Technical Information

Radiocommunication Service Monitor

CMS 33

400 kHz to 1000 MHz

- Navigation:
  - VOR (VHF Omnidirectional Radiorange)
  - ILS (Instrument Landing System)
  - MB (Marker Beacon)
  - ADF (Automatic Directional Finder)
  - Auto ILS (Automatic ILS = autopilot)
  - HOMING
- Communication:
  - HF (SSB Transceiver)
  - VHF/UHF (AM/FM Transceiver)
  - SELCAL (Selective Call)
- Intercom:
  - Sidetone test
  - Crew station box test

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- Complete test set for testing the communication and navigation instruments in aircraft both with a direct connection to the antenna input of the transceiver and off-air using a test antenna
- Comprehensive measuring equipment including VSWR, spectrum monitor and transient recorder opens all kinds of measurement applications.
- Off-air tests for fast and comfortable testing of the navigation instruments without connecting and exchanging hard-to-get-at antenna inputs
- The only radio tester with an integrated VOR/ILS generator which has already been established on the market and well-tested by national aviation control authorities and armed forces.
- Ease of operation thanks to a clear operational concept and a large 9"-LCD display. Interactions with operators are reduced to a minimum by means of test routines consisting of clear, user-specific instructions. This means that even complex measurement tasks in large service organisations can be standardized and reproduced.
- Prepared automatic test routines for fast verification of entire NAV/COM/INTERCOM equipment
- Automatic or manual impedance matching to INTERCOM networks ensures no operator error and a complete one box solution.
- Minimal weight and small size for portable and stationary use; can be comfortably used even in very confined places such as a cockpit due to an optional small external operating panel.
- Minimal power consumption ensures long battery service life for on-site work
- Modular, future-oriented concept with selftest and automatic self-adjustment to permit long calibration intervals and low operating costs
- Simple and safe logistics for programs and their modifications

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On the basis of more than 20 years of experience in the development and manufacture of compact radio testers, the 'Radiocommunication Service Monitor CMS33' is the consequent development of the successful CMS family for the demanding applications in the avionics field. A universal, most modern concept, minimal weight, small size and most simple operation render the CMS33 equally ideal for mobile use on-site as a ramp tester and, thanks to its outstanding data and flexibility, as a bench tester for repair and maintenance in laboratories.

The CMS33 has been developed to match the special requirements in the measurement of communication and navigation instruments. Short test times, low operating costs, simple operation and the CMS33 being one-man portable were highly important design goals. Portability, splash protection, universal power supply, off-air measurements using a test antenna and a remote operating feature for the direct use in confined places additionally improve usability. All further accessories such as VSWR insertion unit, cable, program card and user guide can be accommodated ready to hand in the transit case.

The CMS33 tests AM, FM and SSB transceivers in the HF, VHF and UHF range including the necessary selective-call methods (SELCAL) and also permits the audio-analysis of the INTERCOM network. This satisfies all test requirements in the field of aircraft communication. For the navigational test, the CMS33 generates exact signals for a precise reading of the navigation instruments. All necessary signal sources to test VOR, ILS, Marker Beacon, Autopilot, Homing and ADF are available.

In automatic operation, a pass/fail message indicates conformity/non-conformity with settled tolerances in order to ensure a fast exchange of a defect unit. Program cards store the exact measurement results which, when printed out, serve as an important source of information for repair. Ultimate precision makes the CMS33 the ideal measurement equipment also in repair workshops.

Measurements

The CMS33 offers the complete measurement program of a modern radio test set (cf. data sheet CMS family as well). Thus the CMS33 replaces various measurement instruments in the workshop. Further, it provides additional measurement equipment for the efficient and effective operation at transceivers and navigational receivers in aircrafts.

