

# CMA RADIO TEST SET

## Specifications



Specifications  
Version 12.00

**ROHDE & SCHWARZ**

Make ideas real



# CONTENTS

<b>Definitions</b> .....	<b>4</b>
<b>At a glance</b> .....	<b>5</b>
<b>General technical specifications</b> .....	<b>6</b>
RF generator .....	6
RF analyzer.....	12
Spectrum measurements.....	17
I/Q recorder (R&S®CMA-K220 option) .....	19
AF generator (AF1 OUT, AF2 OUT).....	19
AF analyzer (AF1 IN, AF2 IN) .....	20
AF oscilloscope (R&S®CMA-K120 option) .....	21
Digital interface, unbalanced.....	21
VoIP support (R&S®CMA-K610 option).....	22
VoIP delay measurement (R&S®CMA-K611 option).....	22
Search routines .....	22
<b>Digital standards</b> .....	<b>23</b>
For all digital standard generators and analyzers.....	23
DMR generator (prerequisite: R&S®CMA-B110B/D option).....	23
DMR analyzer (R&S®CMA-K305 option, prerequisite: R&S®CMA-K300 option).....	23
NXDN generator (prerequisite: R&S®CMA-B110B/D option).....	23
NXDN analyzer.....	23
DPMR generator (prerequisite: R&S®CMA-B110B/D option).....	23
DPMR analyzer (prerequisite: R&S®CMA-K305 option, R&S®CMA-K300 option).....	23
APCO/P25 generator (prerequisite: R&S®CMA-B110B/D option).....	24
APCO/P25 analyzer (R&S®CMA-K305 option, prerequisite: R&S®CMA-K300 option).....	24
POCSAG generator (R&S®CMA-KG260 option, prerequisite: R&S®CMA-B110B/D option).....	24
TETRA analyzer (R&S®CMA-K305 option, prerequisite: R&S®CMA-K300 option).....	24
Zigbee generator (R&S®CMA-KG250 option, prerequisite: R&S®CMA-B110B/D option).....	24
LTE analyzer (R&S®CMA-K320 option, prerequisite: R&S®CMA-K300 option).....	24
Signal content analyzer: DMR (R&S®CMA-KS200 option) .....	25
Signal content analyzer: P25 (R&S®CMA-KS201 option).....	25
Signal content analyzer: TETRA (R&S®CMA-KS268 option).....	25
User defined generator (R&S®CMA-K210 option) .....	25
Bit error rate tester (R&S®CMA-K230 option).....	25
<b>General data</b> .....	<b>26</b>
Timebase .....	26

<b>Extras .....</b>	<b>30</b>
R&S®CMA-Z020A transport case.....	30
R&S®CMA-Z025A soft case.....	30
R&S®CMA-Z053A external power supply (prerequisite: R&S®CMA-S054M option).....	30
R&S®CMA-B060A battery compartment (prerequisite: R&S®CMA-S054M option) .....	30
R&S®CMA-Z061A Lithium-ion battery (prerequisite: R&S®CMA-S054M option, R&S®CMA-B060A option) .....	31
R&S®CMA-Z062A Lithium-ion battery charger for R&S®CMA-Z061A Lithium-ion battery .....	31
R&S®CMA-Z600A AF impedance matching unit (prerequisite: CMA).....	31
R&S®CMA-Z680A antenna set .....	33
R&S®CMA-Z651A 600 Ω set.....	33
R&S®CMA-Z421A radio adapter box and cables.....	33
R&S®CMA-XRT100 setup: R&S®CMW100 – model K06.....	33
<b>Ordering information .....</b>	<b>35</b>
Recommended extras.....	36
Recommended extras for manual operation .....	36
Service options.....	37

# Definitions

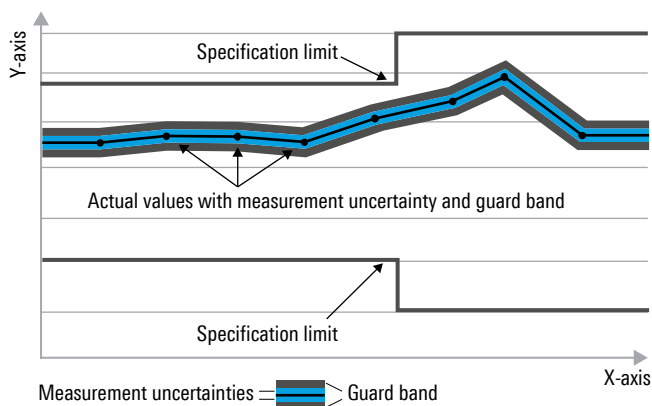
## General

Product data applies under the following conditions:

- Three hours storage at ambient temperature followed by 30 minutes warm-up operation
- Specified environmental conditions met
- Recommended calibration interval adhered to
- All internal automatic adjustments performed, if applicable

## Specifications with limits

Represent warranted product performance by means of a range of values for the specified parameter. These specifications are marked with limiting symbols such as  $<$ ,  $\leq$ ,  $>$ ,  $\geq$ ,  $\pm$ , or descriptions such as maximum, limit of, minimum. Compliance is ensured by testing or is derived from the design. Test limits are narrowed by guard bands to take into account measurement uncertainties, drift and aging, if applicable.



## Non-traceable specifications with limits (n. trc.)

Represent product performance that is specified and tested as described under “Specifications with limits” above. However, product performance in this case cannot be warranted due to the lack of measuring equipment traceable to national metrology standards. In this case, measurements are referenced to standards used in the Rohde & Schwarz laboratories.

## Specifications without limits

Represent warranted product performance for the specified parameter. These specifications are not specially marked and represent values with no or negligible deviations from the given value (e.g. dimensions or resolution of a setting parameter). Compliance is ensured by design.

## Typical data (typ.)

Characterizes product performance by means of representative information for the given parameter. When marked with  $<$ ,  $>$  or as a range, it represents the performance met by approximately 80 % of the instruments at production time. Otherwise, it represents the mean value.

## Nominal values (nom.)

Characterize product performance by means of a representative value for the given parameter (e.g. nominal impedance). In contrast to typical data, a statistical evaluation does not take place and the parameter is not tested during production.

## Measured values (meas.)

Characterize expected product performance by means of measurement results gained from individual samples.

## Uncertainties

Represent limits of measurement uncertainty for a given measurand. Uncertainty is defined with a coverage factor of 2 and has been calculated in line with the rules of the Guide to the Expression of Uncertainty in Measurement (GUM), taking into account environmental conditions, aging, wear and tear.

Device settings and GUI parameters are designated with the format “parameter: value”.

Non-traceable specifications with limits, typical data as well as nominal and measured values are not warranted by Rohde & Schwarz.

In line with the 3GPP standard, chip rates are specified in million chips per second (Mcps), whereas bit rates and symbol rates are specified in billion bit per second (Gbps), million bit per second (Mbps), thousand bit per second (kbps), million symbols per second (Msps) or thousand symbols per second (ksps), and sample rates are specified in million samples per second (Msample/s). Gbps, Mcps, Mbps, Msps, kbps, ksps and Msample/s are not SI units.

## At a glance

With its frequency range from 100 kHz to 3 GHz, the CMA is ideal for testing all common analog and digital radio systems. Input levels up to 150 W are no problem for the CMA. The flexible internal switching capabilities for the audio and RF paths make the CMA suitable for a wide range of test requirements. Users can configure the internal generators, external audio sources, filters and measurements according to the given application. In the predefined test scenarios for receiver, transmitter and duplex tests, the RF and audio paths are preconfigured. This saves time and eliminates configuration errors for standard test cases.

The CMA features a built-in sweeping spectrum analyzer. Extensive configuration options make this analyzer a universal tool for testing all types of DUTs. The spectrum analyzer has two operating modes: full span and user-defined spans. The zero span mode enables analysis in the time domain. In combination with the triggers, it is possible, for instance, to display transients. The built-in tracking generator makes it easy to determine the frequency response of RF components.

The CMA can generate test signals for digital radio standards. Signal content can be configured to match test requirements. Signals can carry audio test tones or pseudo random bit sequences (PRBS), for example. Signaling parameters such as DMR color code can be configured on the instrument's intuitive GUI. The integrated vector signal analyzer demodulates digital signals and delivers results, including eye diagrams and symbol distribution. R&S®CMArun is available for test sequence control. It provides a graphical user interface for programming a test sequence. Individual settings and measurement tasks can be configured and arranged in a specific sequence. Sequences, loops and conditional queries help users easily create and execute complex test sequences. Each setting and measurement value is logged and then summarized and stored in a report. For measurements with limit values, pass or fail indicators can be displayed.

Its outstanding signal quality makes the CMA an extremely versatile radio tester for aircraft. The CMA can generate ILS, VOR and marker beacon signals for aircraft landing systems as well as airborne radio signals. Equipped with a battery and antenna, the CMA is a standalone instrument that is ideal for aircraft maintenance. The CMA incorporates a VoIP generator and analyzer in line with EUROCAE ED-137B/C. The VoIP interface is fully integrated in the CMA.

The CMA can be equipped with an AC power supply for operation at 110 V to 250 V or a DC power supply for operation at 10 V to 30 V. Equipped with a DC power supply, the CMA can also be powered via a vehicle's power supply. The DC power supply can be connected to an external AC/DC converter for AC operation at 110 V to 250 V. An optional battery pack ensures maximum mobility and turns the CMA with DC power supply into a portable tester that can be brought directly to the DUT.

# General technical specifications

## RF generator

Frequency range		0.1 MHz to 3000 MHz
Frequency resolution		1 Hz
Frequency uncertainty		same as timebase + frequency resolution

<b>Output level range</b>		
RF COM with high-power attenuator	0.1 MHz to 30 MHz	
	continuous wave (CW)	-141 dBm to -17 dBm
	peak envelope power (PEP)	up to -17 dBm
	overranging (PEP)	up to -13 dBm
	30 MHz to 2000 MHz	
	continuous wave (CW)	-141 dBm to -15 dBm
	peak envelope power (PEP)	up to -15 dBm
	overranging (PEP)	up to -9 dBm
	2000 MHz to 3000 MHz	
	continuous wave (CW)	-120 dBm to -20 dBm
	peak envelope power (PEP)	up to -20 dBm
	overranging (PEP)	up to -13 dBm
RF COM without high-power attenuator	0.1 MHz to 30 MHz	
	continuous wave (CW)	-128 dBm to 0 dBm
	peak envelope power (PEP)	up to 0 dBm
	overranging (PEP)	up to 4 dBm
	30 MHz to 2000 MHz	
	continuous wave (CW)	-128 dBm to 2 dBm
	peak envelope power (PEP)	up to 2 dBm
	overranging (PEP)	up to 8 dBm
	2000 MHz to 3000 MHz	
	continuous wave (CW)	-120 dBm to -3 dBm
	peak envelope power (PEP)	up to -3 dBm
	overranging (PEP)	up to 4 dBm
RF OUT	0.1 MHz to 30 MHz	
	continuous wave (CW)	-120 dBm to 8 dBm
	peak envelope power (PEP)	up to 8 dBm
	overranging (PEP)	up to 12 dBm
	30 MHz to 2000 MHz	
	continuous wave (CW)	-120 dBm to 10 dBm
	peak envelope power (PEP)	up to 10 dBm
	overranging (PEP)	up to 16 dBm
	2000 MHz to 3000 MHz	
	continuous wave (CW)	-112 dBm to 5 dBm
	peak envelope power (PEP)	up to 5 dBm
	overranging (PEP)	up to 12 dBm

<b>Output level uncertainty</b>	in temperature range from +20 °C to +35 °C, no overranging	
RF COM	output level > -120 dBm	
	0.1 MHz to 1 MHz	< 1.2 dB
	1 MHz to 2000 MHz	< 0.7 dB
	2000 MHz to 2700 MHz	< 1.2 dB
RF OUT	2700 MHz to 3000 MHz	< 1.5 dB
	output level > -112 dBm	
	0.1 MHz to 1 MHz	< 1.2 dB
	1 MHz to 2000 MHz	< 0.7 dB
	2000 MHz to 2700 MHz	< 1.2 dB
	2700 MHz to 3000 MHz	< 1.5 dB

<b>Output level uncertainty</b>	in temperature range from 0 °C to +50 °C, no overranging	
RF COM	output level > -120 dBm	
	0.1 MHz to 1 MHz	< 2.0 dB
	1 MHz to 2000 MHz	< 1.0 dB
	2000 MHz to 2700 MHz	< 2.0 dB
	2700 MHz to 3000 MHz	< 2.0 dB
RF OUT	output level > -112 dBm	
	0.1 MHz to 1 MHz	< 2.0 dB
	1 MHz to 2000 MHz	< 1.0 dB
	2000 MHz to 2700 MHz	< 2.0 dB
	2700 MHz to 3000 MHz	< 2.0 dB

<b>Output level linearity with fixed RF output attenuator setting (digital gain)</b>	in temperature range from +20 °C to +35 °C, level range 0 dB to -30 dB	
RF COM	no overranging	< 0.2 dB, < 0.1 dB (typ.)

