R&S®CMW
Wideband Radio Communication Tester
Specifications

R&S®CMW500, R&S®CMW290, R&S®CMW270

ROHDE&SCHWARZ

Data Sheet | Version 14.00

CONTENTS

Specifications apply under the following conditions:

Data valid for

- the R&S®CMW500, the R&S®CMW290 and the R&S®CMW270 with 40/80 MHz bandwidth unit (R&S®CMW-H570A/B and R&S®CMW-H100A/D)

and

- the R&S®CMW500, the R&S®CMW290 and the R&S®CMW270 with 160 MHz bandwidth unit (R&S®CMW-H570H and R&S®CMW-H100H)

unless otherwise stated.

Data without tolerance limits is not binding. Based on a 24-month calibration interval unless otherwise stated. At least 15 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to, and all internal automatic adjustments performed. Typical values are designated with the abbreviation “typ.”. These values are verified during the final test but are not assured by Rohde & Schwarz. Nominal values are design parameters that are not assured by Rohde & Schwarz. These values are verified during product development but are not specifically tested during production.

In line with the 3GPP/3GPP2 standard, chip rates are specified in Mcps (million chips per second), whereas bit rates and symbol rates are specified in Mbps (million bits per second), kbps (thousand bits per second) or ksps (thousand symbols per second), and sample rates are specified in Msample/s (million samples per second). Mcps, kbps, ksps and Msample/s are not SI units.

During the production process, each instrument is calibrated in line with defined procedures. All measurement results, including measurement uncertainties of the calibration system, have to be within the published specification limits to release the individual instrument. The expanded measurement uncertainties of the calibration system used in the production process are determined with a coverage factor of $k = 2$ (normally approx. 95 % probability).

Parameters written in italics can be set directly on the tester.

Data without tolerance limits is not binding.

General technical specifications

Possible configurations with two RF paths

Necessary hardware (R&S®CMW-H570, R&S®CMW-H590X):
Selections: R&S®CMW-S590A RF frontend (BASIC) or R&S®CMW-S590D RF frontend (ADV.), and R&S®CMW-S570 RF TRX
Options: R&S®CMW-B590A RF frontend (BASIC) or R&S®CMW-B590D RF frontend (ADV.), and R&S®CMW-B570 RF TRX

Configuration with two R&S®CMW-H570 (RF TRX) and two R&S®CMW-H590A (RF frontend (BASIC))

The R&S®CMW-B570 and R&S®CMW-B590A options make the second RF path (RF path 2) available on the front of the instrument at three additional RF connectors, i.e. RF3 COM, RF4 COM and RF3 OUT.

RF3 COM	equivalent to RF1 COM	see general technical specifications
RF4 COM	equivalent to RF2 COM	see general technical specifications
RF3 OUT	equivalent to RF1 OUT	see general technical specifications

Configuration with two R&S®CMW-H570 (RF TRX) and one R&S®CMW-H590D (RF frontend (ADV.))

The R&S®CMW-B570 option and R&S®CMW-S590D selection make the second RF path (RF path 2) available on the front of the instrument at connectors RF1 COM, RF2 COM and RF1 OUT.

RF path 1 and RF path 2 routed to separate connectors

RF generator 1 and RF generator 2	switchable to RF1 COM, RF2 COM, RF1 OUT	see general technical specifications
RF analyzer 1 and RF analyzer 2	switchable to RF1 COM, RF2 COM	see general technical specifications
Expected nominal power setting range		see general technical specifications, + 3 dB for lower level limit value
Expected nominal power setting for full dynamic range		see general technical specifications, + 3 dB for lower level limit value
Level range		see general technical specifications, + 3 dB (typ. + 2 dB) for lower level limit value

RF path 1 and RF path 2 routed to common connector

RF generator 1 and RF generator 2	switchable to RF1 COM, RF2 COM, RF1 OUT	see general technical specifications
Output level range	peak envelope power (PEP)	the specified value is valid for the total power of the two RF generators, see general technical specifications
Output level uncertainty	for each carrier	see general technical specifications, + 0.2 dB
Signal-to-noise ratio	for the carrier with the highest output level (at least 3 dB higher than the other carrier)	see general technical specifications
RF analyzer 1 and RF analyzer 2	switchable to RF1 COM, RF2 COM	see general technical specifications
Level uncertainty	70 MHz to 3300 MHz	see general technical specifications, + 0.2 dB
	3300 MHz to 6000 MHz	see general technical specifications + 0.3 dB
Expected nominal power setting range		see general technical specifications, + 3 dB for lower level limit value
Expected nominal power setting for full dynamic range		see general technical specifications, + 3 dB for lower level limit value
Level range		see general technical specifications, + 3 dB (typ. + 2 dB) for lower level limit value

Possible configurations with four RF paths [1]

Necessary hardware (R&S®CMW-H570, R&S®CMW-H590D):
Selections: R&S®CMW-S590D RF frontend (ADV.) and R&S®CMW-S570 RF TRX
Options: R&S®CMW-B590D RF frontend (ADV.) and three R&S®CMW-B570 RF TRX

Configuration with four R&S®CMW-H570 (RF TRX) and two R&S®CMW-H590D (RF frontend (ADV.))

The three R&S®CMW-B570 options and the R&S®CMW-B590D option make the four RF paths (RF path 1 RX and TX, RF path 2 RX and TX, RF path 3 RX and TX, RF path 4 RX and TX) available on the front of the instrument at connectors RF1 COM, RF2 COM, RF1 OUT and RF3 COM, RF4 COM, RF3 OUT.

RF path 1, 2, 3 and 4 routed to separate connectors

RF generator 1 and RF generator 3	switchable to RF1 COM, RF2 COM, RF1 OUT	see general technical specifications
RF generator 2 and RF generator 4	switchable to RF3 COM, RF4 COM, RF3 OUT	see general technical specifications
RF analyzer 1 and RF analyzer 3	switchable to RF1 COM, RF2 COM	see general technical specifications
Expected nominal power setting range		see general technical specifications, + 3 dB for lower level limit value
Expected nominal power setting for full dynamic range		see general technical specifications, + 3 dB for lower level limit value
Level range		see general technical specifications, + 3 dB (typ. + 2 dB) for lower level limit value
RF analyzer 2 and RF analyzer 4	switchable to RF3 COM, RF4 COM	see general technical specifications
Expected nominal power setting range		see general technical specifications, + 3 dB for lower level limit value
Expected nominal power setting for full dynamic range		see general technical specifications, + 3 dB for lower level limit value
Level range		see general technical specifications, + 3 dB (typ. + 2 dB) for lower level limit value

RF path 1, RF path 3 routed to common connector and RF path 2, RF path 4 routed to common connector

RF generator 1 and RF generator 3	switchable to RF1 COM, RF2 COM, RF1 OUT	see general technical specifications
Output level range	peak envelope power (PEP)	the specified value is valid for the total power of the two RF generators, see general technical specifications
Output level uncertainty	for each carrier	see general technical specifications, + 0.2 dB
Signal-to-noise ratio	for the carrier with the highest output level (at least 3 dB higher than the other carrier)	see general technical specifications
RF generator 2 and RF generator 4	switchable to RF3 COM, RF4 COM, RF3 OUT	see general technical specifications
Output level range	peak envelope power (PEP)	the specified value is valid for the total power of the two RF generators, see general technical specifications
Output level uncertainty	for each carrier	see general technical specifications, + 0.2 dB
Signal-to-noise ratio	for the carrier with the highest output level (at least 3 dB higher than the other carrier)	see general technical specifications

RF analyzer 1 and RF analyzer 3	switchable to RF1 COM, RF2 COM	see general technical specifications
Level uncertainty	70 MHz to 3300 MHz	see general technical specifications, + 0.2 dB
	3300 MHz to 6000 MHz	see general technical specifications, + 0.3 dB
Expected nominal power setting range		see general technical specifications, + 3 dB for lower level limit value
Expected nominal power setting for full dynamic range		see general technical specifications, + 3 dB for lower level limit value

[1] R&S®CMW500 and R&S®CMW270 only.