General Tests and Measurements

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, 20 Hz to 20 kHz each, resolution 0.1 Hz
- SELCAL coder and various other selective call standards
- VOR/ILS signal generator

Measuring facilities

- RF frequency counter, RF frequency-offset counter
- RF power meter from 5 mW to 125 W
- Selective RF power meter down to -100 dBm
- Modulation meter for AM, FM and φM; weighting: +PK, -PK, PK HOLD, ±PK/2, RMS, RMS$\sqrt{2}$
- AF voltmeter with peak and true RMS weighting
- SINAD and Distortion meter with variable test frequency
- S/N meter
- AF frequency counter
- Selective-call decoder for all standards
- Oscilloscope
- Transient recorder (optional)

Filters

- CCITT 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 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 of high sensitivity for off-air measurements
- Internal memory for storing complete instrument setups

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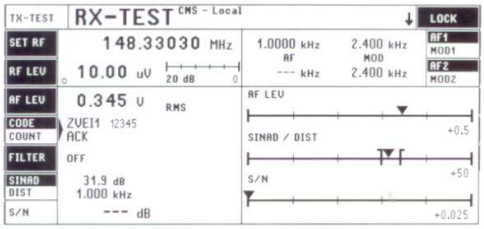
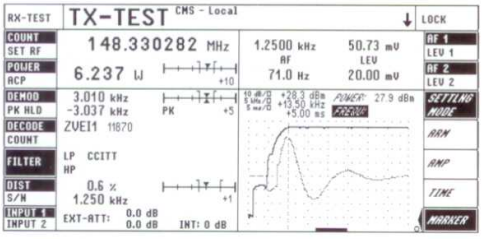
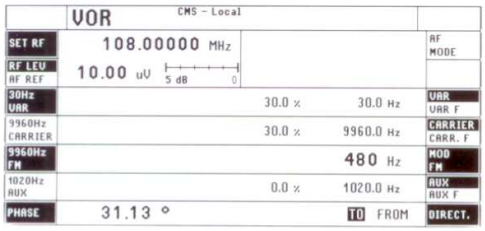


Receiver measurements, supported by automatic test routines for sensitivity, bandwidth, quieting and squelch, enable fast and thorough service work.

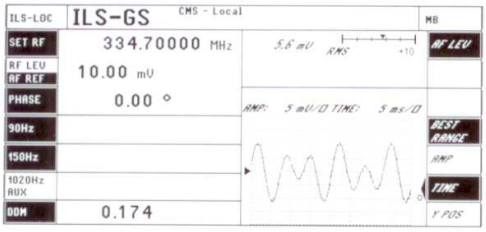


Thanks to simultaneous display of all parameters, the transmit signal quality can be immediately monitored and additionally evaluated. The optional transient recorder allows for measurement of power and frequency settling characteristics of transmitters - as shown in the attached menu - as well as for recording of power bursts.

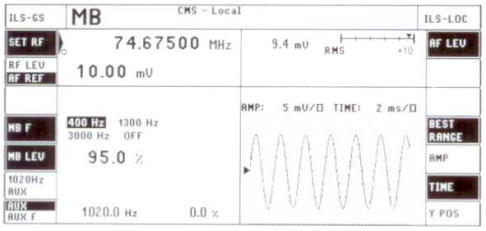


The built-in signal generator for VOR, ILS and MB provides fast and convenient test of nav aids. Free defineable phase increments in VOR testing allow together with the autorun function to check the smooth movement of the steering indicators.

Fine variation of DDM value in steps of 0.001 DDM for ILS and of phase in steps of 0.01^{o} for VOR ensure accurate adjustment of onboard indicators.



An AF oscillogram can be displayed in all operating modes and allows for instance simultaneous display of the bearing signal demodulated by the device under test.



A menu is also available for signal generation of marker beacons.

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CMS33 Specific Measurement - Added Value in the Avionic Fields

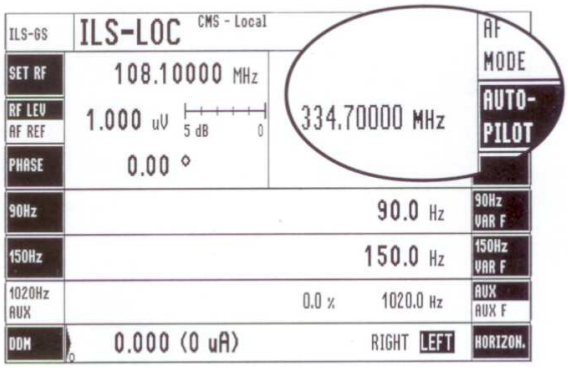
The CMS 33 has been developed in close cooperation with many different users. As a result, three main operation modes are available for different applications in the avionics field: on one hand there is often only inconvenient access to the various antenna inputs of an aircraft. That's why the CMS33 is designed and ready-to-use for off-air measurements. On the other hand tests have to be performed in confined places (e.g. in the cockpit of airfighters). The CMS33 responds by being remote controllable by a small and handy external control panel. Finally auto-run programs facilitate complete checks of installations in a few minutes.