<b>Output level resolution</b>		0.01 dB
<b>Output level repeatability</b>	typical values after 1 h warm-up time, always returning to same level and frequency, no temperature change, insignificant time change	< 0.02 dB

<b>Output level setting range</b>	possible settings in the HMI, specifications not warranted	
RF COM with high-power attenuator	0.1 MHz to 3000 MHz	-158 dBm to -9 dBm
RF COM without high-power attenuator	0.1 MHz to 3000 MHz	-141 dBm to 8 dBm
RF OUT	0.1 MHz to 3000 MHz	-133 dBm to 16 dBm

<b>RF power overload protection</b>		
RF COM with high-power attenuator ("RF COM connector attenuation" in setup menu)	maximum allowed input power for continuous operation	100 W
	max. allowed input power for 1 min (typ.), at $T_{amb} \leq +25$ °C, recovery time necessary	150 W
	shutdown (open)	when thermal overload is detected
RF COM without high-power attenuator ("RF COM connector attenuation" in setup menu)	maximum allowed input power	1 W (typ.)
	shutdown (open)	when voltage overload is detected
RF IN	maximum allowed input power	100 mW (+20 dBm)
	shutdown (short)	when voltage overload is detected
RF OUT	maximum allowed reverse input power	20 mW (+13 dBm)
	shutdown (short)	when voltage overload is detected

Shutdown: All three connectors are shut down simultaneously; RF COM is switched to open, and RF IN and RF OUT are switched to short.

<b>VSWR</b>		
RF COM with high-power attenuator	0.1 MHz to 2000 MHz	< 1.2
	2000 MHz to 2700 MHz	< 1.7
	2700 MHz to 3000 MHz	< 2.0
RF COM without high-power attenuator	0.1 MHz to 2000 MHz	< 1.4
	2000 MHz to 2700 MHz	< 1.4
	2700 MHz to 3000 MHz	< 2.0
RF OUT	0.1 MHz to 2000 MHz	< 1.53
	2000 MHz to 2700 MHz	< 1.53
	2700 MHz to 3000 MHz	< 1.53

RF OUT is switched to short when off.

<b>Attenuation of second harmonics</b>		
RF COM with high-power attenuator	0.1 MHz to 3000 MHz, $P < -27$ dBm	> 30 dB
RF COM without high-power attenuator	0.1 MHz to 3000 MHz, $P < -10$ dBm	> 30 dB
RF OUT	0.1 MHz to 3000 MHz, $P < -2$ dBm	> 30 dB

<b>Attenuation of third harmonics</b>		
RF COM with high-power attenuator	0.1 MHz to 3000 MHz, $P < -27$ dBm	> 40 dB
RF COM without high-power attenuator	0.1 MHz to 3000 MHz, $P < -10$ dBm	> 40 dB
RF OUT	0.1 MHz to 3000 MHz, $P < -2$ dBm	> 40 dB

<b>Attenuation of nonharmonics</b>		
RF COM, RF OUT, with/without high-power attenuator	for full-scale CW signal	
	0.1 MHz to 30 MHz	> 60 dB
	30 MHz to 2000 MHz, except $f_{\text{nonharmonic}} = 2659.9375 \text{ MHz} - f_{\text{carrier}}$ , except $f_{\text{nonharmonic}} = 2 \cdot f_{\text{carrier}} - 2659.9375 \text{ MHz}$ , except $f_{\text{nonharmonic}} = 2659.9375 \text{ MHz}$	> 55 dB
	2000 MHz to 3000 MHz, except $f_{\text{nonharmonic}} = 7362.5 \text{ MHz} - 2 \cdot f_{\text{carrier}}$ , except $f_{\text{nonharmonic}} = 2 \cdot f_{\text{carrier}} - 3681.25 \text{ MHz}$ , except $f_{\text{nonharmonic}} = 4702.5625 \text{ MHz} - f_{\text{carrier}}$	> 45 dB

<b>Nonharmonics, absolute</b>		
RF COM with high-power attenuator	harmonics of 24.576 MHz and 25 MHz, except 175 MHz, 225 MHz, 275 MHz, 325 MHz, 375 MHz	< -130 dBm
	175 MHz, 225 MHz, 275 MHz, 325 MHz, 375 MHz	< -120 dBm
	harmonics of 800 MHz	< -130 dBm
	920.3125 MHz and 1840.625 MHz	< -130 dBm
	2760.9375 MHz	< -115 dBm

<b>Phase noise</b>		
	single sideband, 0.1 MHz to 30 MHz	
	10 kHz offset from carrier	< -130 dBc (1 Hz)
	100 kHz offset from carrier	< -130 dBc (1 Hz)
	3 MHz offset from carrier	< -133 dBc (1 Hz)
	single sideband, 30 MHz to 890 MHz	
	10 kHz offset from carrier	< -113 dBc (1 Hz)
	100 kHz offset from carrier	< -115 dBc (1 Hz)
	3 MHz offset from carrier	< -130 dBc (1 Hz)
	single sideband, 890 MHz to 3000 MHz	
	10 kHz offset from carrier	< -110 dBc (1 Hz)
	100 kHz offset from carrier	< -110 dBc (1 Hz)
	3 MHz offset from carrier	< -122 dBc (1 Hz)

<b>Residual FM</b>		
	CCITT, RMS	
	0.1 MHz to 30 MHz	< 2 Hz
	30 MHz to 2000 MHz	< 3 Hz
	2000 MHz to 3000 MHz	< 5 Hz

<b>Residual PM</b>		
	CCITT, RMS	
	0.1 MHz to 30 MHz	< 0.5 mrad
	30 MHz to 2000 MHz	< 5 mrad
	2000 MHz to 3000 MHz	< 5 mrad

<b>Residual AM</b>		
	CCITT, RMS	
	0.1 MHz to 30 MHz	< 0.05 %
	30 MHz to 2000 MHz	< 0.1 %
	2000 MHz to 3000 MHz	< 0.1 %



**Modulation**

Modulation		CW (off), AM, FM, FM stereo, PM, SSB USB, SSB LSB, ARB
------------	--	--

**Amplitude modulation**

Source		internal modulation source, external AF1 IN, AF2 IN, external SPDIF IN
AM depth	range	0 % to 100 %
	resolution	0.1 %
	uncertainty, internal source	< 1 %
	uncertainty, external source	< 3 %
Modulation frequency	range	0 Hz to 21 kHz
	resolution	0.1 Hz
Modulation distortion	CCITT-weighted	< 1 %

**Frequency modulation**

Source		internal modulation source, external AF1 IN, AF2 IN, external SPDIF IN
Deviation	range	0 Hz to 100 kHz
	resolution	1 Hz
	uncertainty, internal source	< 1 %
	uncertainty, external source	< 3 %
Modulation frequency	range, internal modulation generator	0 Hz to 21 kHz
Modulation distortion	CCITT-weighted	< 1 %

**Phase modulation**

Source		internal modulation source, external AF1 IN, AF2 IN, external SPDIF IN
Deviation	range	0 rad to 10 rad
	resolution	0.1 mrad
	uncertainty, internal source	< 1 %
	uncertainty, external source	< 3 %
Modulation frequency	range, internal modulation generator	0 Hz to 21 kHz
Modulation distortion	CCITT-weighted	< 1 %

**SSB modulation**

Source	upper sideband (USB), lower sideband (LSB)	internal modulation source, external AF1 IN, AF2 IN, external SPDIF IN
Modulation frequency		30 Hz to 21 kHz
Carrier suppression		> 70 dB
Sideband suppression		> 70 dB

**FM stereo modulation**

Source		internal modulation source, external AF1 IN, AF2 IN, external SPDIF IN
Maximum audio deviation		0 Hz to 90.5 kHz
Pilot deviation		0 Hz to 10 kHz
RDS deviation		0 Hz to 10 kHz

**Internal modulation source**

Modulation generators		2 generators, each single tone/multitone/noise/square with additional subtone/CTCSS tone/DCS tone
Frequency range	basic tone	1 Hz to 21 kHz
	square wave, bandwidth limited to 21 kHz	1 Hz to 4 kHz
	subtone	1 Hz to 2 kHz
	resolution, single tone/dual tone	0.1 Hz
	resolution, others	1 Hz
Multitone	CTCSS tone	tone 1 (67 Hz) to tone 50 (254.1 Hz)
	frequency range	1 to 20 selectable tones with individual frequencies and levels 1 Hz to 21 kHz
Noise		FFT noise, signal composite with flat frequency response from 0 Hz to 21 kHz
DCS	data rate	134.4 bit/s
	rate offset	±30 bit/s
	FSK deviation	0 Hz to 10 kHz
	modes	off_code, inverted FSK
	length	100 ms to 300 ms

**Modulation source: DTMF, Selcall, free dialing, SELCAL**

DTMF	DTMF frequencies	697 Hz, 770 Hz, 852 Hz, 941 Hz, 1209 Hz, 1336 Hz, 1447 Hz, 1633 Hz
	sequence	1 digit to 7 digits
	repetition	1 to 100
	pause	0 ms to 10000 ms
	digit time	0 ms to 3000 ms
Selcall	digit pause	0 ms to 3000 ms
	standard	CCIR, EAA, EIA, ZVEI I/II/III, DZVEI, PZVEI
	Selcall frequencies	1981 Hz, 1124 Hz, 1197 Hz, 1275 Hz, 1358 Hz, 1446 Hz, 1540 Hz, 1640 Hz, 1747 Hz, 1860 Hz, 2400 Hz, 930 Hz, 2247 Hz, 991 Hz, 2110 Hz, 1055 Hz
	sequence	1 digit to 5 digits
	repetition	1 to 100
	pause	0 ms to 10000 ms
	digit time	0 ms to 3000 ms
Free dialing	digit pause	0 ms to 3000 ms
	single tones, dual tones	
	frequency range 1st tone	60 Hz to 4000 Hz
	frequency range 2nd tone	1200 Hz to 4000 Hz
	resolution	0.1 Hz
	sequence	1 digit to 7 digits
	repetition	1 to 100
	pause	0 ms to 10000 ms
	digit time	0 ms to 3000 ms
SELCAL/SELCAL32	digit pause	0 ms to 3000 ms
	dual tones	
	frequency range	<ul style="list-style-type: none"> <li>297.5 Hz to 1553.1 Hz</li> <li>predefined: SELCAL: A to S</li> <li>predefined: SELCAL32: A to 9</li> <li>user defined</li> </ul>
	resolution	0.1 Hz
	repetition	1 to 100
	pause	0 ms to 10000 ms
digit time	0 ms to 3000 ms	
digit pause	0 ms to 3000 ms	