Level range		see general technical specifications, + 3 dB (typ. + 2 dB) for lower level limit value
RF analyzer 2 and RF analyzer 4	switchable to RF3 COM, RF4 COM	see general technical specifications
Level uncertainty	70 MHz to 3300 MHz	see general technical specifications, + 0.2 dB
	3300 MHz to 6000 MHz	see general technical specifications, + 0.3 dB
Expected nominal power setting range		see general technical specifications, + 3 dB for lower level limit value
Expected nominal power setting for full dynamic range		see general technical specifications, + 3 dB for lower level limit value
Level range		see general technical specifications, + 3 dB (typ. + 2 dB) for lower level limit value

VSWR		
RF1 COM, RF2 COM	70 MHz to 3300 MHz	< 1.2
	3300 MHz to 5000 MHz	< 1.5
	5000 MHz to 6000 MHz	< 1.6
RF1 OUT	70 MHz to 3300 MHz	< 1.5
	3300 MHz to 5000 MHz	< 1.5
	5000 MHz to 6000 MHz	< 1.6

RF generator with 40/80 MHz bandwidth unit

Frequency range		70 MHz to 3300 MHz, up to 6000 MHz with the R&S®CMW-KB036 option
Frequency resolution		0.1 Hz
Frequency uncertainty		same as timebase + frequency resolution

Output level range		
RF1 COM, RF2 COM	70 MHz to 100 MHz	
	continuous wave (CW)	–130 dBm to –15 dBm
	peak envelope power (PEP)	up to –15 dBm
	overranging (PEP)	up to –10 dBm
	100 MHz to 3300 MHz	
	continuous wave (CW)	–130 dBm to –5 dBm
	peak envelope power (PEP)	up to –5 dBm
	overranging (PEP)	up to 0 dBm
	3300 MHz to 6000 MHz	
	continuous wave (CW)	–120 dBm to –15 dBm
	peak envelope power (PEP)	up to –15 dBm
	overranging (PEP)	up to –10 dBm
	maximum input DC level	0 V DC
RF1 OUT	70 MHz to 100 MHz	
	continuous wave (CW)	–120 dBm to –7 dBm
	peak envelope power (PEP)	up to –7 dBm
	overranging (PEP)	up to +3 dBm
	100 MHz to 3300 MHz	
	continuous wave (CW)	–120 dBm to +3 dBm
	peak envelope power (PEP)	up to +3 dBm
	overranging (PEP)	up to +13 dBm
	3300 MHz to 6000 MHz	
	continuous wave (CW)	–112 dBm to –7 dBm
	peak envelope power (PEP)	up to –7 dBm
	overranging (PEP)	up to +3 dBm
	maximum input DC level	0 V DC

Output level uncertainty	in temperature range +20 °C to +35 °C, no overranging	
RF1 COM, RF2 COM	output level > –120 dBm	
	70 MHz to 100 MHz	< 1.2 dB [2]
	100 MHz to 3300 MHz	< 0.6 dB [2]
	3300 MHz to 6000 MHz	< 1.2 dB [2]
RF1 OUT	output level > –112 dBm	
	70 MHz to 100 MHz	< 1.6 dB [2]
	100 MHz to 3300 MHz	< 0.8 dB [2]
	3300 MHz to 6000 MHz	< 1.6 dB [2]

Output level uncertainty	in temperature range +5 °C to +45 °C, no overranging	
RF1 COM, RF2 COM	output level > –120 dBm	
	70 MHz to 100 MHz	< 2.0 dB [2]
	100 MHz to 3300 MHz	< 1.0 dB [2]
	3300 MHz to 6000 MHz	< 2.0 dB [2]
RF1 OUT	output level > –112 dBm	
	70 MHz to 100 MHz	< 2.0 dB [2]
	100 MHz to 3300 MHz	< 1.0 dB [2]
	3300 MHz to 6000 MHz	< 2.0 dB [2]

Output level linearity with fixed RF output attenuator setting	in temperature range +20 °C to +35 °C, GPRF generator list mode, level range 0 dB to –30 dB	
RF1 COM, RF2 COM	no overranging	< 0.2 dB, typ. < 0.1 dB

Output level resolution		0.01 dB
Output level repeatability	typical values after 1 h warm-up time, always returning to same level and frequency, no temperature change, insignificant time change	
	output level ≥ –80 dBm	< 0.01 dB
	output level < –80 dBm	< 0.05 dB

Attenuation of second harmonic		
RF1 COM, RF2 COM	70 MHz to 6000 MHz, P < –10 dBm	> 30 dB
RF1 OUT	70 MHz to 6000 MHz, P < 0 dBm	> 30 dB

Attenuation of third harmonic		
RF1 COM, RF2 COM	70 MHz to 6000 MHz, P < –10 dBm	> 40 dB
RF1 OUT	70 MHz to 6000 MHz, P < 0 dBm	> 40 dB

Attenuation of nonharmonics	> 5 kHz offset from carrier, for output level > –40 dBm, for full scale CW signal	
	400 MHz to 3300 MHz, except $f_{nonharmonic}$ = 3900 MHz – $f_{carrier}$, except $f_{nonharmonic}$ = 3900 MHz, except $f_{carrier}$ = (899 to 901) MHz + n × 800 MHz with n = 1, 2, 3	> 60 dB
	3300 MHz to 3600 MHz	> 25 dB
	3600 MHz to 6000 MHz, except $f_{nonharmonic}$ = 2 × $f_{carrier}$ – 6400 MHz	> 40 dB

Phase noise	single sideband, 70 MHz to 3300 MHz	
Carrier offset	≥ 1 MHz	< –120 dBc, 1 Hz

Phase noise	single sideband, 3300 MHz to 6000 MHz	
Carrier offset	≥ 1 MHz	< –117 dBc, 1 Hz

Signal-to-noise ratio	70 MHz to 3300 MHz	
RF1 COM, RF2 COM	5 MHz offset from carrier, for output level > –30 dBm	> 95 dB, typ. > 101 dB, 1 kHz (> 125 dB, typ. > 131 dB, 1 Hz)

[2] Valid for a 12-month calibration interval.