Impedance Matching

AF matching to the different types of transceivers requires a specific adaptation to the different impedances of these instruments. The CMS33 not only measures these impedances but can alternatively effect an automatic adaptation to the most different values and thus ensures the required AF level or the correct AF analysis at the device under test.

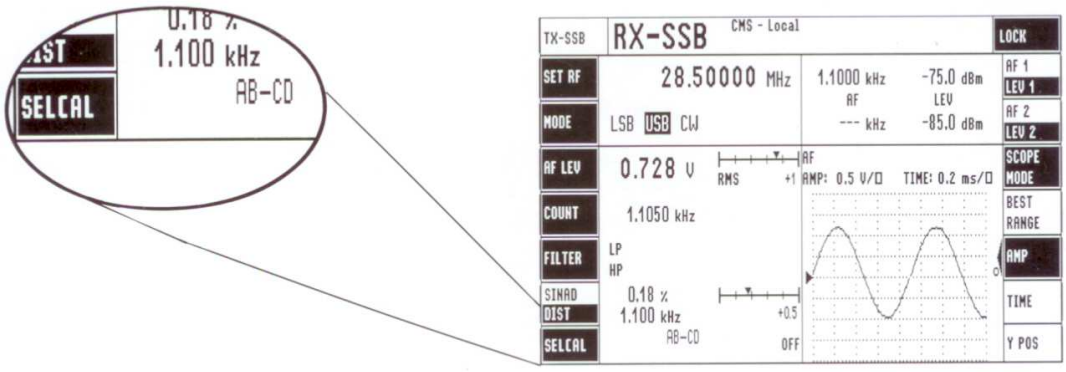
Auto-ILS /Autopilot CMS-B38 (optional)

To test the autopilot, the CMS33 uniquely provides two RF carriers simulating glideslope and localizer in one radio tester at the same time. All standard pairs of frequencies are considered; when the localizer frequency is entered, the appropriate glideslope frequency is set automatically. The relative modulation depths of localizer and glideslope are simultaneously changed by varying the DDM value.



SELCAL

The CMS33 provides SELCAL paging of an aircraft. The coder is conveniently activated by a push of a button and the required characters can be keyed-in via a prepared keypad.



SSB

In today's avionic maintenance, SSB testing is a prerequisite for aircraft checks. Thus an SSB menu has been specifically designed for convenient and comprehensive SSB transceiver tests in the CMS33. SSB-specific measurement requirements are built-in such as a PEP meter.

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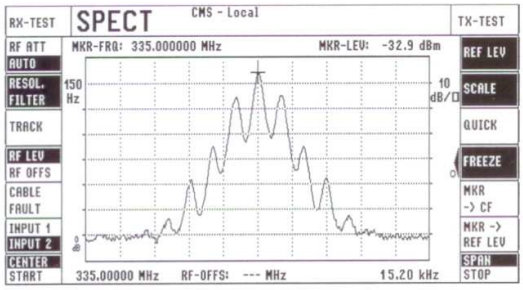
Spectrum Monitor

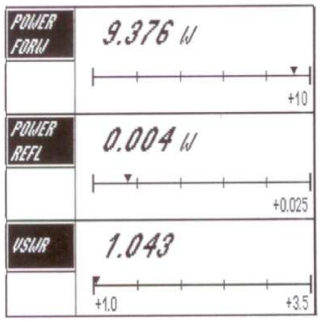
The spectrum monitor permits the synthesizer-accurate display of both modulation spectra and complete band assignments. The display of the spectra can be stored and the individual spectral line demodulated.



VSWR

Measuring the adaptation of the transceiver to the antenna (VSWR) provides important information on the receiver and transmitter power of a transceiver. While both the sensitivity of the receiver and the power of the transmitter can be determined via conventional RX and TX measurements, the determination of the VSWR is necessary for checking and adjusting antenna matching.

The CMS33 permits determining the VSWR easily with the insertion unit taken off: When the insertion unit is connected, the VSWR menu is directly entered and the VSWR as well as forward and reflected power are immediately indicated by means of a large analog display.