**Modulation source: arbitrary waveform generator (ARB) (R&S®CMA-B110B/D option)**

Memory size	R&S®CMA-B110B	1.024 Gbyte
	R&S®CMA-B110D	4.096 Gbyte
Word length	I	16 bit
	Q	16 bit
	marker	4 bit to 16 bit
Sample length	R&S®CMA-B110B, with 8-bit marker	up to 214.7 Msample
	R&S®CMA-B110D, with 8-bit marker	up to 858.9 Msample
Sample rate	minimum	400 Hz
	maximum	100 MHz
Maximum possible RF bandwidth	depending on arbitrary waveform file	20 MHz

<b>Trigger</b>		
Trigger sources		external TRIG IN
Delay		0 s to 100 s
Repetition		single, continuous

**Interferer**

<b>Interferer</b>		0.1 MHz to 3000 MHz
Delta frequency range		±10 MHz
Delta level range		±80 dB
Modulation		CW (off), AM, FM, PM

**VOR/ILS signal generator (R&S®CMA-K130 option)**

<b>VOR mode</b>		
Output level range and uncertainty		see General technical specifications
Frequency bands		108 MHz to 117.95 MHz
Bearing	switchable TO/FROM	0° to 360°
30 Hz tone (VAR)	modulation frequency, linked for VAR and REF	20 Hz to 40 Hz
	modulation depth <sup>1</sup>	0 % to 100 %
9960 Hz carrier (REF)	modulation frequency	7.5 kHz to 12.5 kHz
	FM deviation	300 Hz to 600 Hz
	modulation depth <sup>1</sup>	0 % to 100 %
1020 Hz auxiliary tone (IDENT)	modulation frequency	0 Hz to 21 kHz
	modulation depth <sup>1</sup>	0 % to 100 %
Uncertainty	modulation depth, at 30 %	0.1 %
	modulation frequency	0.05 Hz
	FM deviation	0.05 Hz
	bearing	0.02°

<b>ILS mode</b>		
Output level range and uncertainty		see General technical specifications
Frequency bands	localizer	108.1 MHz to 111.95 MHz
	glideslope	329.15 MHz to 335 MHz
90 Hz tone	modulation frequency, linked to 150 Hz	72 Hz to 108 Hz
150 Hz tone	modulation frequency, linked to 90 Hz	120 Hz to 180 Hz
90 Hz tone and 150 Hz tone	SDM <sup>1</sup>	0 % to 100 %
	DDM, depending on SDM	-1 to +1
	phase offset	-60° to +120°
1020 Hz auxiliary tone (IDENT)	modulation frequency	0 Hz to 21 kHz
	modulation depth <sup>1</sup>	0 % to 100 %
Uncertainty	modulation depth, at SDM 40 % to 80 %	0.1 %
	modulation frequency	0.05 Hz
	phase offset	0.05°
	DDM	0.001 FS

<sup>1</sup> Total modulation depth not to exceed 100 %.

<b>Marker beacon</b>		
Output level range and uncertainty		see General technical specifications
Frequency band		75 MHz
Marker tone	modulation frequency	400 Hz, 1300 Hz, 3000 Hz (selectable) 0 Hz to 10 kHz (variable)
	modulation depth <sup>1</sup>	0 % to 100 %
1020 Hz auxiliary tone (IDENT)	modulation frequency	0 Hz to 21 kHz
	modulation depth <sup>1</sup>	0 % to 100 %

## RF analyzer

<b>RF power overload protection</b>		
RF COM with high-power attenuator ("RF COM connector attenuation" in setup menu)	maximum allowed input power for continuous operation, at $T_{amb} \leq +30 \text{ }^{\circ}\text{C}$	100 W
	max. allowed input power for 1 min (typ.), recovery time necessary, at $T_{amb} \leq +30 \text{ }^{\circ}\text{C}$	150 W
	shutdown (open)	when thermal overload is detected
RF COM without high-power attenuator ("RF COM connector attenuation" in setup menu)	maximum allowed input power	1 W (typ.)
	shutdown (open)	when voltage overload is detected
RF IN	maximum allowed input power	100 mW (+20 dBm)
	shutdown (short)	when voltage overload is detected
RF OUT	maximum allowed reverse input power	20 mW (+13 dBm)
	shutdown (short)	when voltage overload is detected

Shutdown: All three connectors are shut down simultaneously; RF COM is switched to open, and RF IN and RF OUT are switched to short.

<b>Expected nominal power setting range</b>		
RF COM with high-power attenuator	0.1 MHz to 3000 MHz	-13 dBm to 53 dBm
RF COM without high-power attenuator	0.1 MHz to 3000 MHz	-30 dBm to 36 dBm
RF IN	0.1 MHz to 3000 MHz	-36 dBm to 20 dBm

<b>VSWR</b>		
RF COM with high-power attenuator	0.1 MHz to 2000 MHz	< 1.2
	2000 MHz to 2700 MHz	< 1.7
	2700 MHz to 3000 MHz	< 2.0
RF COM without high-power attenuator	0.1 MHz to 2000 MHz	< 1.4
	2000 MHz to 2700 MHz	< 1.4
	2700 MHz to 3000 MHz	< 2.0
RF IN	0.1 MHz to 2000 MHz	< 1.58
	2000 MHz to 2700 MHz	< 1.58
	2700 MHz to 3000 MHz	< 1.58

RF IN is switched to short when off.

<b>Harmonic response</b>		
RF COM	second harmonic	
	$f_{in} = 1 \text{ MHz to } 1000 \text{ MHz}$ , $f_{selected} = 2 \text{ MHz to } 2000 \text{ MHz}$ , input power near expected nominal power setting	< -30 dB
	$f_{in} = 1000 \text{ MHz to } 1500 \text{ MHz}$ , $f_{selected} = 2000 \text{ MHz to } 3000 \text{ MHz}$ , input power near expected nominal power setting	< -30 dB
	third harmonic	
	$f_{in} = 1 \text{ MHz to } 666.7 \text{ MHz}$ , $f_{selected} = 3 \text{ MHz to } 2000 \text{ MHz}$ , input power near expected nominal power setting	< -50 dB
	$f_{in} = 666.7 \text{ MHz to } 1000 \text{ MHz}$ , $f_{selected} = 2000 \text{ MHz to } 3000 \text{ MHz}$ , input power near expected nominal power setting	< -50 dB

<b>Spurious response</b>	for full-scale, single tone input signal	
	0.1 MHz to 2000 MHz, except $f_{in} = 1318.46875 \text{ MHz} + f_{selected}$	< -55 dB
	2000 MHz to 3000 MHz, except $f_{in} = 3681.25 \text{ MHz} - f_{selected}$ , except $f_{in} = 3681.25 \text{ MHz} - 0.5 \cdot f_{selected}$	< -45 dB

<b>Inherent spurious response</b>	without input signal, 1 MHz to 3000 MHz except $f_{in} = 2760.9375 \text{ MHz}$	
	expected nominal power setting $\leq -10 \text{ dBm}$	< -100 dBm
	expected nominal power setting $\leq -10 \text{ dBm}$ , 200 MHz, 400 MHz, 425 MHz, 475 MHz, 500 MHz, 600 MHz, 2250 MHz	< -90 dBm
	expected nominal power setting > -10 dBm	< -90 dB below expected nominal power setting

<b>Phase noise</b>	single sideband, 0.1 MHz to 30 MHz	
	10 kHz offset from carrier	< -127 dBc (1 Hz)
	100 kHz offset from carrier	< -127 dBc (1 Hz)
	3 MHz offset from carrier	< -130 dBc (1 Hz)
	single sideband, 30 MHz to 913 MHz	
	10 kHz offset from carrier	< -111 dBc (1 Hz)
	100 kHz offset from carrier	< -115 dBc (1 Hz)
	3 MHz offset from carrier	< -130 dBc (1 Hz)
	single sideband, 913 MHz to 3000 MHz	
	10 kHz offset from carrier	< -110 dBc (1 Hz)
	100 kHz offset from carrier	< -110 dBc (1 Hz)
	3 MHz offset from carrier	< -125 dBc (1 Hz)

<b>Dynamic range</b>	<i>RBW</i> → 1 kHz, with fixed expected nominal power setting	
RF COM with high-power attenuator	1 MHz to 2000 MHz, +12 dBm to +51.8 dBm	> 100 dB
	2000 MHz to 3000 MHz, +17 dBm to +51.8 dBm	> 95 dB
RF COM without high-power attenuator	1 MHz to 2000 MHz, -5 dBm to +33 dBm	> 100 dB
	2000 MHz to 3000 MHz, 0 dBm to +33 dBm	> 95 dB
RF IN	1 MHz to 2000 MHz, -11 dBm to +20 dBm	> 100 dB
	2000 MHz to 3000 MHz, -6 dBm to +20 dBm	> 95 dB

## Power meter

<b>TX test, expert test</b>		
<b>Frequency range</b>		0.1 MHz to 3000 MHz
<b>Frequency resolution</b>		1 Hz
<b>Measurement modes</b>		power current RMS, power current min., power current max., power average RMS, power minimum, power maximum, standard deviation
<b>Resolution bandwidths</b>		Gaussian, 10 Hz to 10 MHz, in 1/3/5 steps bandpass, 1 kHz to 20 MHz, in 1/2/3/5 steps, RRC, $\alpha = 0.1$
<b>Expected nominal power setting range</b>		see General technical specifications
<b>Measurement control</b>	measurement timeout	0 s to 1000 s in steps of 1 ms
	repetition	continuous, single shot
	statistic	1 to 100000
	measurement length	10 $\mu\text{s}$ to 1 s (< step length)
	step length	50 $\mu\text{s}$ to 1 s

Level range		
RF COM with high-power attenuator	0.1 MHz to 1 MHz	
	continuous wave (CW)	up to 40 dBm
	peak envelope power (PEP)	up to 40 dBm
	1 MHz to 30 MHz	
	continuous wave (CW)	up to 51.8 dBm (150 W) <sup>2</sup>
	peak envelope power (PEP)	up to 51.8 dBm (150 W) <sup>2</sup>
	30 MHz to 2000 MHz	
	continuous wave (CW)	up to 51.8 dBm (150 W) <sup>2</sup>
	peak envelope power (PEP)	up to 51.8 dBm (150 W) <sup>2</sup>
	2000 MHz to 3000 MHz	
	continuous wave (CW)	up to 51.8 dBm (150 W) <sup>2</sup>
	peak envelope power (PEP)	up to 51.8 dBm (150 W) <sup>2</sup>
RF COM without high-power attenuator	0.1 MHz to 1 MHz	
	continuous wave (CW)	up to 23 dBm
	peak envelope power (PEP)	up to 23 dBm
	1 MHz to 30 MHz	
	continuous wave (CW)	up to 33 dBm (2 W)
	peak envelope power (PEP)	up to 33 dBm (2 W)
	30 MHz to 2000 MHz	
	continuous wave (CW)	up to 33 dBm (2 W)
	peak envelope power (PEP)	up to 33 dBm (2 W)
	2000 MHz to 3000 MHz	
	continuous wave (CW)	up to 33 dBm (2 W)
	peak envelope power (PEP)	up to 33 dBm (2 W)
RF IN	0.1 MHz to 1 MHz	
	continuous wave (CW)	up to 18 dBm
	peak envelope power (PEP)	up to 18 dBm
	1 MHz to 30 MHz	
	continuous wave (CW)	up to 20 dBm
	peak envelope power (PEP)	up to 20 dBm
	30 MHz to 2000 MHz	
	continuous wave (CW)	up to 20 dBm
	peak envelope power (PEP)	up to 20 dBm
	2000 MHz to 3000 MHz	
	continuous wave (CW)	up to 20 dBm
	peak envelope power (PEP)	up to 20 dBm

Level uncertainty	in temperature range from +20 °C to +35 °C, no overranging <sup>3</sup>	
RF COM	0.1 MHz to 1 MHz	< 1.0 dB
	1 MHz to 30 MHz	< 0.7 dB
	30 MHz to 2000 MHz	< 0.7 dB
	2000 MHz to 3000 MHz	< 1.0 dB
RF IN	0.1 MHz to 1 MHz	< 1.0 dB
	1 MHz to 30 MHz	< 0.8 dB
	30 MHz to 2000 MHz	< 0.8 dB
	2000 MHz to 3000 MHz	< 1.0 dB

Level uncertainty	in temperature range from +20 °C to +35 °C, no overranging <sup>3,4</sup>	
RF COM with high-power attenuator	1 MHz to 1000 MHz, > 13 dBm	< 0.4 dB

<sup>2</sup> Apply high power (> 100 W) for a limited time only (about 1 min).