Signal-to-noise ratio	3300 MHz to 6000 MHz	
RF1 COM, RF2 COM	5 MHz offset from carrier, for output level > –30 dBm	> 92 dB, 1 kHz

Modulation source: arbitrary waveform generator (ARB) (R&S®CMW-B110A/R&S®CMW-B110D option)

Memory size	R&S®CMW-B110A	1.024 Gbyte
	R&S®CMW-B110D	4.096 Gbyte
Word length	I	16 bit
	Q	16 bit
	marker	4 bit
Sample length	with 4-bit marker	up to 227.55 Msample
Sample rate	minimum	400 Hz
	maximum	100 MHz
Maximum possible RF bandwidth	depends on arbitrary waveform file	80 MHz

Trigger		
Trigger sources		BASE: external TRIG A, BASE: external TRIG B

RF analyzer with 40/80 MHz bandwidth unit

Inherent spurious response	without input signal, 70 MHz to 6000 MHz, except 4000 MHz, 4800 MHz, 5162.5 MHz, 5600 MHz, 6000 MHz	
	expected nominal power setting ≤ –10 dBm	< –100 dBm
	expected nominal power setting > –10 dBm	< –90 dB below expected nominal power setting

Spurious response	for full scale single tone input signal	
	70 MHz to 3300 MHz, except f_{in} = 1962.5 MHz and 3925 MHz, except f_{in} = 1962.5 MHz + $f_{selected}$	< –55 dB
	3300 MHz to 3700 MHz, except f_{in} = 6400 MHz – $f_{selected}$, except f_{in} = 6400 MHz – 0.5 × $f_{selected}$	< –40 dB
	3700 MHz to 6000 MHz, except f_{in} = 6400 MHz – 0.5 × $f_{selected}$	< –40 dB

Harmonic response	second harmonic	
RF1 COM, RF2 COM	f_{in} = 70 MHz to 1650 MHz, $f_{selected}$ = 140 MHz to 3300 MHz	< –30 dB
	f_{in} = 1650 MHz to 3000 MHz, $f_{selected}$ = 3300 MHz to 6000 MHz	< –30 dB

Harmonic response	third harmonic	
RF1 COM, RF2 COM	f_{in} = 70 MHz to 900 MHz, $f_{selected}$ = 210 MHz to 2700 MHz	< –50 dB
	f_{in} = 900 MHz to 1100 MHz, $f_{selected}$ = 2700 MHz to 3300 MHz	< –45 dB
	f_{in} = 1100 MHz to 2000 MHz, $f_{selected}$ = 3300 MHz to 6000 MHz	< –50 dB

Phase noise	single sideband, 70 MHz to 3300 MHz	
Carrier offset	≥ 1 MHz	< –120 dBc, 1 Hz

Phase noise	single sideband, 3300 MHz to 6000 MHz	
Carrier offset	≥ 1 MHz	< –117 dBc, 1 Hz

Trigger		
Trigger sources		BASE: external TRIG A, BASE: external TRIG B, GPRF: free run, GPRF: IF power, BB generators, BB signaling

Power meter

Frequency range		70 MHz to 3300 MHz, up to 6000 MHz with the R&S®CMW-KB036 option
Frequency resolution		0.1 Hz
Resolution bandwidths		Gaussian, 1 kHz to 10 MHz, in 1/3/5 steps, bandpass, 1 kHz to 30 MHz, in 1/3/5 steps, RRC, α = 0.1, 3.84 MHz, RRC, α = 0.22, WCDMA filter, 1.2288 MHz, CDMA filter
Expected nominal power setting range	for ADC full scale	
RF1 COM, RF2 COM	70 MHz to 100 MHz	–37 dBm to +42 dBm [3]
	100 MHz to 3300 MHz	–47 dBm to +42 dBm [3]
	3300 MHz to 6000 MHz	–37 dBm to +42 dBm [3]

Level range		
RF1 COM, RF2 COM	70 MHz to 100 MHz	
	continuous power (CW)	–74 dBm [4] to +34 dBm
	peak envelope power (PEP)	up to +42 dBm [3]
	100 MHz to 3300 MHz	
	continuous power (CW)	–84 dBm [4] to +34 dBm
	peak envelope power (PEP)	up to +42 dBm [3]
	3300 MHz to 6000 MHz	
	continuous power (CW)	–74 dBm [4] to +34 dBm
	peak envelope power (PEP)	up to +42 dBm [3]
	maximum input DC level	0 V DC

Level uncertainty	in temperature range +20 °C to +35 °C	
RF1 COM, RF2 COM	70 MHz to 100 MHz	< 1.0 dB [5]
	100 MHz to 3300 MHz	< 0.5 dB [5]
	3300 MHz to 6000 MHz	< 1.0 dB [5]

Level uncertainty	in temperature range +5 °C to +45 °C	
RF1 COM, RF2 COM	70 MHz to 100 MHz	< 1.2 dB [5]
	100 MHz to 3300 MHz	< 0.7 dB [5]
	3300 MHz to 6000 MHz	< 1.2 dB [5]

Level linearity with fixed expected nominal power setting	in temperature range +20 °C to +35 °C	
RF1 COM, RF2 COM	level range 0 dB to –40 dB	< 0.15 dB, typ. < 0.1 dB

Level resolution		0.01 dB

Level repeatability	typical values after 1 h warm-up time, always returning to same level and frequency, no temperature change, insignificant time change	
	input level ≥ –40 dBm	< 0.01 dB
	input level < –40 dBm	< 0.03 dB

Dynamic range	70 MHz to 3300 MHz, *RBW → 1 kHz*, with fixed expected nominal power setting and mixer level offset ≥ +4 dB	> 100 dB

[3] The maximum permissible continuous power is +34 dBm due to thermal limits.

[4] *RBW → 1 kHz.*

[5] Valid for a 12-month calibration interval.

Expected nominal power setting for full dynamic range		
RF1 COM, RF2 COM		–8 dBm to +42 dBm [6]

Dynamic range	3300 MHz to 6000 MHz, *RBW → 1 kHz*, with fixed expected nominal power setting and mixer level offset ≥ +4 dB	> 97 dB
Expected nominal power setting for full dynamic range		
RF1 COM, RF2 COM		+2 dBm to +42 dBm [6]

Spectrum measurements

FFT spectrum analyzer		
Frequency range		70 MHz to 3300 MHz, up to 6000 MHz with the R&S®CMW-KB036 option
Frequency span		1.25 MHz, 2.5 MHz, 5 MHz, 10 MHz, 20 MHz, 40 MHz
FFT length		1k, 2k, 4k, 8k, 16k
Detector		peak, RMS

Dynamic range	70 MHz to 3300 MHz, *for FFT length → 16k and span → 5 MHz* (equivalent to RBW → 781 Hz), with fixed expected nominal power setting and mixer level offset ≥ +4 dB	> 100 dB
Expected nominal power setting for full dynamic range		
RF1 COM, RF2 COM		–8 dBm to +42 dBm [6]

Dynamic range	3300 MHz to 6000 MHz, *for FFT length → 16k and span → 5 MHz* (equivalent to RBW → 781 Hz), with fixed expected nominal power setting and mixer level offset ≥ +4 dB	> 97 dB
Expected nominal power setting for full dynamic range		
RF1 COM, RF2 COM		+2 dBm to +42 dBm [6]