Instrument Configuration

The CMS33 is designed as a first-line tester and is integrated in a splash-protected carrier bag. A lateral pocket accommodates the necessary accessories such as cables, VSWR insertion unit and user guide. The carrier bag is prepared for the attachment of the optional battery pack which is trickle-charged via the CMS33. This permits operating the CMS33 on-site both via the battery and by means of an external power supply. In comparison to an internal battery, this has the advantage of lower weight if battery operation is not required. Nevertheless, also an internal battery is optional available.

The carrier bag of the CMS33 protects from splash water and comfortably accommodates all necessary equipment.

The optional external battery with battery charge indication and convenient accessible sockets for VSWR, MIC/TEL and remote control

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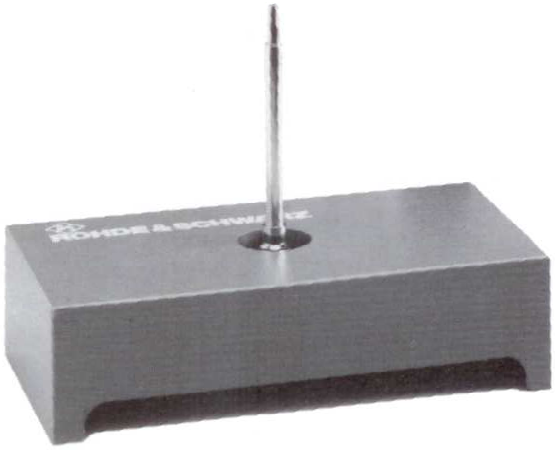
The telescopic antenna for off-air measurement including the antenna cable is accommodated in the front panel cover. This cover is designed to simultaneously serve as an antenna base. The antenna cable has spacers for the comfortable and reproducable positioning of the antenna on the runway for controlled off-air tests.

The AF connections with special MIC-TEL sockets and the connection for the VSWR insertion unit are integrated in the rear panel of the CMS33. With the battery pack used, these connections are available on the front panel of the battery pack as well.

Both, the MIC/TEL sockets and the VSWR connection, are integrated on the rear of the CMS.



The optional front panel cover of the CMS33 can be used simultaneously as an antenna base and together with the integrated antenna for OFF-AIR tests.

The small and lightweight VSWR insertion unit (NAS-Z5) covers a wide frequency range

Automatic Test Procedures

Preparations for Measurements

To prepare the measurements, the only thing to do is to connect the CMS33 to the external operating unit (remote-control box = RCB), to insert the memory card corresponding to the type of aircraft and to provide a power supply system. Necessary AF connections are directly applied to the CMS33. An external interface box is not required since the different terminating impedances as well as an automatic impedance matching are already integrated in the CMS33.

On the RCB display, the user is requested to enter the desired program by means of which individual subsystems (e.g. UHF1, VHF1, UHF2) can be selectively tested or an overall test of all communication and navigation equipment can be executed.

This makes the CMS33 ready for the actual measurements.

Exemplary Run of an Automatic Measurement

On the display of the CMS33 or, in the case of remote control, via the display of the remote-control box (RCB), the user is given most detailed instructions on which settings to make at the different test items (e.g. channel frequency, push to talk etc.).

These visual instructions can be supported by acoustic signals output via the intercom equipment. The automatic test is continued subsequently by the user's manual acknowledgement.

Once the settings required for the test sequence have been made, the CMS33 starts to measure. The user is then indicated the current measurement on the CMS33 display or on the one of the RCB, and the result of a tolerance analysis can be output via a pass/fail message. In case of non-conformity of measurements with settled tolerances, the user can either repeat the measurement or continue with the tests. All measurements can be stored in the test protocol and printed out later. With the measurements running automatically, the user neither requires knowledge of operating the CMS33, nor does he need to take comprehensive service literature on the instruments to be tested with him. All parameters including the tolerances are stored on the memory card.

```
REPORT  1
REPORT: 01   PROGRAM: 05    09-02-94 10:35 USER: DEWEY
DEVICE under TEST IDENT: PTR 1751

NO          COMMAND                    PARAMETER        RESULT        TOL
    VHF AM TEST: PTR 1751
    *** TX TEST ***
    RF LEVEL                                             0.995 W      OK
    RF FREQUENCY OFFSET                                 -0.00054 MHz  OK
    *** MODULATION SENSITIVITY ***
    MOD DEPTH: 30%                                       30.19 %
    AF-LEVEL1                                            0.025 V
    *** DISTORTION ***
    1000 HZ:                                              1.9 %
    *** S/N RATIO ***                                    38.5 dB
    *** RX TEST ***
    *** AF LEVEL  ***                                    1.412 V      OK
    *** RX SENSITIVITY  ***                              20.0 dB
    RF-LEVEL                                            -105.2 dBm
    *** S/N RATIO ***                                    9.6 dB
    *** RX DISTORTION ***
    1000 HZ:                                             1.14 %
    *** RX BANDWITH ***                                  20.80 kHz
    FREQUENCY ERROR                                      -0.70 kHz
    *** SQUELCH MEASUREMENTS ***
    SWITCH-ON RF-LEVEL                                  -105.7 dBm
    HYSTERESIS                                           1.2 dB
    SWITCH-OFF RF-LEVEL                                 -104.5 dBm
    *** TEST FINISHED ***
    TOTAL TOLERANCE                                                   OK
```