<sup>3</sup> For suitable setting of expected nominal power.

<sup>4</sup> Valid for a 12-month calibration interval, apply RF power ≥ 100 W for max. 1 min, ≥ 50 W for max. 2 min, with a duty cycle of 30 %.

<b>Level uncertainty</b>	in temperature range from 0 °C to +50 °C, no overranging <sup>5</sup>	
RF COM	0.1 MHz to 1 MHz	< 1.0 dB
	1 MHz to 30 MHz	< 0.8 dB
	30 MHz to 2000 MHz	< 0.8 dB
	2000 MHz to 3000 MHz	< 1.0 dB
RF IN	0.1 MHz to 1 MHz	< 1.0 dB
	1 MHz to 30 MHz	< 1.0 dB
	30 MHz to 2000 MHz	< 1.0 dB
	2000 MHz to 3000 MHz	< 1.0 dB

<b>Level resolution</b>		0.01 dB
<b>Level repeatability</b>	typical values after 1 h warm-up time, always returning to same level and frequency, no temperature change, insignificant time change	< 0.02 dB

<b>Level linearity, with fixed expected nominal power setting</b>	in temperature range from +20 °C to +35 °C, no overranging	
RF COM	level range from 0 dB to –24 dB	< 0.1 dB

## RF frequency meter

Find RF functionality		
Frequency range		0.1 MHz to 3000 MHz
Resolution		1 Hz
Uncertainty		as reference frequency
Input level range	RF COM with high-power attenuator	> 10 dBm
	RF COM without high-power attenuator	> –7 dBm
	RF IN	> –13 dBm
Repetition mode		single shot, continuous
Timeout setting		0 s to 36000 s

## Modulation deviation measurements

<b>Frequency modulation</b>		
Modes		RMS, $\text{RMS} \cdot \sqrt{2}$ , +PK, –PK, $\pm\text{PK}/2$
Measurement range		0 Hz to 96 kHz
Resolution		1 Hz
Uncertainty		< 1 %
AF frequency range		10 Hz to 21 kHz
Residual FM	CCITT, RMS	
	0.1 MHz to 30 MHz	< 2 Hz
	30 MHz to 2000 MHz	< 3 Hz
	2000 MHz to 3000 MHz	< 5 Hz

<b>Amplitude modulation</b>		
Modes		RMS, $\text{RMS} \cdot \sqrt{2}$ , +PK, –PK, $\pm\text{PK}/2$
Measurement range		0 % to 100 %
Resolution		0.01 %
Uncertainty		< 1 %
AF frequency range		10 Hz to 21 kHz
Residual AM	CCITT, RMS	
	0.1 MHz to 30 MHz	< 0.05 %
	30 MHz to 2000 MHz	< 0.1 %
	2000 MHz to 3000 MHz	< 0.1 %

<sup>5</sup> For suitable setting of expected nominal power.

<b>Phase modulation</b>		
Modes		RMS, $\text{RMS} \cdot \sqrt{2}$ , +PK, -PK, $\pm\text{PK}/2$
Measurement range		0 rad to 10 rad
Resolution		0.01 rad
AF frequency range		10 Hz to 21 kHz
Residual PM	CCITT, RMS	
	0.1 MHz to 30 MHz	< 2 mrad
	30 MHz to 2000 MHz	< 5 mrad
	2000 MHz to 3000 MHz	< 5 mrad

<b>SSB modulation</b>		
Modes		SSB USB, SSB LSB frequency error, power (RMS), power (PEP)

**THD+N and THD meter (distortion meter)**

Frequency range		50 Hz to 10.5 kHz
Measurement range		0 % to 100 %
Resolution		0.01 %
Inherent distortion	CCITT, AM > 5 %, FM > 1 kHz, PM > 0.2 rad	< 0.1 % THD+N and < 0.05 % THD
Uncertainty		< 0.5 % + inherent distortion

**SINAD meter**

Frequency range		50 Hz to 10.5 kHz
Measurement range		up to 63 dB
Resolution		0.01 dB
Uncertainty	SINAD > 3 dB	< 1 dB

**S/N meter**

Frequency range		50 Hz to 10.5 kHz
Measurement range		up to 63 dB
Resolution		0.01 dB
Uncertainty	S/N > 3 dB	< 1 dB

**AF FFT analyzer**

Frequency range		DC to 21 kHz
FFT length		4k
Frequency resolution	21 kHz span	11.7 Hz
	10 kHz span	5.6 Hz
	5 kHz span	2.8 Hz
	1 kHz span	0.6 Hz
FFT windows		flat top, rectangular, Hamming, Hann, Blackman-Harris
Statistic count		1 to 1000

**Audio filter, weighting**

Lowpass		off, 255 Hz, 3 kHz, 3.4 kHz, 4 kHz, 15 kHz
Highpass		off, 6 Hz, 50 Hz, 300 Hz
Bandpass, for level results only	center frequency	10 Hz to 21 kHz
	bandwidth	off, 20 Hz to 20 kHz
Weighting filter		off, A-weighting, CCITT, C-message
Deemphasis		off, 50 $\mu\text{s}$ , 75 $\mu\text{s}$ , 750 $\mu\text{s}$
Notch filter	3 notch filters for each of the following paths:	5 Hz to 21 kHz
	• demodulation path	
	• AF1 IN, AF2 IN	
	• SPDIF left, SPDIF right	
	• VoIP	



**Distortion filter**

Center frequency		50 Hz to 10.5 kHz
Bandwidth	constant or relative to frequency	narrow, wide

**RF bandpass filter**

Bandwidth	digital filter	8.33 kHz, 25 kHz, 50 kHz, 500 kHz
-----------	----------------	-----------------------------------

**RX sensitivity**

RX sensitivity	for 10 dB SINAD, AF: 1 kHz, FM: 2.4 kHz, RF bandpass filter: 25 kHz	
	30 MHz to 2000 MHz	< -107 dBm (1 $\mu$ V)
	2000 MHz to 3000 MHz	< -104 dBm (2 $\mu$ V)

**Spectrum measurements****FFT spectrum analyzer**

<b>For RF signals</b>		
Display		spectrum in frequency domain, I/Q signals in time domain, I/Q constellation diagram
Frequency range		0.1 MHz to 3000 MHz
Frequency span	in steps of 2	10 kHz, 20 kHz, 40 kHz, 80 kHz, 160 kHz, 320 kHz, 640 kHz, 1.25 MHz, 2.5 MHz, 5 MHz, 10 MHz, 20 MHz
FFT length		1k, 2k, 4k, 8k, 16k
Detector		peak, RMS
Averaging mode		logarithmic, linear
Trigger		free run, IF, external TRIG IN
Trigger slope		rising edge, falling edge
Trigger threshold		-50 dB to 0 dB
Trigger offset mode		fixed, variable
Trigger offset	start	-150 ms to +1 ms
	stop	0 ms to +150 ms
Trigger timeout		10 ms to 300 s
Trigger gap		0 ms to 10 ms
Repetition		continuous, single shot
Statistic count		1 to 1000

<b>Expected nominal power setting range</b>		see General technical specifications
---	--	--------------------------------------

<b>Level range</b>		see General technical specifications
--------------------	--	--------------------------------------

<b>Level uncertainty</b>		see General technical specifications
--------------------------	--	--------------------------------------

<b>Inherent spurious response</b>		see General technical specifications
-----------------------------------	--	--------------------------------------

<b>Spurious response</b>		see General technical specifications
--------------------------	--	--------------------------------------

<b>Harmonic response</b>		see General technical specifications
--------------------------	--	--------------------------------------

<b>Phase noise</b>		see General technical specifications
--------------------	--	--------------------------------------

<b>Dynamic range</b>		see General technical specifications
----------------------	--	--------------------------------------

**ACP/OBW measurements**

<b>ACP measurements</b>		absolute and relative measurements
Measurement on channel number		-2, -1, 0, +1, +2
Channel space		100 Hz to 4 MHz
Measurement bandwidth		100 Hz to 4 MHz
Occupied bandwidth (OBW)	range	70 % to 99.9 %
Expected nominal power setting range		see General technical specifications
Level range		see General technical specifications
Level uncertainty		see General technical specifications

**RF swept spectrum analyzer (R&S®CMA-K120 option)**

Frequency range		100 kHz to 3000 MHz
Frequency span	start/stop, center/span, full span, last span	1 kHz to 2999.9 MHz
Resolution bandwidth (RBW)		auto, 100 Hz to 10 MHz in 1/2/3/5 steps
Video bandwidth (VBW)		auto, off, 10 Hz to 10 MHz in 1/2/3/5 steps
Sweep time	frequency sweep, depending on RBW, VBW and span zero span, depending on RBW and VBW	500 µs to 2000 s 80 µs to 2000 s
Detector		average, RMS, sample, min. peak, max. peak, auto peak
Trigger	frequency sweep zero span	free run video, external TRIG IN, all CMA internal trigger sources
Display modes		continuous, single shot, continuous current, average, max., min.
Expected nominal power setting range		see General technical specifications
Level range		see General technical specifications
Level uncertainty		see General technical specifications
Inherent spurious response		see General technical specifications
Spurious response		see General technical specifications
Harmonic response		see General technical specifications
Phase noise		see General technical specifications
Dynamic range		see General technical specifications

<b>Zero span mode (transient analysis, power versus time)</b>		
Sweep time range		80 µs to 2000 s
Trigger		free run, video, external TRIG IN
Trigger slope		rising edge, falling edge
Trigger threshold		-50 dB to 0 dB
Trigger offset		-500 ms to +500 ms
Trigger timeout		10 ms to 300 s
Trigger gap		0 ms to 10 ms
Repetition		continuous, single shot
Statistic count		1 to 1000
Filter type		Gaussian, bandpass

<b>Displayed average noise level (DANL)</b>		
RF COM without high-power attenuator	0.1 MHz to 3000 MHz, RBW normalized to 1 Hz	< -150 dBm (typ.)