RF spectrum analyzer (R&S®CMW-KM010 option)		
Frequency range		70 MHz to 3300 MHz, up to 6000 MHz with the R&S®CMW-KB036 option
Frequency span		0 Hz (zero span), 500 Hz to 3230 MHz, up to 5930 MHz with the R&S®CMW-KB036 option
Resolution bandwidth (RBW)		100 Hz to 10 MHz (additional 40 MHz in zero span)
Video bandwidth (VBW)		10 Hz to 10 MHz
Sweep time	frequency sweep, depends on RBW, VBW and span	500 µs to 2000 s
	zero span, depends on RBW and VBW	80 µs to 2000 s
Detector		average, RMS, sample, min. peak, max. peak, auto peak
Trigger	frequency sweep	free run
	zero span	video, BASE: external TRIG A, B all R&S®CMW internal trigger sources

Dynamic range	70 MHz to 3300 MHz, *RBW→ 1 kHz, detector → RMS*	> 100 dB
Expected nominal power setting for full dynamic range		
RF1 COM, RF2 COM		–8 dBm to +42 dBm [6]

Dynamic range	3300 MHz to 6000 MHz, *RBW → 1 kHz, detector → RMS*	> 97 dB

[6] The maximum permissible continuous power is +34 dBm due to thermal limits.

Expected nominal power setting for full dynamic range		
RF1 COM, RF2 COM		+2 dBm to +42 dBm [7]

Level range		see general technical specifications

Level uncertainty	for center frequency and *detector → peak*	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

RF generator with 160 MHz bandwidth unit

Frequency range		70 MHz to 3300 MHz, up to 6000 MHz with the R&S®CMW-KB036 option
Frequency resolution		0.1 Hz
Frequency uncertainty		same as timebase + frequency resolution

Output level range		
RF1 COM, RF2 COM	70 MHz to 100 MHz	
	continuous wave (CW)	–130 dBm to –15 dBm
	peak envelope power (PEP)	up to –15 dBm
	overranging (PEP)	up to –10 dBm
	100 MHz to 3300 MHz	
	continuous wave (CW)	–130 dBm to –5 dBm
	peak envelope power (PEP)	up to –5 dBm
	overranging (PEP)	up to 0 dBm
	3300 MHz to 6000 MHz	
	continuous wave (CW)	–120 dBm to –15 dBm
	peak envelope power (PEP)	up to –15 dBm
	overranging (PEP)	up to –10 dBm
	maximum input DC level	0 V DC
RF1 OUT	70 MHz to 100 MHz	
	continuous wave (CW)	–120 dBm to –7 dBm
	peak envelope power (PEP)	up to –7 dBm
	overranging (PEP)	up to +3 dBm
	100 MHz to 3300 MHz	
	continuous wave (CW)	–120 dBm to +3 dBm
	peak envelope power (PEP)	up to +3 dBm
	overranging (PEP)	up to +13 dBm
	3300 MHz to 6000 MHz	
	continuous wave (CW)	–112 dBm to –7 dBm
	peak envelope power (PEP)	up to –7 dBm
	overranging (PEP)	up to +3 dBm
	maximum input DC level	0 V DC

Output level uncertainty	in temperature range +20 °C to +35 °C, no overranging	
RF1 COM, RF2 COM	output level > –120 dBm	
	70 MHz to 100 MHz	< 1.2 dB [8]
	100 MHz to 3300 MHz	< 0.6 dB [8]
	3300 MHz to 6000 MHz	< 1.2 dB [8]
RF1 OUT	output level > –112 dBm	
	70 MHz to 100 MHz	< 1.6 dB [8]
	100 MHz to 3300 MHz	< 0.8 dB [8]
	3300 MHz to 6000 MHz	< 1.6 dB [8]

[7] The maximum permissible continuous power is +34 dBm due to thermal limits.

[8] Valid for a 12-month calibration interval.

Output level uncertainty	in temperature range +5 °C to +45 °C, no overranging	
RF1 COM, RF2 COM	output level > –120 dBm	
	70 MHz to 100 MHz	< 2.0 dB [9]
	100 MHz to 3300 MHz	< 1.0 dB [9]
	3300 MHz to 6000 MHz	< 2.0 dB [9]
RF1 OUT	output level > –112 dBm	
	70 MHz to 100 MHz	< 2.0 dB [9]
	100 MHz to 3300 MHz	< 1.0 dB [9]
	3300 MHz to 6000 MHz	< 2.0 dB [9]

Frequency-dependent attenuation (FDA) setting range		–30 dB to 0 dB
Max. FDA setting range	for specified output level uncertainty	–10 dB to 0 dB

Output level linearity with fixed RF output attenuator setting	in temperature range +20 °C to +35 °C, GPRF generator list mode, level range 0 dB to –30 dB	
RF1 COM, RF2 COM	no overranging	< 0.2 dB, typ. < 0.1 dB

Output level resolution		0.01 dB
Output level settling time	to within 0.1 dB	< 50 µs [10]
Output level repeatability	typical values after 1 h warm-up time, always returning to same level and frequency, no temperature change, insignificant time change	
	output level ≥ –80 dBm	< 0.01 dB
	output level < –80 dBm	< 0.05 dB

Attenuation of second harmonic		
RF1 COM, RF2 COM	70 MHz to 6000 MHz, P < –10 dBm	> 30 dB
RF1 OUT	70 MHz to 6000 MHz, P < 0 dBm	> 30 dB

Attenuation of third harmonic		
RF1 COM, RF2 COM	70 MHz to 6000 MHz, P < –10 dBm	> 40 dB
RF1 OUT	70 MHz to 6000 MHz, P < 0 dBm	> 40 dB

Attenuation of nonharmonics	> 5 kHz offset from carrier, for output level > –40 dBm, for full scale CW signal	
	400 MHz to 3300 MHz, except $f_{nonharmonic}$ = 3800 MHz – $f_{carrier}$, except $f_{nonharmonic}$ = abs(3800 MHz – 2 × $f_{carrier}$), except $f_{carrier}$ = (899 to 901) MHz + n × 800 MHz with n = 1, 2, 3, 4, 5, 6, 7	> 60 dB
	3300 MHz to 3600 MHz	> 25 dB
	3600 MHz to 6000 MHz, except $f_{nonharmonic}$ = 2 × $f_{carrier}$ – 6400 MHz	> 40 dB

Phase noise	single sideband, 70 MHz to 3300 MHz	
Carrier offset	≥ 1 MHz	< –120 dBc, 1 Hz

Phase noise	single sideband, 3300 MHz to 6000 MHz	
Carrier offset	≥ 1 MHz	< –117 dBc, 1 Hz

Signal-to-noise ratio	70 MHz to 3300 MHz	
RF1 COM, RF2 COM	5 MHz offset from carrier, for output level > –30 dBm	> 95 dB, typ. > 101 dB, 1 kHz (> 125 dB, typ. > 131 dB, 1 Hz)

Signal-to-noise ratio	3300 MHz to 6000 MHz	
RF1 COM, RF2 COM	5 MHz offset from carrier, for output level > –30 dBm	> 92 dB, 1 kHz

[9] Valid for a 12-month calibration interval.