Exemplary Test Reports for COM testing

```
REPORT  3
REPORT: 03   PROGRAM: 07    09-02-94 10:45 USER: DEWEY
DEVICE under TEST IDENT: NAV AIDS

NO          COMMAND                    PARAMETER        RESULT        TOL
    *** NAV AIDS RAMP TEST ***
    *** VOR RAMP TEST ***
    CHECK FOR  0
    OK
    CHECK FOR  30
    ERROR 30
    CHECK FOR  60
    OK
    CHECK FOR DIRECTION "TO"
    OK
    CHECK FOR DIRECTION FROM
    OK
    *** ILS RAMP TEST ***
    CHECK LOC FOR FULL LEFT
    OK
    CHECK LOC FOR MID
    OK
    CHECK LOC FOR FULL RIGHT
    OK
    CHECK G/S FOR FULL DOWN
    OK
    CHECK G/S FOR MIDDLE
    ERROR G/S MIDDLE
    CHECK G/S FOR FULL UP
    OK
    *** MARKER RAMP TEST ***
    CHECK BLUE LAMP
    OK
    CHECK YELLOW LAMP
    OK
    CHECK WHITE LAMP
    OK
    TOTAL TOLERANCE                                                   OUT
```

Exemplary Test Reports for NAV testing

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Test Routines, Programming and Software Management

All test routines are stored on a write-protected memory card. A test routine can be created on a PC including card reader at a central office or on-site at the test item using the CMS33 directly.

In both cases, creating a test routine is very simple. When creating it on the PC, the only thing to do is to enter the corresponding IEC-bus command, knowledge of programming is not required. Creation is even simpler directly at the CMS without an external keyboard: Every manual setting or measurement can be stored at the stroke of a key, which are then processed automatically in the order stored.

When the RCB is used, all necessary commands are directly transmitted from the memory card in the CMS33 to the remote control box via the RS232 interface.

This means that the management of software states is reduced to the memory card to be used for both items - the radio tester as well as the remote control box.

The remote control box is ideal for the use in the cockpit in combination with automatic test runs. MIC/TELS sockets conforming to standards are available for the AF adaptation to the INTERCOM equipment. Data and voice communication with the CMS33 is effected via a single cable connection.

The small and handy remote-control box (optional) allows for operation in confined places.

Low Cost of Ownership

The CMS33 is based on the successful CMS family. Its use with numerous aviation control authorities and armed forces guarantees high reliability.

Modern design, modular concept and the built-in selftest permit a minimal MTTR of <15 minutes.

SMD technology, manufacture according to ISO9000 and the internal calibration routines ensure a high MTBF and maximal recalibration intervals. Thus a calibration cycle of 3 years is recommended.

