	**CMS-B27**	–	–	–	See option CMS-B27, CDCSS coder fitted as standard in basic model
RS-232 Interface	**CMS-B30**	**CMS-B30**	–	–	–	See option CMS-B30
300-Hz Lowpass Filter	**CMS-B33**	**CMS-B33**	**CMS-B33**	–	–	See option CMS-B33
Adapter for VSWR Measurements	**CMS-Z37**	**CMS-Z37**	–	–	**CMS-Z37**	See option CMS-Z37

[1] CMS-B9 or CMS-B59 also required, CMS-B13 and CMS-B53 may be used alternatively.
[2] CMS-B33 also required for CDCSS.
[3]) CMS-B5 or -B39 required for Insertion Units NAS-Z1/-Z3/-Z5/-Z6/-Z7.
[4]) Choice of one option.

• included
– not included

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