[10] When using list mode.

Modulation source: arbitrary waveform generator (ARB) (included in R&S®CMW-B100H option)

Memory size	R&S®CMW-H100H	4.096 Gbyte
Word length	I	16 bit
	Q	16 bit
	marker	4 bit
Sample length	with 4-bit marker	up to 800 Msample
Sample rate	minimum	400 Hz
	maximum	200 MHz
Maximum possible RF bandwidth	depends on arbitrary waveform file	160 MHz

Trigger		
Trigger sources		BASE: external TRIG A, BASE: external TRIG B

RF analyzer with 160 MHz bandwidth unit

Inherent spurious response	without input signal, 150 MHz to 6000 MHz, except 4800 MHz, 5162.5 MHz, 5600 MHz and n x 500 MHz with n = 5 to 12	
	expected nominal power setting ≤ –10 dBm	< –100 dBm
	expected nominal power setting > –10 dBm	< –90 dB below expected nominal power setting

Spurious response	for full scale single tone input signal	
	150 MHz to 3800 MHz, except f_{in} = 2215.5 MHz and 4425 MHz, except f_{in} = 2212.5 MHz + $f_{selected}$	< –55 dB
	3800 MHz to 4200 MHz, except f_{in} = 7200 MHz – $f_{selected}$, except f_{in} = 7200 MHz – 0.5 × $f_{selected}$	< –40 dB
	4200 MHz to 6000 MHz, except f_{in} = 7200 MHz – 0.5 × $f_{selected}$	< –40 dB

Harmonic response	second harmonic	
RF1 COM, RF2 COM	f_{in} = 150 MHz to 3000 MHz, $f_{selected}$ = 300 MHz to 6000 MHz	< –30 dB

Harmonic response	third harmonic	
RF1 COM, RF2 COM	f_{in} = 150 MHz to 900 MHz, $f_{selected}$ = 450 MHz to 2700 MHz	< –50 dB
	f_{in} = 900 MHz to 1100 MHz, $f_{selected}$ = 2700 MHz to 3300 MHz	< –45 dB
	f_{in} = 1100 MHz to 2000 MHz, $f_{selected}$ = 3300 MHz to 6000 MHz	< –50 dB

Phase noise	single sideband, 150 MHz to 3800 MHz	
Carrier offset	≥ 1 MHz	< –120 dBc, 1 Hz

Phase noise	single sideband, 3800 MHz to 6000 MHz	
Carrier offset	≥ 1 MHz	< –117 dBc, 1 Hz

Trigger		
Trigger sources		BASE: external TRIG A, BASE: external TRIG B, GPRF: free run, GPRF: IF power, BB generators, BB signaling

Power meter

Frequency range		150 MHz to 3300 MHz, up to 6000 MHz with the R&S®CMW-KB036 option
Frequency resolution		0.1 Hz
Resolution bandwidths		Gaussian, 1 kHz to 10 MHz, in 1/3/5 steps, bandpass, 1 kHz to 30 MHz, in 1/3/5 steps, RRC, α = 0.1, 3.84 MHz, RRC, α = 0.22, WCDMA filter, 1.2288 MHz, CDMA filter
Expected nominal power setting range	for ADC full scale	
	150 MHz to 3300 MHz	–47 dBm to +42 dBm [11]
	3300 MHz to 6000 MHz	–37 dBm to +42 dBm [11]

Level range		
	150 MHz to 3300 MHz	
	continuous power (CW)	–84 dBm [12] to +34 dBm
	peak envelope power (PEP)	up to +42 dBm [11]
	3300 MHz to 6000 MHz	
	continuous power (CW)	–74 dBm [12] to +34 dBm
	peak envelope power (PEP)	up to +42 dBm [11]
	maximum input DC level	0 V DC

Level uncertainty	in temperature range +20 °C to +35 °C	
	150 MHz to 3300 MHz	< 0.5 dB [13]
	3300 MHz to 6000 MHz	< 1.0 dB [13]

Level uncertainty	in temperature range +5 °C to +45 °C	
	150 MHz to 3300 MHz	< 0.7 dB [13]
	3300 MHz to 6000 MHz	< 1.2 dB [13]

Level linearity with fixed expected nominal power setting	in temperature range +20 °C to +35 °C	
RF1 COM, RF2 COM	level range 0 dB to –40 dB	< 0.15 dB, typ. < 0.1 dB

Level resolution		0.01 dB

Level repeatability	typical values after 1 h warm-up time, always returning to same level and frequency, no temperature change, insignificant time change	
	input level ≥ –40 dBm	< 0.01 dB
	input level < –40 dBm	< 0.03 dB

Port switching time	to within 0.1 dB	< 50 µs [14]

Dynamic range	150 MHz to 3800 MHz, *RBW → 1 kHz*, with fixed expected nominal power setting and mixer level offset ≥ +4 dB	> 100 dB
Expected nominal power setting for full dynamic range		
RF1 COM, RF2 COM		–8 dBm to +42 dBm [11]

Dynamic range	3800 MHz to 6000 MHz, *RBW → 1 kHz*, with fixed expected nominal power setting and mixer level offset ≥ +4 dB	> 97 dB
Expected nominal power setting for full dynamic range		
RF1 COM, RF2 COM		+2 dBm to +42 dBm [11]

[11] The maximum permissible continuous power is +34 dBm due to thermal limits.

[12] *RBW → 1 kHz.*

[13] Valid for a 12-month calibration interval.

[14] When using list mode.

Spectrum measurements

FFT spectrum analyzer		
Frequency range		150 MHz to 3300 MHz, up to 6000 MHz with the R&S®CMW-KB036 option
Frequency span		1.25 MHz, 2.5 MHz, 5 MHz, 10 MHz, 20 MHz, 40 MHz, 80 MHz, 160 MHz
FFT length		1k, 2k, 4k, 8k, 16k
Detector		peak, RMS

Dynamic range	150 MHz to 3800 MHz, *for FFT length → 16k and span → 5 MHz* (equivalent to RBW → 781 Hz), with fixed expected nominal power setting and mixer level offset ≥ +4 dB	> 100 dB
Expected nominal power setting for full dynamic range		
RF1 COM, RF2 COM		–8 dBm to +42 dBm [15]

Dynamic range	3800 MHz to 6000 MHz, *for FFT length → 16k and span → 5 MHz* (equivalent to RBW → 781 Hz), with fixed expected nominal power setting and mixer level offset ≥ +4 dB	> 97 dB
Expected nominal power setting for full dynamic range		
RF1 COM, RF2 COM		+2 dBm to +42 dBm [15]