CMS33 inclusive options: External battery, VSWR head, remote control box and the front cover with antenna

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Instrument data

Timebase

Warm up time:	Frequency within limits 5 min from switch on at 0 °C 1 min from switch on at +30 °C
Temperature effect 0 to 50°C	$\leq 1 \times 10^{-6}$
Aging	$\leq 5 \times 10^{-8}$/day $\leq 5 \times 10^{-7}$/month $\leq 1 \times 10^{-6}$/year
Frequency accuracy	$\pm 1 \times 10^{-6}$

Receiver measurements

Signal generator

Frequency range	0.4 to 1000 MHz usable from 100 kHz
Frequency resolution	10 Hz
Frequency error	same as timebase
Level	
FM, φM, CW	-128 to 0 dBm
AM	-128 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 [1]
Harmonics	≤-25 dBc
Nonharmonics	≤-50 dBc (>5 kHz from carrier, level -3 dBm)
Residual AM (CCITT, RMS)	≤0.03%
Residual FM (CCITT, RMS)	
0.4 to 250, 500 to 1000 MHz	≤10 Hz
250 to 500 MHz	≤5 Hz
Phase noise	≤-110 dBc/Hz (20 kHz from carrier)

Modulation

Frequency range	0.4 to 1000 MHz usable from 100 kHz
AM modulation depth	0 to 90%
Resolution	0.5%
Mod. frequency range	DC to 20 kHz,
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 (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
External modulation	20 Hz to 100 kHz
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

1) fine level variation 0 dB

Modulation modes

internal (single-tone/two-tone), external, internal + external

AM ext default: 1 mV @ 1 kHz produces 35% modulation

Distortion meter, SINAD meter, AF frequency counter

see transmitter and receiver measurements

AF voltmeter

Frequency range	Frontpanel: 20 Hz to 20 kHz TEL 1/2: 50 Hz to 20 kHz
Measurement range	Frontpanel: 0.1 mV to 30 V TEL 1/2: 0.1 mV to 20 V
Resolution	100 µV, V <10 mV 1%, V ≥10 mV
Error [2]	±3% off reading, at 1kHz
Input impedance	Frontpanel: 1MΩ TEL 1/2: switchable to 150Ω, 300Ω

Transmitter measurements

RF power meter

Frequency range	1.5 to 1000 MHz
Measurement range	5 mW to 125 W [3] [4]
Resolution	1 mW, P <100 mW 1%, P ≥100 mW
Error (P >20 mW, AM = 0%)	±10 % + resolution
Selective level measurement	in frequency range 1 to 1000 MHz
Level range	-60 to +50 dBm without weighting filter, -80 to +50 dBm with 2 kHz resonance filter

VSWR meter

Frequency range (NAS-Z5)	70 to 1000 MHz
Measurement range	1.1:1 to 10:1
Error	<10 % of reading
Operating modes	direct display of forward and reflected power and VSWR

2) without weighting filters
3) 80 W continuous; 125 W for 2 minutes, then 10 minutes off
4) Audio/visual warning in the event of overload

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RF frequency counter

Frequency range	0.4 to 1000 MHz
Input level range (input 1)	5 mW to 125 W [3) 4)]
Sensitivity of input 2	0.1 µW
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 125 W [3) 4)]
RF frequency range	1.5 to 1000 MHz
Deviation measurement range	0 Hz to 25 kHz
AF frequency range	20 Hz to 20 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
250 to 500 MHz	≤5 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 125 W [3) 4)]
RF frequency range	1.5 to 1000 MHz
Phase deviation measurement range	0.001 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 125 W [3) 4)]
RF frequency range	1.5 to 1000 MHz
AM depth measurement range	0.01 to 90 %
AF frequency range	20 Hz to 20 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

Frequency range	1 to 1000 MHz
Reference level	+50 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

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 about

RF frequency counter	100 µV (selective frequency counter with presetting)
Modulation meter	20 µV (IF narrow) 10 µV (IF narrow, selective measurement)
Selective level measurement	-70 to -35 dBm without weighting filter, -90 to -35 dBm with 2-kHz resonance filter

Transmitter and receiver measurements

Modulation generator I and II

Frequency range	Frontpanel: 20 Hz to 20 kHz MIC: 100 Hz to 10 kHz
Frequency resolution	0.1 Hz
Error	same as timebase + ½ resolution
Output level range	Frontpanel: 10 µV to 5 V_{EMF} MIC: 100 µV to 350 mV
Max. output current	20 mA_{peak}
Resolution	10 µV, V <1 mV 1%, V ≥1 mV
Error	±5%, V >1 mV
Output impedance	Frontpanel: <5 Ω MIC: automatic impedance matching and impedance measurement for loads 50 to 400 Ω
Distortion	≤0.5%

Distortion meter / Modulation distortion

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

SINAD meter

Frequency	100 Hz to 5 kHz ±10 Hz
Measurement range	0 to 46 dB
Input level range	100 mV to 30 V
Resolution	0.1 dB
Weighting bandwidth	≤12 kHz
Error	±1 dB @ 12 dB