**RF tracking generator (R&S®CMA-K120 option)**

<b>Tracking generator</b>		
RF output	SA on RF COM SA on RF IN	RF OUT RF COM, RF OUT
Expected nominal power setting range		see General technical specifications
Level range		see General technical specifications
Level uncertainty		see General technical specifications
Inherent spurious response		see General technical specifications
Spurious response		see General technical specifications
Harmonic response		see General technical specifications
Phase noise		see General technical specifications

**I/Q recorder (R&S®CMA-K220 option)**

<b>I/Q recorder</b>	samples from RF receiver ADC, possibility to replay I/Q records (with R&S®CMA-B110B/D option)	
Sample length		64 Msample
Sample rate	depending on used filter	0.5 kHz to 100 MHz
Filter	Gaussian, bandpass	1 kHz, 10 kHz, 100 kHz, 1 MHz, 10 MHz
Trigger	pretrigger, posttrigger	1 sample to 67108863 sample
	trigger source	free run, IF power, ext. TRIG IN
	trigger slope	rising, falling
Storage		SSD, USB device
File format		I/Q, R&Phi, wv (playback with ARB generator)

**AF generator (AF1 OUT, AF2 OUT)****AF1 OUT/AF2 OUT connectors**

Output impedance		< 4 $\Omega$
Maximum output current		20 mA
DC coupling	no external DC voltage	0 V
AC coupling	3 dB frequency	< 7 Hz
	maximum voltage, DC and AC	10 V

**AF sine wave generator**

Frequency range		20 Hz to 21 kHz
Frequency uncertainty		same as timebase + half resolution, see base unit specifications
Frequency resolution		1 Hz
Level range	RMS	10 $\mu$ V to 5 V
Level resolution	RMS	10 $\mu$ V
Level uncertainty	at level $\geq$ 1 mV and frequency $\leq$ 10 kHz	$\leq$ 1.5 % + resolution
THD+N	at level $\geq$ 100 mV, into load $\geq$ 600 $\Omega$ , measurement bandwidth 21.9 kHz	$\leq$ 0.05 %
THD	at level $\geq$ 100 mV, into load $\geq$ 600 $\Omega$ , measurement bandwidth 21.9 kHz	$\leq$ 0.025 %

**Composite AF signals**

Single tone/multitone/noise/square with additional subtone/CTCSS		see chapter Internal modulation source
--	--	--

## AF analyzer (AF1 IN, AF2 IN)

### AF1 IN/AF2 IN connectors

Input impedance		100 k $\Omega$    15 pF
-----------------	--	-------------------------

### AF voltmeter

Frequency range	AC coupling	50 Hz to 21 kHz
Level range	AC coupling, RMS	50 $\mu$ V to 30 V
	DC coupling	-43 V to +43 V
Level resolution	at level < 1 mV	1 $\mu$ V
	at level $\geq$ 1 mV	0.1 %
Level uncertainty	at 1 mV $\leq$ level $\leq$ 20 mV	< 1.3 % + resolution
	at 20 mV < level $\leq$ 20 V	< 1.0 % + resolution

### THD+N and THD meter

Measurement bandwidth		21 kHz
Frequency range		50 Hz to 10.5 kHz
Level range	RMS	10 mV to 30 V
Resolution		0.01 %
Inherent distortion	at 100 mV $\leq$ level $\leq$ 20 V	< 0.05 % THD+N and < 0.025 % THD
Uncertainty	at 100 mV $\leq$ level < 2 V	< 1 % + inherent distortion
	at 2 V $\leq$ level $\leq$ 20 V	< 2 % + inherent distortion

### SINAD meter

Measurement bandwidth		21 kHz
Frequency range		50 Hz to 10.5 kHz
Measurement range		1 dB to 46 dB
Level range	RMS	10 mV to 30 V
Resolution		0.1 dB
Uncertainty	at 100 mV $\leq$ level < 2 V, at 2 V $\leq$ level $\leq$ 20 V	< 1 dB

### Audio filter, weighting

Lowpass		off, 255 Hz, 3 kHz, 3.4 kHz, 4 kHz, 15 kHz
Highpass		off, 6 Hz, 50 Hz, 300 Hz
Bandpass, for level results only	center frequency	10 Hz to 21 kHz
	bandwidth	off, 20 Hz to 20 kHz
Weighting filter		off, A-weighting, CCITT, C-message

### Statistics

Statistical count		1 to 1000
Values		current, average, max., min., standard deviation

## AF oscilloscope (R&S®CMA-K120 option)

<b>Signal source</b>		AF1 IN, AF2 IN, demod, SPDIF
Display		
Traces	current, max	2
Markers		2
Horizontal	sweep	1 $\mu$ s/div to 1 s/div in 1/2/5 steps autoscaling
Bandwidth (0 dB)		21 kHz
Input range		-43 V to +43 V
Scales	AF IN	0.1 mV/div to 20 V/div
	FM demod	100 Hz/div to 20 kHz/div
	AM demod	1 %/div to 20 %/div
	PM demod	0.1 rad/div to 10 rad/div
	all	autoscaling
Coupling		AC, DC
Trigger	modes	single, normal, automatic, free run
	trigger slope	rising, falling
	threshold AF IN	-43 V to +43 V
	threshold FM demod	-96 kHz to +96 kHz
	threshold AM demod	-100 % to +100 %
	threshold PM demod	-30 rad to +30 rad

## AF frequency measurement

<b>Signal source</b>		AF1 IN, AF2 IN, demod
Frequency range		10 Hz to 21 kHz
Resolution		0.1 Hz

## AF tones analyzer

<b>Modes</b>		DTMF, Selcall, SELCAL, SELCAL32, free dialing
	frequency	Hz
	frequency deviation	Hz, %
	frequency resolution	0.1 Hz
	time, pause	ms

## Digital interface, unbalanced

### BNC rear panel connectors

<b>SPDIF IN connector</b>		BNC
Input impedance		75 $\Omega$

<b>SPDIF OUT connector</b>		BNC
Output impedance		75 $\Omega$

Sampling rate		48 kHz
Maximum resolution		20-bit PCM
Output level		0.5 V, peak-to-peak
Maximum output		0.6 V, peak-to-peak
Maximum current		8 mA
Maximum input		0.2 V, peak-to-peak
Modulation		biphase mark code
Usage		audio analysis

**VoIP support (R&S®CMA-K610 option)**

VoIP support	in line with EUROCAE ED-137B/C	AF source → VoIP, VoIP → AF meas.
	PCM codec	A-law, $\mu$ -law, in line with ITU-T G.711
	signal level setting	0 to FS
	sources	AF1 GEN, AF2 GEN, AF1 IN, AF2 IN, SPDIF IN
	AF measurements	frequency, level, THD, THD+N, SINAD, S/N, audio spectrum

**VoIP delay measurement (R&S®CMA-K611 option)**

Device		for transmitter (TX)
Packet size		20 ms
Uncertainty		< 0.6 ms (meas.)

**Search routines**

RX sensitivity		reduces the RF level until signal quality reaches a specified value
RX IF bandwidth		shifts the RF frequency to find the receiver bandwidth
RX squelch		varies the RF level to find the squelch open and close level as well as the hysteresis
Switched SNR		switches the modulation on and off to measure SNR

## Digital standards

### For all digital standard generators and analyzers

Frequency range		see base unit specifications
Frequency resolution		see base unit specifications
Frequency uncertainty		see base unit specifications
Output level range		see base unit specifications
Level resolution		see base unit specifications
Level accuracy		see base unit specifications

### DMR generator (prerequisite: R&S®CMA-B110B/D option)

Modulation		4FSK
	deviation	1.944 kHz
Signal content	test patterns	1031, silence, PRBS9, O.153, O.153 (Cal)
	color code	0 to 15
	source address	0 to 16777215
	group address	0 to 16777215
Modulation accuracy	FSK deviation error	< 1 %
	frequency error, RMS	< 1 %
	magnitude error, RMS	< 1 %

### DMR analyzer (R&S®CMA-K305 option, prerequisite: R&S®CMA-K300 option)

Modulation uncertainty	FSK frequency error, RMS	< 1 %
	FSK deviation error	< 1 %
	magnitude error, RMS	< 1 %

### NXDN generator (prerequisite: R&S®CMA-B110B/D option)

Modulation		4FSK (4800 bps/EHR, 9600 bps/EHR, 9600 bps/EFR)
Signal content	test patterns	1031, 1011, silence, PRBS9, PRBS15
	RAN	00 to 3F
	source unit ID	0000 to FFFF
	destination unit ID	0000 to FFFF
Modulation accuracy	FSK deviation error	< 1 %
	frequency error, RMS	< 1 %
	magnitude error, RMS	< 1 %

### NXDN analyzer

Modulation uncertainty	FSK frequency error, RMS	< 1 %
	FSK deviation error	< 1 %
	magnitude error, RMS	< 1 %

### DPMR generator (prerequisite: R&S®CMA-B110B/D option)

Modulation		4FSK, 4800 bps
Signal content	test patterns	1031, silence, PRBS9, STD1
	channel code	0 to 63
	source unit ID	0000 to FFFF
	destination unit ID	0000 to FFFF
	emergency bit	on/off
	peer to peer mode	on/off

### DPMR analyzer (prerequisite: R&S®CMA-K305 option, R&S®CMA-K300 option)

Modulation uncertainty	FSK frequency error, RMS	< 1 %
	FSK deviation error	< 1 %
	magnitude error, RMS	< 1 %

**APCO/P25 generator (prerequisite: R&S®CMA-B110B/D option)**

Modulation		C4FM
Signal content	test patterns	1011, silence, interference, busy, idle, calibration
	NAC	000 to FFF
	TGID	0000 to FFFF
	source unit ID	000000 to FFFFFFFF
	emergency	on/off
Modulation accuracy	C4FM deviation error	< 2 %
	frequency error, RMS	< 1 %
	magnitude error, RMS	< 1 %

**APCO/P25 analyzer (R&S®CMA-K305 option, prerequisite: R&S®CMA-K300 option)**

Modulation uncertainty	FSK frequency error, RMS	< 1 %
	FSK deviation error	< 2 %
	modulation fidelity	< 1 %

**POCSAG generator (R&S®CMA-KG260 option, prerequisite: R&S®CMA-B110B/D option)**

Modulation		2FSK
	deviation	0 to 100 kHz
	symbol rate	0 to 5000 symbol/s
Signal content	pager address	0 to 9999999
	function bits	00bin to 11bin
	pager type	numeric, alphanumeric, tone-only

**TETRA analyzer (R&S®CMA-K305 option, prerequisite: R&S®CMA-K300 option)**

Modulation uncertainty	EVM, RMS	< 0.5 %
	MER, RMS	> 46 dB
	magnitude error, RMS	< 1 %
	phase error, RMS	< 1°

**Zigbee generator (R&S®CMA-KG250 option, prerequisite: R&S®CMA-B110B/D option)**

Modulation		OQPSK
	deviation	135°
	symbol rate	1 Msymbol/s
Signal content	sequence number	00 to FF
	destination PAN	0000 to FFFF
	destination address	0000 to FFFF
	source PAN	0000 to FFFF
	source address	0000 to FFFF
	payload	00 to FF
Modulation accuracy	EVM, RMS	< 1 %
	MER, RMS	> 40 dB
	magnitude error, RMS	< 1 %
	phase error, RMS	< 1 %