RF spectrum analyzer **(R&S®CMW-KM010 option)**		
Frequency range		150 MHz to 3300 MHz, up to 6000 MHz with the R&S®CMW-KB036 option
Frequency span		0 Hz (zero span), 500 Hz to 3230 MHz, up to 5930 MHz with the R&S®CMW-KB036 option
Resolution bandwidth (RBW)		100 Hz to 10 MHz (additional 40 MHz in zero span)
Video bandwidth (VBW)		10 Hz to 10 MHz
Sweep time	frequency sweep, depends on RBW, VBW and span	500 µs to 2000 s
	zero span, depends on RBW and VBW	80 µs to 2000 s
Detector		average, RMS, sample, min. peak, max. peak, auto peak
Trigger	frequency sweep	free run
	zero span	video, BASE: external TRIG A, B all R&S®CMW internal trigger sources

Dynamic range	150 MHz to 3800 MHz, *RBW → 1 kHz, detector → RMS*	> 100 dB
Expected nominal power setting for full dynamic range		
RF1 COM, RF2 COM		–8 dBm to +42 dBm [15]

Dynamic range	3800 MHz to 6000 MHz, *RBW → 1 kHz, detector → RMS*	> 97 dB
Expected nominal power setting for full dynamic range		
RF1 COM, RF2 COM		+2 dBm to +42 dBm [15]

Level range		see general technical specifications

Level uncertainty	for center frequency and *detector → peak*	see general technical specifications

Inherent spurious response		see general technical specifications

[15] The maximum permissible continuous power is +34 dBm due to thermal limits.

Spurious response		see general technical specifications

Harmonic response		see general technical specifications

Phase noise		see general technical specifications

Timebase

Timebase, TCXO

Max. frequency drift	in temperature range +5 °C to +45 °C	$\pm 1 \times 10^{-6}$
Max. aging	at +25 °C, after 14 days of continuous operation	$\pm 1 \times 10^{-6}$/year

Timebase, basic OCXO (R&S®CMW-B690A option)

Max. frequency drift	in temperature range +5 °C to +45 °C	$\pm 5 \times 10^{-8}$
Retrace	at +25 °C, after 24 hours power on / 2 hours power off / 1 hour power on	$\pm 2 \times 10^{-8}$
Max. aging	at +25 °C, after 10 days of continuous operation	$\pm 1 \times 10^{-7}$/year, $\pm 1 \times 10^{-9}$/day
Warm-up time	at +25 °C, the frequency is in the range that is 10 times the frequency drift ($\pm 5 \times 10^{-7}$)	approx. 10 min

Timebase, highly stable OCXO (R&S®CMW-B690B option)

Max. frequency drift	in temperature range +5 °C to +45 °C, referenced to +25 °C	$\pm 5 \times 10^{-9}$
	with instrument orientation	$\pm 1 \times 10^{-9}$
Retrace	at +25 °C, after 24 hours power on / 2 hours power off / 1 hour power on	$\pm 5 \times 10^{-9}$
Max. aging	at +25 °C, after 10 days of continuous operation	$\pm 3 \times 10^{-8}$/year, $\pm 5 \times 10^{-10}$/day
Warm-up time	at +25 °C, the frequency is in the range that is 10 times the frequency drift ($\pm 5 \times 10^{-8}$)	approx. 10 min

Reference frequency inputs/outputs

Synchronization input		BNC connector REF IN, rear panel
Frequency	sine wave	10 MHz to 80 MHz, step: 1 Hz
	square wave (TTL level)	1 MHz to 80 MHz, step: 1 Hz
Max. frequency variation		$\pm 10 \times 10^{-6}$
Input voltage range		0.5 V to 2 V, RMS
Impedance		50 Ω

Synchronization output 1		BNC connector REF OUT 1, rear panel
Frequency		10 MHz from internal reference or frequency at synchronization input
Output voltage		> 1.4 V, peak-to-peak
Impedance		50 Ω

Audio specifications (prerequisite: R&S®CMW-B400B)

Audio analyzer

Statistics

Statistical count		1 to 1000
Values		current, average, extremum, standard deviation

Audio filter, weighting

Lowpass		off, 3 kHz, 4 kHz, 15 kHz
Highpass		off, 6 Hz, 50 Hz, 300 Hz
Weighting filter		off, A-weighting, CCITT, C-message

Connectors AF 1 IN / AF 2 IN

Input impedance		100 kΩ | 15 pF

AF voltmeter

Frequency range		50 Hz to 21 kHz
Level range		50 µV to 30 V
Level resolution	at level < 1 mV	1 µV
	at level ≥ 1 mV	0.1 %
Level uncertainty	at 1mV ≤ level < 20 mV	< 1.3% + resolution
	at 20 mV ≤ level ≤ 20 V	< 1.0 % + resolution

THD+N and THD meter

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

Audio generator

Connectors AF 1 OUT / AF 2 OUT

Output impedance		< 4 Ω
Maximum output current		20 mA

AF sine generator

Frequency range		20 Hz to 21 kHz
Frequency uncertainty		same as timebase, see base unit specifications
Frequency resolution		1 Hz
Level range		10 µV to 5 V
Level resolution	at level < 10 mV	10 µV
	at level ≥ 10 mV	0.1 %
Level uncertainty	at level ≥ 1 mV and frequency ≤ 10 kHz	≤ 1.5 % + resolution
THD+N	at level ≥ 100 mV, into load ≥ 600 Ω, measurement bandwidth: 21.9 kHz	≤ 0.05 %
THD	at level ≥ 100 mV, into load ≥ 600 Ω, measurement bandwidth: 21.9 kHz	≤ 0.025 %

Digital interface unbalanced

BNC rear panel connectors

Connector SPDIF IN		
Input impedance		75 Ω

Connector SPDIF OUT		
Output impedance		75 Ω

Max. sample rate		48 kHz
Max. resolution		24 bit PCM
Output level		0.5 V, peak-to-peak
Max. output		0.6 V, peak-to-peak
Max. current		8 mA
Min input		0.2 V, peak-to-peak
Modulation		biphase mark code
Usage		audio analysis, digital audio tape (DAT)

GSM specifications – mobile station test [16]

GSM RF generator (prerequisite: R&S®CMW-B110A/R&S®CMW-B110D option with 40/80 MHz bandwidth unit; included with 160 MHz bandwidth unit)

Frequency range	GSM450 band	460 MHz to 468 MHz
	GSM480 band	488 MHz to 496 MHz
	GSM750 band	747 MHz to 762 MHz
	GSM850 band	869 MHz to 894 MHz
	GSM900 band	921 MHz to 960 MHz
	GSM1800 band	1805 MHz to 1880 MHz
	GSM1900 band	1930 MHz to 1990 MHz

GSM GEN (R&S®CMW-KG200 option)

Output level range	depends on PAR	see general technical specifications
Output level uncertainty		see general technical specifications
Output level resolution		see general technical specifications

Signal quality		
Phase error	GMSK	< 1°, RMS
		< 4°, peak
Error vector magnitude (EVM)	8PSK	< 2 %, RMS

GSM WinIQSIM2™ (R&S®CMW-KW200 option), GSM EDGE Evolution WinIQSIM2™ (R&S®CMW-KW201 option)