2) without weighting filters
3) 80 W continuous, 125 W for 2 minutes, then 10 minutes off
4) Audio/visual warning in the event of overload

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AF frequency counter

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 timebase + resolution

Signal + Noise to Noise

Measurement range	0 to 48 dB
Accuracy	±5% of reading + resolution

Oscilloscope

Bandwidth	DC: DC to 20 kHz AC: 10 Hz to 20 kHz
Horizontal deflection	50 to 0.05 ms/div
Vertical deflection	scaled in kHz (FM), rad (φM), % (AM), mV/V (AF)
Input level range	0 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 in 10-Hz steps, attenuation typ. 40 dB for 0.8f and 1.2f
IF filter	150 kHz
Notch filter	100 Hz to 5 kHz in 10-Hz steps, attenuation typ. 40 dB for 0.8f and 1.2f
CCITT filter	

Selective call coder

Tonesequences	SELCAL/ZVEI1/ZVEI2/CCIR/EIA/EEA/EURO/NATEL/CCITT/VDEW/VDEW direct dialling / user-defined sequences

Audio monitor (loudspeaker)

demodulated signal, AF signal, beat (frequency offset)

Impedance matching

see page 6

VOR/ILS generator [5]

General

The Localizer and Glideslope carrier frequencies have the capability of varying the modulation depth of the 90 Hz and 150 Hz tones, thus displaying fly left/right and up/down indications on the aircraft displays. To test the operation of the flag alarm the test set has the capability of deleting either the 50 Hz or 150 Hz tones. The Marker Beacon is simulated by transmitting a 75 MHz carrier modulated by one of the 3 AF tones. VOR signals are simulated by modulating a VHF carrier with 2 separate 30 Hz tones, the phase of one being variable with respect to the other. Localizer and Glideslope frequencies have specific pairings and the test set automatically selects the paired Glideslope frequency when a Localizer frequency is selected.

	Range	Resolution	Error
VOR			
Power output	-128 to 0dBm dependent on modulation depth		
Frequency Bands	108 to 117.95 MHz		±0.0035% (0 to 35 °C) ±0.005% (0 to 50 °C)
	Odd / Even 100 kHz spacing		
Phase RF output	0 to 360°	0.01°	±0.06°
AF output	0 to 360°	0.01°	±0.04°
9960-Hz carrier			
Modulation frequency	7.9 to 12 kHz		
Amplitude modulation			
-128 to -12 dBm	0 to 100%	0.1% AM	±2% for 30% AM
-88 to -48 dBm	0 to 100%	0.1% AM	±2% for 30% AM
FM deviation	384 to 576 Hz	1 Hz	≤1 Hz
30-Hz VAR			
Modulation frequency	24 to 36 Hz		
Amplitude modulation			
-128 to -12 dBm	0 to 100%	0.1% AM	±2% for 30% AM
-88 to -48 dBm	0 to 100%	0.1% AM	±2% for 30% AM

5) Data for VOR/ILS/MB signals are specified in the RF level range (-128 to -12 dBm, fine variation 0 dB) for discrete RF frequencies as well as for the following continuous ranges: VOR: 108 to 118 MHz; ILS localizer: 108 to 112 MHz, ILS glideslope: 329 to 335 MHz: Marker beacon: 74 to 76 MHz