**LTE analyzer (R&S®CMA-K320 option, prerequisite: R&S®CMA-K300 option)**

Supported measurements		EVM, power, crest factor, frequency error, sampling error, I/Q offset, I/Q gain imbalance, I/Q quadrature error, I/Q constellation
------------------------	--	--



**Signal content analyzer: DMR (R&S®CMA-KS200 option)**

Signal content	PDU content	color code, source address, target address, PI, protect flag, FLCO feature set ID, data type
	service options	broadcast, privacy, priority level, emergency, open voice call mode

**Signal content analyzer: P25 (R&S®CMA-KS201 option)**

Signal content	network identifier	network access code
	link control word	link control format, manufacturer ID, emergency, reserved, target ID, source ID
	encryption sync word	message indicator, algorithm ID, key ID

**Signal content analyzer: TETRA (R&S®CMA-KS268 option)**

Signal content	downlink/forward	system code, sharing mode, RSVD frame, DTX, frame 18 ext., broadcast, call service level, late entry, BCC, MCC, MNC, time slot number, frame number, multiframe number
----------------	------------------	--

**User defined generator (R&S®CMA-K210 option)**

Modulation		4FSK
	deviation	-100 kHz to +100 kHz
	data rate	200 bit/s to 115200 bit/s
	pattern	PRBS6, PRBS9
	seed value	0H to 1FFH
	sequence length	0 to 9000 bit
	repetition	single, continuous
	pause	0 ms to 10000 ms
Modulation accuracy	for data rate ≤ 38400 bit/s	
	frequency error RMS	< 5 %
	magnitude error RMS	< 1 %
	FSK deviation error	< 1 %

**Bit error rate tester (R&S®CMA-K230 option)**

Interface		TTL
	input	1-wire (data), 2-wire (clock and data)
	data rate	1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, 115200
	pattern	PRBS6, PRBS9

# General data

## Timebase

### Timebase TCXO

Maximum frequency drift	in temperature range from 0 °C to +50 °C	$\pm 1 \cdot 10^{-6}$
Maximum aging	at +25 °C, after 14 days of continuous operation	$\pm 1 \cdot 10^{-6}$ /year

### Timebase OCXO (R&S®CMA-B690A option)

Maximum frequency drift	in temperature range from 0 °C to +50 °C, referenced to +25 °C with instrument orientation	$\pm 5 \cdot 10^{-8}$
Retrace	at +25 °C, after 24 hours power on/ 2 hours power off/1 hour power on	$\pm 5 \cdot 10^{-9}$ $\pm 2 \cdot 10^{-8}$
Maximum aging	at +25 °C, after 10 days of continuous operation	$\pm 1 \cdot 10^{-7}$ /year, $\pm 1 \cdot 10^{-9}$ /day
Warm-up time	at +25 °C, the frequency is in the range that is 10 times the frequency drift ( $\pm 5 \cdot 10^{-7}$ )	approx. 10 min

### Timebase OCXO, high-performance (R&S®CMA-B690M option)

Maximum frequency drift	in temperature range from 0 °C to +50 °C, referenced to +25 °C with instrument orientation	$\pm 5 \cdot 10^{-9}$
Retrace	at +25 °C, after 24 hours power on/ 2 hours power off/1 hour power on	$\pm 1 \cdot 10^{-9}$ $\pm 5 \cdot 10^{-9}$
Maximum aging	at +25 °C, after 10 days of continuous operation	$\pm 3 \cdot 10^{-8}$ /year, $\pm 5 \cdot 10^{-10}$ /day
Warm-up time	at +25 °C, the frequency is in the range that is 10 times the frequency drift ( $\pm 5 \cdot 10^{-8}$ )	approx. 10 min

## Reference frequency inputs/outputs

<b>Synchronization input</b>		BNC connector REF IN, rear panel
Frequency	sine wave	10 MHz
	square wave (TTL level)	10 MHz
Lock-in range	wide	$\pm 1$ kHz (typ.)
	medium	$\pm 80$ Hz (typ.)
	narrow	$\pm 8$ Hz (typ.)
Input voltage range		0.5 V to 2 V, RMS
Impedance		50 $\Omega$

<b>Synchronization output</b>		BNC connector REF OUT, rear panel
Frequency		10 MHz from internal reference or frequency at synchronization input
Output voltage		> 2 V, peak-to-peak
Impedance		50 $\Omega$

<b>RF connectors (front panel)</b>		SnapN female, 50 $\Omega$ , compatible with N female connectors
RF COM		combined RF input and RF output
RF IN		RF input
RF OUT		RF output

<b>AF connectors (front panel)</b>		BNC connectors
AF1 IN, AF2 IN		AF inputs
AF1 OUT, AF2 OUT		AF outputs

<b>Other interfaces (front panel)</b>		
USB	for keyboard, mouse, USB stick	3 × USB 2.0 type A connector
SENSOR		for R&S®NRP-Zxx power sensors, for R&S®NRT-Zxx power sensors with R&S®NRT-Z5 USB adapter
PHONES	for headphones impedance	3.5 mm audio jack ≥ 16 Ω

<b>Loudspeaker (front panel)</b>		for AF generator and demodulator signals
----------------------------------	--	--

<b>Remote control interfaces (rear panel)</b>		
LAN REMOTE		Ethernet RJ-45 connector, 1000 Mbps
IEEE 488	R&S®CMA-B612A IEEE bus interface option	IEC 60625-2 (IEEE 488.2), 24-pin Amphenol connector

<b>Other interfaces (rear panel)</b>		
USB	for keyboard, mouse, USB flash drive	2 × USB 3.0 type A connector
DisplayPort	for external monitor	DisplayPort connector
TRIG IN, TRIG OUT	trigger input/output	2 × BNC connector, 3.3 V TTL
SPDIF IN, SPDIF OUT	SPDIF input/output	2 × BNC connector, 3.3 V

<b>CONTROL interface (rear panel)</b>		
4 × OUT	level	D-Sub 25-pin connector 3.3 V TTL, max. 10 mA
4 × IN/OUT	level	3.3 V TTL, max. 10 mA
2 × relay	switching voltage	max. 30 V
	switching current	max. 2 A

<b>Display</b>		
Size		22.8 cm (9.0") TFT color display
Resolution		800 × 480 pixel (WVGA resolution)
Pixel failure rate		< 1.1 • 10 <sup>-5</sup>

<b>Storage memory</b>		
Solid-state disk	selection: R&S®CMA-S052R, R&S®CMA-S052S	512 Gbyte

Lifespan and data retention time of a NAND flash SSD typically depend on the number of write cycles and the temperature.

Each byte can be overwritten 2000 times. When this value is reached, the solid-state disk (SSD) enters a read-only mode to ensure data retention. Depending on the operating and storage temperatures, the data retention period decreases over the SSD lifespan from several years to an ensured value of over 60 days.

Lifespan example: The lifespan is approx. 5 years if the entire SSD is written to once a day.

If you use an SSD as the system drive, start the instrument at least once a year with inserted SSD. Otherwise the data stored on the SSD may be lost. SSDs are not designed for long-term storage without power supply.

<b>Environmental conditions</b>		
Temperature	operating temperature range with SSD (R&S®CMA-S052R or R&S®CMA-S052S)	0 °C to +50 °C, in line with MIL-PRF-28800F
	storage temperature range	–40 °C to +71 °C, in line with MIL-PRF-28800F
Damp heat		5 % to 95 % rel. humidity, in line with MIL-PRF-28800F; 5 % to 80 % rel. humidity, in line with EN 60068-2-78
Altitude		4600 m
Classification		class 3 equipment, in line with MIL-PRF-28800F

<b>Product conformity</b>		
Electromagnetic compatibility	EU: in line with EMC Directive 2014/30/EC, UK: in line with Electromagnetic Compatibility Regulations 2016 (S.I. 2016/1091)	applied harmonized standards: <ul style="list-style-type: none"> <li>EN 61326-1 (industrial environment)</li> <li>EN 55011 (class A)</li> </ul>
	with R&S®CMA-S054M DC power supply	<ul style="list-style-type: none"> <li>EN 50498</li> </ul>
	Directive of United Nations relating to approval of vehicles with regard to EMC (with R&S®CMA-S054M DC power supply)	applied standard: <ul style="list-style-type: none"> <li>ECE R10 Rev. 4, Suppl. 2</li> </ul>
Electrical safety	EU: in line with Low Voltage Directive 2014/35/EC, UK: in line with Electromagnetic Compatibility Regulations 2016 (S.I. 2016/1091)	applied harmonized standard: <ul style="list-style-type: none"> <li>EN 61010-1</li> </ul>
	USA/Canada	applied standards: <ul style="list-style-type: none"> <li>UL 61010-1 (third edition)</li> <li>CAN C22.2 No. 61010.1-12</li> </ul>

International safety approvals	VDE Testing and Certification Institute	GS mark – certificate no.: 40039469
	CSA Group Testing & Certification Inc.	cCSA <sub>US</sub> mark – file number: LR114196
RoHS	EU: in line with Directive 2011/65/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment	DIN IEC 63000
	UK: in line with Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (S.I. 2012/3032)	EN IEC 63000
	Korea KC	MSIP-REM-RnS-CMCMAG

<b>Mechanical resistance</b>		
Vibration	sinusoidal	<ul style="list-style-type: none"> <li>5 Hz to 55 Hz, 0.15 mm amplitude const., 55 Hz to 150 Hz, 0.5 g const., in line with EN 60068-2-6</li> <li>5 Hz to 55 Hz, in line with MIL-PRF-28800F</li> </ul>
	random	<ul style="list-style-type: none"> <li>8 Hz to 500 Hz, acceleration: 1.2 g RMS, in line with EN 60068-2-64</li> <li>5 Hz to 500 Hz, in line with MIL-PRF-28800F</li> </ul>
Shock		<ul style="list-style-type: none"> <li>30 g, in line with MIL-PRF-28800F, method 516.4, procedure I, 45 Hz to 2000 Hz</li> <li>max. 40 g, in line with MIL-STD-810E</li> </ul>

<b>Power rating of R&amp;S®CMA-S054B AC power supply</b>		
Rated voltage		100 V to 240 V AC (± 10 %)
Rated frequency		50 Hz to 60 Hz, 400 Hz (± 5 %)
Rated current		3.3 A to 1.5 A
Power consumption	CMA basic model	approx. 75 W
	CMA with typical options	approx. 85 W
	standby	approx. 3 W

<b>Power rating of R&amp;S®CMA-S054M DC power supply</b>		
Rated voltage		10 V to 30 V DC
Rated current		27 A to 9 A
Power consumption	CMA basic model	approx. 75 W
	CMA with typical options	approx. 85 W
	standby	approx. 3 W
Length of DC supply cable	each line of plus and minus signal	max. 5 m

<b>Dimensions</b>	W x H x D, overall	360.5 mm x 195.4 mm x 351 mm (14.19 in x 7.69 in x 13.82 in)
	for rack mounting	19", ¾, 4 HU, 350
<b>Weight</b>	base unit without options	approx. 10.9 kg (24 lb)
	fully equipped	approx. 13 kg (28.7 lb)

<b>Calibration interval</b>		24 months
-----------------------------	--	-----------

## Extras

### R&S®CMA-Z020A transport case

Hard case for CMA unit and accessories		with wheels, telescoping handle, carrying handles; watertight, black
Spaces	fixed	for CMA, R&S®CMA-Z600, R&S®CMA-Z060A, keyboard
	flexible	24 cm × 23 cm × 3 cm, 24 cm × 12.5 cm × 3.5 cm
Dimensions	W × H × D, overall	620 mm × 500 mm × 366 mm (24.6 in × 19.7 in × 14.4 in)
Weight		approx. 11 kg (24 lb)

### R&S®CMA-Z025A soft case

Soft case for CMA unit and accessories		with carrying handles, adjustable padded shoulder straps, side bag
Dimensions	W × H × D, overall	400 mm × 390 mm × 250 mm (15.7 in × 15.4 in × 9.8 in)
Weight		approx. 4 kg (9 lb)

### R&S®CMA-Z053A external power supply (prerequisite: R&S®CMA-S054M option)

The R&S®CMA-Z053A makes it possible to connect the CMA with the R&S®CMA-S054M DC power supply option to AC mains.