Arbitrary waveform files	GMSK, B × T = 0.3, with the R&S®CMW-KW200 option	GSM_GMSK.WV (PAR = 0 dB), GMSKDIGMOD.WV (PAR = 0 dB)
	8PSK, with the R&S®CMW-KW200 option	GSM_EDGE.WV (PAR = 3.23 dB), EDGEDIGMOD.WV (PAR = 3.22 dB)
Arbitrary waveform files	16QAM, with the R&S®CMW-KW200 and R&S®CMW-KW201 options	EDGE_EVO_16QAM_A.WV (PAR = 4.70 dB)
	32QAM, with the R&S®CMW-KW200 and R&S®CMW-KW201 options	EDGE_EVO_32QAM_B.WV (PAR = 5.37 dB)

Output level range	depends on PAR	see general technical specifications
Output level uncertainty	with the R&S®CMW-KW200 option, waveform files used: GMSKDIGMOD.WV or EDGEDIGMOD.WV	see general technical specifications
	with the R&S®CMW-KW200 and R&S®CMW-KW201 options, waveform files used: EDGE_EVO_16QAM_A.WV, EDGE_EVO_32QAM_B.WV	see general technical specifications
Output level resolution		see general technical specifications

[16] R&S®CMW500 and R&S®CMW290 only.

Signal quality		
Phase error	GMSK with the R&S®CMW-KW200 option, waveform file used: GSM_GMSK.WV	< 1°, RMS
		< 4°, peak
Error vector magnitude (EVM)	8PSK with the R&S®CMW-KW200 option, waveform file used: GSM_EDGE.WV	< 2 %, RMS
	16QAM / 32QAM level A with the R&S®CMW-KW200 and R&S®CMW-KW201 options, waveform file used: EDGE_EVO_16QAM_A.WV	< 2 %, RMS
	QPSK / 16QAM / 32QAM level B with the R&S®CMW-KW200 and R&S®CMW-KW201 options, waveform file used: EDGE_EVO_32QAM_B.WV	< 2 %, RMS

GSM RF analyzer (R&S®CMW-KM200 option) and GSM EDGE Evolution A analyzer (R&S®CMW-KM201 option)

Frequency range	GSM450 band	450 MHz to 458 MHz
	GSM480 band	478 MHz to 486 MHz
	GSM750 band	777 MHz to 792 MHz
	GSM850 band	824 MHz to 849 MHz
	GSM900 band	876 MHz to 915 MHz
	GSM1800 band	1710 MHz to 1785 MHz
	GSM1900 band	1850 MHz to 1910 MHz

Trigger		
Trigger sources		BASE: external TRIG A, BASE: external TRIG B, GPRF: BB generator, GSM: free run, GSM: IF power, GSM: acquisition

Modulation analysis

Level range		–28 dBm to +42 dBm [17]
Analysis mode	with the R&S®CMW-KM200 option	GMSK, 8PSK
	with the R&S®CMW-KM200 and R&S®CMW-KM201 options	GMSK, 8PSK, 16QAM (level A)
Inherent phase error	GMSK	< 0.6°, RMS
		< 2°, peak
Inherent error vector magnitude (inherent EVM)	8PSK, 16QAM (level A)	< 0.8 %, RMS
Frequency measurement uncertainty		< 20 Hz + drift of timebase, see general technical specifications
Inherent I/Q offset		< –50 dB
Filter	GMSK	bandpass, 900 kHz, RRC filter, α = 0.16
	8PSK, 16QAM (level A)	windowed, raised cosine filter in line with 3GPP TS 45.005

Burst power measurement		
Level uncertainty	bandpass, 900 kHz, RRC filter, α = 0.16	see general technical specifications

[17] The maximum permissible continuous power is +34 dBm due to thermal limits.

Power versus time measurement

Filter	selectable	Gaussian, 500 kHz or 1 MHz

Dynamic range	*filter → 500 kHz, Gaussian,* with fixed expected nominal power setting	
	GMSK	> 72 dB, RMS
	8PSK, 16QAM (level A)	> 69 dB, RMS
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	–8 dBm to +42 dBm [18]

Relative measurement uncertainty	result > –40 dB	typ. < 0.1 dB
	–60 dB ≤ result ≤ –40 dB	typ. < 0.5 dB

Burst power measurement		
Level range		–50 dBm to +42 dBm [18]
Level uncertainty	*filter → 500 kHz or 1 MHz, Gaussian*	see general technical specifications

Spectrum due to modulation measurement

Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	–8 dBm to +42 dBm [18]
Test method		relative measurement, averaging
Filter		Gaussian, 30 kHz, 5 pole
Measurement	at an offset of ±	100/200/250/400/600/800/1000/1200/ 1400/1600/1800 kHz

Dynamic range	offset ≥ 1200 kHz	
	GMSK	> 74 dB
	8PSK, 16QAM (level A)	> 70 dB

Spectrum due to switching measurement

Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	–8 dBm to +42 dBm [18]
Test method		absolute measurement, max. hold
Filter		Gaussian, 30 kHz, 5 pole
Measurement	at an offset of ±	400/600/1200/1800 kHz

Dynamic range	offset ≥ 1200 kHz	
	GMSK	> 72 dB
	8PSK, 16QAM (level A)	> 68 dB

GSM signaling (prerequisite: R&S®CMW-KS200, R&S®CMW-KS201, R&S®CMW-KS203, R&S®CMW-KS210, R&S®CMW-KS211 options; either R&S®CMW-B200A and R&S®CMW-B210A options or R&S®CMW-B500I option)

Frequency range		
GSM850 band, GSM900 band, GSM1800 band, GSM1900 band	DL	see GSM RF generator specifications
	UL	see GSM RF analyzer specifications

Frequency setting		channel number

Output level range	depends on PAR and additional 6 dB level margin	see general technical specifications
	with DLDC: depends on PAR and additional 9.3 dB level margin	see general technical specifications
Output level resolution		see general technical specifications
Output level uncertainty		see general technical specifications

Modulation		
Inherent phase error	GMSK	< 1°, RMS
		< 4°, peak

[18] The maximum permissible continuous power is +34 dBm due to thermal limits.

GSM specifications – small cell test [19]

GSM RF analyzer (R&S®CMW-KN200 option)

Frequency range	GSM450 band	460 MHz to 468 MHz
	GSM480 band	488 MHz to 496 MHz
	GSM750 band	747 MHz to 762 MHz
	GSM850 band	869 MHz to 894 MHz
	GSM900 band	921 MHz to 960 MHz
	GSM1800 band	1805 MHz to 1880 MHz
	GSM1900 band	1930 MHz to 1990 MHz

Trigger		
Trigger sources		BASE: external TRIG A, BASE: external TRIG B, GPRF: BB generator, GSM: free run, GSM: IF power, GSM: acquisition

Modulation analysis

Level range		–28 dBm to +42 dBm [20]
Analysis mode	with the R&S®CMW-KN200 option	GMSK, 8PSK
Inherent phase error	GMSK	< 0.6°, RMS
		< 2°, peak
Inherent error vector magnitude (inherent EVM)	8PSK	< 0.8 %, RMS
Frequency measurement uncertainty		< 20 Hz + drift of timebase, see general technical specifications
Inherent I/Q offset		< –50 dB
Filter	GMSK	bandpass, 900 kHz, RRC filter, α = 0.16
	8PSK	windowed, raised cosine filter in line with 3GPP TS 45.005

Burst power measurement		
Level uncertainty	bandpass, 900 kHz, RRC filter, α = 0.16	see general technical specifications

Power versus time measurement

Filter	selectable	Gaussian, 500 kHz or 1 MHz

Dynamic range	*filter → 500 kHz, Gaussian,* with fixed expected nominal power setting	
	GMSK	> 72 dB, RMS
	8PSK	> 69 dB, RMS
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	–8 dBm to +42 dBm [20]

Relative measurement uncertainty	result > –40 dB	typ. < 0.1 dB
	–60 dB ≤ result ≤ –40 dB	typ. < 0.5 dB

Burst power measurement		
Level range		–50 dBm to +42 dBm [20]
Level uncertainty	*filter → 500 kHz or 1 MHz, Gaussian*	see general technical specifications

[19] R&S®CMW500 only.