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	Range	Resolution	Error
1020-Hz AUX			
Modulation frequency	50 Hz to 20 kHz		
Amplitude modulation	0 to 100%	0.1% AM	±3%, at 1020 Hz and 10 to 20% AM
Switchable TO or FROM			
ILS			
90-Hz and 150-Hz phase	0 to 180°, referred to 150 Hz	0.01°	±0.1°
90-Hz tone			
Modulation frequency	72 to 108 Hz		
150-Hz tone			
Modulation frequency	120 to 180 Hz		
1020-Hz tone (AUX)			
Modulation frequency	50 Hz to 20 kHz		
Amplitude modulation	0 to 90%	0.1% AM	±3%, at 1020 Hz and 10 to 20% AM
ILS Localizer			
Amplitude modulation			
-128 to -12 dBm	0 to 50%	0.1% AM	±2% for 20% AM
-88 to -48 dBm	0 to 50%	0.1% AM	±2% for 20% AM
DDM[6] RF output	±0 to 0.4 DDM for 20% AM		
On-course error, -128 to -12 dBm			<0.0004 DDM
Off-course error, -128 to -12 dBm			±2% + 0.0004 DDM for |DDM| ≤0.2
DDM[6] 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 to 5 V
ILS Glideslope			
Frequency Band	329.15 to 333.95 MHz		±0.003% (0 to 35 °C) ±0.005% (0 to 50 °C)
Amplitude modulation			
-128 to -12 dBm	0 to 50%	0.1% AM	typ. <2% for 40% AM
-88 to -48 dBm	0 to 50%	0.1% AM	±2% for 40% AM
DDM[6] RF output	±0 to 0.8 DDM for 40% AM	0.001 DDM	
On-course error, -128 to -12 dBm			<0.001 DDM
Off-course error, -128 to -12 dBm			±2% + 0.0004 DDM for |DDM| ±0.4
DDM[6] 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 to 5 V
Marker Beacon			
Carrier frequency	75 MHz		
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	±5 % + resolution + residual AM, m <0.8, f_{AF}=300 Hz to 3 kHz
Autopilot CMS-B38 (optional)	Provides additional glideslope bearings with the localiser simultaneously; level approx. -53 dBm frequencies: standard glideslope		

AUTORUN Program

VOR / ILS / MB tests carried out automatically in the form of an auto run facility requiring only confirmation inputs from the operator.

6) Difference in Depth of Modulation; describes the modulation depth difference between the 90-Hz and the 150-Hz tone; |DDM| = |(90-Hz modulation in % - 150-Hz modulation in %)| / 100%.

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SSB Measurement

Frequency range	1 to 1000 MHz
Bandwith	20 Hz to 20 kHz
Distortion and Noise	< 3% at 1kHz rate in a 0.3 to 3.4 kHz BW

General data

IEEE bus	interface to IEEE 488 with listener/talker function
Rated and operating temperature range	0 to +50°C
Storage temperature range	-40 to +70°C
Temperature load	complies with IEC 68-2-1 and IEC 68-2-2
Climatic load (damp heat)	+25°C/+40°C cyclically with 95% rel. humidity; complies with IEC 68-2-30
Mechanical load	tested to MIL-STD-28800 CAT III, class 3, style C
Sinusoidal vibration	5 to 150 Hz, max. 2 g at 55 Hz, 0.5 g at 55 to 150 Hz
Standards complied with	IEC 68-2-6 and IEC 1010-1 as well as MIL-T-28000D class 5
Random vibration	10 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 standards of EU (89/336/EWG)
Safety	complies with EN 61010-1
Power supply	100/120/220/240 V AC ±10%, 47 to 420 Hz or 11 to 32 V DC (50 W)
Weight	approx. 14.5 kg (32 lb)
Dimensions (WxHxD)	320 mm x 175 mm x 375 mm (12.6 inch x 6.9 inch x 14.8 inch)

Options

External battery pack CMS-Z42 ID.1065.5803.02

with battery condition indication
MIC/TEL , VSWR socket

Minimum operating time	1 h at 0° C to 50° C
Weight	approx 4.4 kg (9.7 lb)
Dimension (WxHxD)	85 mm x 175 mm x 375mm (3.3 inch x 6.9 inch x 14.8 inch)

Autopilot CMS-B38 ID.1065.5003.02

Weight	approx 0.3 kg (0.7 lb)

Antenna base CMS-Z35 ID.1066.7300.02

cover, cable and antenna

Weight	approx 1.6 kg (3.5 lb)
Dimension (WxHxD)	350 mm x 180 mm x 90mm (13.8 inch x 7 inch x 3.5 inch)

Remote Control Box CMS-Z34 ID.1065.4213.02

Weight	approx 2.2 kg (4.8 lb)
Dimension (WxHxD)	215 mm x 53 mm x 144mm (8.5 inch x 2.1 inch x 5.7 inch)

Carrying Bag CMS-Z44 ID.1066.7400.02

Memory Card CMS-Z2 ID.0841.1509.02

128 kByte

Ordering information

Radiocommunication Service Monitor

CMS33	0840.0009.34
Accessories supplied	User's guide, spare fuses, power cable (right angled), NAS-Z5 VSWR head and cable