<b>Power rating</b>		
Rated voltage		100 V to 240 V AC (± 10 %)
Rated frequency		50 Hz to 60 Hz (± 5 %)
Rated current		max. 4 A
Output voltage		24 V DC (± 3 %)
Output current		max. 9.2 A
Power consumption	with CMA load	see R&S®CMA-S054M DC power supply
	without load	approx. 0.5 W
Altitude	operating	2000 m
Electromagnetic compatibility	EU: in line with EMC Directive 2004/108/EC	applied harmonized standards: • EN 61000 • EN 55022 class B
	USA/Canada/Japan	applied standards: • UL file: E183223 • Japan PSE certificate: issued by TÜV R. JD 50458874
Electrical safety	EU: in line with Low Voltage Directive 2006/95/EC	applied harmonized standard: • EN 62368-1
	USA/Canada/Japan	applied standards: • UL file: E183223 • Japan PSE certificate: issued by TÜV R. JD 50458874
Dimensions	W × H × D, overall	210 mm × 85 mm × 46 mm (8.26 in × 3.34 in × 1.81 in)
Weight		approx. 1.1 kg (2.4 lb)

### R&S®CMA-B060A battery compartment (prerequisite: R&S®CMA-S054M option)

Voltage		12 V (nom.)
Temperature	operating temperature range, discharge	0 °C to +50 °C
	storage temperature range	−40 °C to +71 °C, in line with MIL-PRF-28800F
Dimensions	W × H × D, overall	345.2 mm × 45.6 mm × 239.7 mm (13.59 in × 1.80 in × 9.44 in)
Weight		approx. 1.33 kg (2.9 lb)

## R&S®CMA-Z061A Lithium-ion battery (prerequisite: R&S®CMA-S054M option, R&S®CMA-B060A option)

Set		consists of two batteries
Operating time	instrument without options, one set, batteries are hot swappable	1.5 h (nom.)
Charge time	with R&S®CMA-Z062 charger, T = +25 °C	3.5 h (nom.)
Temperature	operating temperature range, discharge	0 °C to +50 °C (see R&S®CMA-B060A battery compartment)
	operating temperature range, charge	0 °C to +45 °C
	storage temperature range	-20 °C to +60 °C <sup>6</sup>
Dimensions	W x H x D, overall, single battery	77.6 mm x 23 mm x 151 mm (3.1 in x 0.9 in x 5.9 in)
Weight	single battery	approx. 0.43 kg (0.96 lb)

## R&S®CMA-Z062A Lithium-ion battery charger for R&S®CMA-Z061A Lithium-ion battery

The R&S®CMA-Z062A Lithium-ion battery charger allows charging of R&S®CMA-Z061A Lithium-ion batteries.

AC input voltage range		100 V to 240 V AC (± 10 %)
AC supply frequency		50 Hz to 60 Hz
Power consumption		max. 300 W
Dimensions	W x H x D, overall	400 mm x 127 mm x 203 mm (15.8 in x 5.0 in x 8.0 in)
Weight		3.1 kg (6.9 lb)

## R&S®CMA-Z600A AF impedance matching unit (prerequisite: CMA)

The R&S®CMA-Z600A allows the conversion and matching of unbalanced/balanced audio systems.

Pushbuttons are used to select between several operating modes and impedances.

### From AF OUT UNBALANCED connector

Input from unbalanced AF generator source		BNC connector
Input impedance		> 100 kΩ    15 pF
Maximum input level		5 V

### AF OUT BALANCED connector

Output to DUT		XLR male connector
Modes	switchable	balanced/unbalanced
	XLR pin 1 switchable	float/unfloat
Output impedance	switchable	50 Ω, 150 Ω, 300 Ω, 600 Ω
		OUT LOW 2 Ω (nom.)
Frequency range		20 Hz to 21 kHz
Level range	for OUT LOW	50 μV to 5 V
	for 600 Ω/300 Ω/150 Ω	50 μV to 2.5 V
	for 50 Ω	50 μV to 1 V
Level uncertainty	at level ≥ 100 mV	≤ 1 % (typ.) + CMA AF generator specifications
		≤ 0.05 % (typ.) + CMA AF generator specifications
THD+N	at level ≥ 100 mV, measurement bandwidth 21.9 kHz	≤ 0.05 % (typ.) + CMA AF generator specifications
CMRR	balanced mode	> 65 dB (typ.)

### To AF IN UNBALANCED connector

Output to AF analyzer destination		BNC connector
Output impedance		3 Ω (nom.)

<sup>6</sup> The battery packs should be stored in an environment with low humidity, free of corrosive gas at a recommended temperature range < +21 °C. Extended exposure to temperatures above +45 °C could degrade battery performance and life.

**AF IN BALANCED connector**

Input from DUT		XLR female connector
Modes	switchable XLR pin 1 switchable	balanced/unbalanced float/unfloat
Input impedance	switchable	50 $\Omega$ , 150 $\Omega$ , 300 $\Omega$ , 600 $\Omega$ , IN HIGH 220 k $\Omega$    50 pF (nom.)
Frequency range		20 Hz to 21 kHz
Level range	for IN HIGH	50 $\mu$ V to 7 V
	for IN HIGH with AF IN attenuation	500 $\mu$ V to 30 V
	for 600 $\Omega$ /300 $\Omega$ /150 $\Omega$ /50 $\Omega$	50 $\mu$ V to 7 V
	for 600 $\Omega$ /300 $\Omega$ /150 $\Omega$ /50 $\Omega$ with AF IN attenuation	500 $\mu$ V to 10 V
Level uncertainty	at level $\geq$ 100 mV, for frequency 50 Hz to 21 kHz	< 1 % (typ.) + CMA AF analyzer specifications
THD+N	at level $\geq$ 100 mV, for frequency 100 Hz to 10.5 kHz	< 0.05 % (typ.) + CMA AF analyzer specifications
CMRR	balanced mode	> 65 dB (typ.)

**R&S®CMA-Z600A general data**

<b>Environmental conditions</b>		
Temperature	operating temperature range	+0 °C to +50 °C
	storage temperature range	-40 °C to +71 °C, in line with MIL-PRF-28800F
Damp heat		5 % to 80 % rel. humidity, in line with MIL-PRF-28800F, in line with EN 60068-2-78
Classification		class 3 equipment, in line with MIL-PRF 28800F

<b>Product conformity</b>		
Electromagnetic compatibility	EU: in line with EMC Directive 2004/108/EC, UK: in line with Electromagnetic Compatibility Regulations 2016 (S.I. 2016/1091)	applied harmonized standards: <ul style="list-style-type: none"> <li>EN 61326-1 (industrial environment)</li> <li>EN 61326-2-1</li> <li>EN 55011 (class A)</li> </ul>
Electrical safety		applied harmonized standard: <ul style="list-style-type: none"> <li>IEC/EN 61010-1</li> </ul>
RoHS	EU: in line with Directive 2011/65/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment, UK: in line with Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (S.I. 2012/3032)	applied harmonized standard: <ul style="list-style-type: none"> <li>EN IEC 63000</li> </ul>

<b>Mechanical resistance</b>		
Vibration	sinusoidal	in line with EN 60068-2-6, 5 Hz to 55 Hz, 0.15 mm amplitude const., 55 Hz to 150 Hz, 0.5 g const.
	random	in line with EN 60068-2-64, 10 Hz to 300 Hz, acceleration 1.2 g RMS
Shock		in line with MIL-STD-810E, method 516.4, procedure I, 40 g shock spectrum

<b>Power rating</b>	with delivered USB type A/type B cable 0.5 m	USB type B connector
Rated voltage		5 V DC ( $\pm$ 5 %)
Power consumption		max. 2.5 W



<b>Altitude</b>	operating	4600 m
<b>Dimensions</b>	W x H x D, overall	217 mm x 156 mm x 53.6 mm (8.53 in x 6.14 in x 2.11 in)
<b>Weight</b>	base unit without options	approx. 930 g (2.05 lb)

### R&S® CMA-Z680A antenna set

Telescope antenna	type	BNC, articulated joint, length: 175 mm to 605 mm
	best frequency range, long	10 MHz to 1000 MHz
	best frequency range, short	300 MHz to 2700 MHz
Antenna with base	base	depth: 87 mm, height: 80 mm, M6, cable length: 3.6 m, FME, magnetic
	rod	M6, length: 275 mm
	best frequency range	150 MHz to 2700 MHz

### R&S® CMA-Z651A 600 Ω set

Coax series resistor	for AF OUT	600 Ω (nom.)
Coax parallel resistor	for AF IN	600 Ω (nom.)

### R&S® CMA-Z421A radio adapter box and cables

Supported Rohde & Schwarz radios for automated tests		R&S®Series4100, R&S®Series4200, R&S®Series4400, R&S®Series5200
--	--	---

### R&S® CMA-XRT100 setup: R&S® CMW100 – model K06

#### General technical specifications

<b>General functions</b>		simultaneous receiver and transmitter testing
	RF generator/analyzer, RF1 to RF8	8 x SnapN, RF input/output to DUT
Receiver test functions		RF generator signal is split and forwarded to 8 output ports; every output can be switched off separately; collective output level setting for connectors RF 1 to RF 8
Transmitter test functions		8 input signals to be multiplexed to RF analyzer
Isolation		refer to R&S®CMW100 – model K06 specifications
VSWR	RF 1 to RF 8	refer to R&S®CMW100 – model K06 specifications

**RF generator**

Frequency range		70 MHz to 6000 MHz
Frequency resolution		refer to the R&S®CMW100 – model K06 specifications
Frequency uncertainty		refer to the R&S®CMW100 – model K06 specifications

<b>Output level range</b>		
RF 1 to RF 8		refer to the R&S®CMW100 – model K06 specifications

<b>Output level uncertainty</b>		
RF 1 to RF 8		refer to the R&S®CMW100 – model K06 specifications

<b>Output level imbalance</b>	difference between RF1 to RF8	refer to the R&S®CMW100 – model K06 specifications
-------------------------------	-------------------------------	--

**Modulation source: arbitrary waveform generator (ARB)**

<b>Memory size</b>		4.096
<b>Word length</b>	I	16 bit
	Q	16 bit
<b>Sample length</b>	with 4-bit marker	up to 800 Msample
<b>Sample rate</b>	minimum	400 Hz
	maximum	200 MHz
<b>Maximum possible RF bandwidth</b>		160 MHz

**RF analyzer**

<b>Inherent spurious response</b>		refer to the R&S®CMW100 – model K06 specifications
-----------------------------------	--	--

<b>Spurious response</b>		refer to the R&S®CMW100 – model K06 specifications
--------------------------	--	--

<b>Harmonic response</b>	second harmonic	
RF 1 to RF 8		refer to the R&S®CMW100 – model K06 specifications

<b>Harmonic response</b>	third harmonic	
RF 1 to RF 8		refer to the R&S®CMW100 – model K06 specifications

<b>Phase noise</b>		refer to the R&S®CMW100 – model K06 specifications
--------------------	--	--

**General data**

<b>Technical data</b>		refer to the R&S®CMW100 – model K06 specifications
-----------------------	--	--

**External Rohde & Schwarz AC adapter (1210.7812.00)**

<b>Technical data</b>		refer to the R&S®CMW100 – model K06 specifications
-----------------------	--	--

## Ordering information

Designation	Type	Order No.
Radio test set	CMA 180	1173.2000K18
<b>Selections</b>		
Solid-state disk	R&S®CMA-S052R	1173.5100.19
Solid-state disk	R&S®CMA-S052S	1173.5100.20
AC power supply	R&S®CMA-S054B	1173.5151.03
DC power supply	R&S®CMA-S054M	1173.5151.14
<b>Hardware options</b>		
Baseband generator, 4 Gbyte memory	R&S®CMA-B110D	1173.5751.05
IEC/IEEE bus interface	R&S®CMA-B612A	1173.5800.02
IEC/IEEE bus interface	R&S®CMA-B612R	1173.5800.03
Ocxo reference oscillator	R&S®CMA-B690A	1173.5851.02
Ocxo reference oscillator, high-performance	R&S®CMA-B690M	1173.5851.14
Battery compartment	R&S®CMA-B060A	1209.5003.02
<b>Software options, general purpose</b>		
Signal analyzer (SA), tracking generator (TG), oscilloscope (scope)	R&S®CMA-K120	1173.6206.02
ILS/VOR generator	R&S®CMA-K130	1209.5703.02
I/Q recorder	R&S®CMA-K220	1209.6200.02
VoIP support in line with ED-137B/C	R&S®CMA-K610	1209.7058.02
VoIP delay measurement	R&S®CMA-K611	1209.9509.02
<b>Software options, R&amp;S®CMArun</b>		
Analog radio tests	R&S®CMA-KT051	1209.5603.02
Analog radio tests, advanced	R&S®CMA-KT052	1209.7412.02
Battery life test	R&S®CMA-KT061	1209.6300.02
VOR/ILS tests	R&S®CMA-KT130	1209.7393.02
Digital tests (DMR/APCO/NXDN)	R&S®CMA-KT200	1209.8619.02
R&S®Series4100 radio test	R&S®CMA-KT410	1209.7764.02
R&S®Series4200 radio test	R&S®CMA-KT420	1209.6422.02
R&S®Series4400 radio test	R&S®CMA-KT440	1209.7358.02
R&S®Series5200 radio test	R&S®CMA-KT520	1209.9521.02
VoIP support	R&S®CMA-KT610	1209.7335.02
<b>Software options, waveforms</b>		
Waveform library, GPS tests	R&S®CMA-KV140	1209.5855.02
Waveform library, GLONASS tests	R&S®CMA-KV141	1209.7206.02
Waveform library, Galileo tests	R&S®CMA-KV142	1209.7229.02
Waveform library, Beidou tests	R&S®CMA-KV143	1209.7241.02
Waveform library, APCO fading tests	R&S®CMA-KV240	1209.7087.02
<b>Software options, waveforms, with R&amp;S®WinIQSIM2</b>		
LTE tests	R&S®CMA-KW500	1209.8677.02
Bluetooth® tests	R&S®CMA-KW610	1209.8925.02
GPS tests	R&S®CMA-KW620	1209.6222.02
GLONASS tests	R&S®CMA-KW621	1209.6245.02
Galileo tests	R&S®CMA-KW622	1209.6268.02
WLAN tests	R&S®CMA-KW656	1209.8919.02
TETRA Rel. 2 tests	R&S®CMA-KW668	1209.6874.02
<b>Software options, digital</b>		
Signal analyzer, base	R&S®CMA-K300	1209.8990.02
Signal analyzer, digital (APCO, DMR, NXDN, dPMR, TETRA)	R&S®CMA-K305	1209.9009.02
Signal analyzer, LTE FDD	R&S®CMA-K320	1209.8877.02
POCSAG generator	R&S®CMA-KG260	1209.7487.02
Zigbee generator	R&S®CMA-KG250	1209.7506.02
FSK generator	R&S®CMA-K210	1209.8654.02
Signal content analyzer: FSK	R&S®CMA-KS200	1209.8819.02
Signal content analyzer: APCO	R&S®CMA-KS201	1209.9515.02
Signal content analyzer: TETRA	R&S®CMA-KS268	1209.8825.02
BER TEST	R&S®CMA-KS230	1209.8631.02
<b>MMI</b>		
MMI language: Russian	R&S®CMA-KL007	1209.6468.02
MMI language: French	R&S®CMA-KL033	1209.6480.02
MMI language: Chinese	R&S®CMA-KL086	1209.6500.02

Designation	Type	Order No.
<b>Extras</b>		
Transit case	R&S®CMA-Z020A	1209.5555.02
Soft case	R&S®CMA-Z025A	1209.5510.02
Display protective cover	R&S®CMA-Z030A	1209.9796.00
Extra SSD	R&S®CMA-Z052R	1209.9644.19
External power supply	R&S®CMA-Z053A	1173.6058K00
Protective caps (N, BNC, D-Sub)	R&S®CMA-Z059A	1209.6445.02
Lithium-ion battery pack (two batteries)	R&S®CMA-Z061A	1209.5303.02
Lithium-ion battery charger	R&S®CMA-Z062A	1209.5355K02
Radio adapter (box and cables) for R&S®Series4100, R&S®Series4200, R&S®Series4400 and R&S®Series5200 radios	R&S®CMA-Z421A	1209.8831.02
AF impedance matching unit	R&S®CMA-Z600A	1173.6406.02
VoIP kit, ED-137	R&S®CMA-Z610A	1209.7293.02
Feedthrough termination, BNC, 600 Ω (2 × parallel)	R&S®CMA-Z650A	1209.6700.02
Feedthrough, BNC, 600 Ω (1 × serial, 1 × parallel)	R&S®CMA-Z651A	1209.7170.02
DC block, N type, 10 MHz to 6 GHz	R&S®CMA-Z670A	1209.6780.02
Antenna set	R&S®CMA-Z680A	1209.6745.02
Accredited calibration (DKD)	R&S®CMA-ACA	1209.6368.02

For more ordering information about available options contact your local Rohde & Schwarz expert.

## Recommended extras

Designation	Type	Order No.
19" rack adapter, 4 HU, ¾, T350	R&S®ZZA-KN10	1175.3091.00
Power sensors	R&S®NRPxxx	Contact your local Rohde & Schwarz sales office.
Directional power sensors	R&S®FSH-Z14/-Z44, R&S®NRT-Z14/-Z44 (requires R&S®NRT-Z5)	Contact your local Rohde & Schwarz sales office.
RF shield box	R&S®CMW-Z10	1204.7008.02
Antenna coupler, up to 6 GHz	R&S®CMW-Z11	1204.7108.02
Audio accessory	R&S®CMW-Z15	1204.7508.02
RF cable, up to 6 GHz, N to N	R&S®CMW-Z110	1204.7608.02
Attenuator, 3/6/10/20/30 dB, 100 W, 50 Ω	R&S®RBU100	1073.8495.xx (xx = 03/06/10/20/30)
50 W load	R&S®CTH-Z30	1207.1700.02
Handset	R&S®CMW-Z50	1208.7602.02
Headphone		0708.9010.00
XLR/BNC adapter set m/f	R&S®UP-Z1MF	1411.3306.02
IEC/IEEE bus cable, length: 1 m	R&S®PCK	0292.2013.10
IEC/IEEE bus cable, length: 2 m	R&S®PCK	0292.2013.20

## Recommended extras for manual operation

Designation	Type	Order No.
Keyboard with USB interface (US assignment)	R&S®RMS-KEY-US	3059.2815.03
Keyboard with USB interface (DE assignment)	R&S®RMS-KEY-DE	3059.2815.02
Keyboard with USB interface (FR assignment)	R&S®RMS-KEY-FR	3059.2815.04
Keyboard with USB interface (RU assignment)	R&S®RMS-KEY-RU	3059.2815.08
Keyboard with USB interface (CN assignment)	R&S®RMS-KEY-CN	3059.2815.09
Mouse, USB optical scroll mouse	R&S®RMS-MOUSE	3059.2821.02

### Important information:

We recommend using only the above-mentioned original PC components from Rohde & Schwarz in connection with the CMA. The interaction of all components is continuously tested.

Insufficiently shielded PC components can lead to EMC problems that disturb RF measurements results.

## Service options

Service options		
Extended warranty, one year	R&S®WE1	Contact your local Rohde & Schwarz sales office.
Extended warranty, two years	R&S®WE2	
Extended warranty, three years	R&S®WE3	
Extended warranty, four years	R&S®WE4	
Extended warranty with calibration coverage, one year	R&S®CW1	
Extended warranty with calibration coverage, two years	R&S®CW2	
Extended warranty with calibration coverage, three years	R&S®CW3	
Extended warranty with calibration coverage, four years	R&S®CW4	
Extended warranty with accredited calibration coverage, one year	R&S®AW1	
Extended warranty with accredited calibration coverage, two years	R&S®AW2	
Extended warranty with accredited calibration coverage, three years	R&S®AW3	
Extended warranty with accredited calibration coverage, four years	R&S®AW4	

### Extended warranty with a term of one to four years (WE1 to WE4)

Repairs carried out during the contract term are free of charge <sup>7</sup>. Necessary calibration and adjustments carried out during repairs are also covered.

### Extended warranty with calibration (CW1 to CW4)

Enhance your extended warranty by adding calibration coverage at a package price. This package ensures that your Rohde & Schwarz product is regularly calibrated, inspected and maintained during the term of the contract. It includes all repairs <sup>7</sup> and calibration at the recommended intervals as well as any calibration carried out during repairs or option upgrades.

### Extended warranty with accredited calibration (AW1 to AW4)

Enhance your extended warranty by adding accredited calibration coverage at a package price. This package ensures that your Rohde & Schwarz product is regularly calibrated under accreditation, inspected and maintained during the term of the contract. It includes all repairs <sup>7</sup> and accredited calibration at the recommended intervals as well as any accredited calibration carried out during repairs or option upgrades.

The Bluetooth® word mark and logos are registered trademarks owned by Bluetooth SIG, Inc. and any use of such marks by Rohde & Schwarz is under license.

<sup>7</sup> Excluding defects caused by incorrect operation or handling and force majeure. Wear-and-tear parts are not included.





**Service at Rohde & Schwarz**  
**You're in great hands**

- ▶ Worldwide
- ▶ Local and personalized
- ▶ Customized and flexible
- ▶ Uncompromising quality
- ▶ Long-term dependability

**Rohde & Schwarz**

The Rohde&Schwarz technology group is among the trailblazers when it comes to paving the way for a safer and connected world with its leading solutions in test & measurement, technology systems and networks & cybersecurity. Founded more than 85 years ago, the group is a reliable partner for industry and government customers around the globe. The independent company is headquartered in Munich, Germany and has an extensive sales and service network with locations in more than 70 countries.

[www.rohde-schwarz.com](http://www.rohde-schwarz.com)

**Sustainable product design**

- ▶ Environmental compatibility and eco-footprint
- ▶ Energy efficiency and low emissions
- ▶ Longevity and optimized total cost of ownership

Certified Quality Management  
**ISO 9001**

Certified Environmental Management  
**ISO 14001**

**Rohde & Schwarz training**

[www.training.rohde-schwarz.com](http://www.training.rohde-schwarz.com)

**Rohde & Schwarz customer support**

[www.rohde-schwarz.com/support](http://www.rohde-schwarz.com/support)