[20] The maximum permissible continuous power is +34 dBm due to thermal limits.

Spectrum due to modulation measurement

Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	–8 dBm to +42 dBm [21]
Test method		relative measurement, averaging
Filter		Gaussian, 30 kHz, 5 pole
Measurement	at an offset of ±	100/200/250/400/600/800/1000/1200/ 1400/1600/1800 kHz

Dynamic range	offset ≥ 1200 kHz	
	GMSK	> 74 dB
	8PSK	> 70 dB

Spectrum due to switching measurement

Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	–8 dBm to +42 dBm [21]
Test method		absolute measurement, max. hold
Filter		Gaussian, 30 kHz, 5 pole
Measurement	at an offset of ±	400/600/1200/1800 kHz

Dynamic range	offset ≥ 1200 kHz	
	GMSK	> 72 dB
	8PSK	> 68 dB

[21] The maximum permissible continuous power is +34 dBm due to thermal limits.

NB-IoT specifications – mobile station test [22]

Standard		3GPP NB-IoT HD-FDD

NB-IoT RF generator (prerequisite: R&S®CMW-B110A/R&S®CMW-B110D option with 40/80 MHz bandwidth unit; included with 160 MHz bandwidth unit)

Frequency range	NB-IoT operates in the E-UTRA bands 1, 2, 3, 5, 8, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 28, 31, 66	see LTE FDD RF generator specifications

NB-IoT WinIQSIM2™ (R&S®CMW-KW300 option)

Arbitrary waveform file	NB-IoT HD-FDD	KW300_NB_IOT_64frames_DCI_160ms.wv (PAR = 8.64 dB)

Output level range	depends on PAR	see general technical specifications
Output level uncertainty	waveform file used: KW300_NB_IOT_64frames_DCI_160ms.wv	see general technical specifications
Output level resolution		see general technical specifications

Signal quality		
Error vector magnitude (EVM)	EVM NPDSCH QPSK, bandwidth = 200 kHz waveform file used: KW300_NB_IOT_64frames_DCI_160ms.wv	< 2 %, RMS

NB-IoT HD-FDD RF analyzer (R&S®CMW-KM300 option)

Bandwidth		200 kHz

Frequency range	NB-IoT operates in the E-UTRA bands 1, 2, 3, 5, 8, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 28, 31, 66	see LTE FDD RF analyzer specifications
Level setting		manual mode

Statistics		
Statistical count		1 to 1000
Values		current, average, minimum/maximum, standard deviation

Trigger		
Trigger sources		BASE: external TRIG A, BASE: external TRIG B, GPRF: BB generator, NB-IoT: free run, NB-IoT: IF power

Power measurement

Slot power	RMS detector	
Level range		–50 dBm to +30 dBm, RMS
Level uncertainty		see general technical specifications

[22] R&S®CMW500 and R&S®CMW290 only.

Modulation analysis

Measured parameters	numeric results	error vector magnitude (EVM), magnitude error (ME), phase error (PE), frequency error, I/Q origin offset, TX power, peak power, subcarrier power (SC power)
	graphical	EVM versus SC-FDMA symbol, ME versus SC-FDMA symbol, PE versus SC-FDMA symbol, in-band emissions, I/Q constellation

Error vector magnitude (EVM)		
Inherent EVM	–38 dBm ≤ input level < +30 dBm, RMS	< 1 %, RMS

Frequency error		
Measurement range	subcarrier spacing = 3.75 kHz	±1.8 kHz
	subcarrier spacing = 15 kHz	±7.0 kHz
Frequency measurement uncertainty		< 20 Hz [23] + drift of timebase, see general technical specifications

I/Q origin offset		
Inherent I/Q offset	for average ≥ 10 measurements	< –45 dB

In-band emissions		
Dynamic range		> 45 dB
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	see general technical specifications

Spectrum measurements

Adjacent channel leakage ratio		
Filter	NB-IoT, GSM	rectangle 180 kHz
	UTRA	3.84 MHz, RRC, α = 0.22, WCDMA filter
Dynamic range		> 50 dB
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	see general technical specifications

Spectrum emission mask (SEM)		
Frequency span		4 MHz
		< –45 dBm

NB-IoT signaling (prerequisite: R&S®CMW-KS300 option, R&S®CMW-B500I option)

Channels		
Physical channels and signals	DL	NPSS, NSSS, NRS, NPBCH, NPDCCH, NPDSCH
	UL	NPRACH, NPUSCH, demodulation RS
Bandwidth		200 kHz
Modulation schemes	DL NPDSCH	QPSK
	UL NPUSCH	BPSK, QPSK

Frequency range	NB-IoT operates in the E-UTRA bands 1, 2, 3, 5, 8, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 28, 31, 66	see LTE FDD RF generator specifications and LTE FDD RF analyzer specifications

Frequency setting		channel number

[23] For frequency error measurements relative to the downlink signal of the same R&S®CMW100, the uncertainty is in line with 3GPP TS 36.521 V14.3.0.

DL signal

Output level range	due to PAR	15 dB below max. output level of RF generator, see general technical specification
Output level uncertainty		see general technical specification
Output level setting		NRS energy per resource element (EPRE) [dBm/15 kHz]

Signal quality		
Error vector magnitude (EVM)		< 2 %, RMS

WCDMA specifications – mobile station (UE) test [24]

Standard		3GPP FDD

WCDMA RF generator (prerequisite: R&S®CMW-B110A/R&S®CMW-B110D option with 40/80 MHz bandwidth unit; included with 160 MHz bandwidth unit)

Frequency range	WCDMA band 1	2112.4 MHz to 2167.6 MHz
	WCDMA band 2	1932.4 MHz to 1987.6 MHz
	WCDMA band 3	1807.4 MHz to 1877.6 MHz
	WCDMA band 4	2112.4 MHz to 2152.6 MHz
	WCDMA band 5	871.4 MHz to 891.6 MHz
	WCDMA band 6	877.4 MHz to 882.6 MHz
	WCDMA band 7	2622.4 MHz to 2687.6 MHz
	WCDMA band 8	927.4 MHz to 957.6 MHz
	WCDMA band 9	1847.4 MHz to 1877.4 MHz
	WCDMA band 10	2112.4 MHz to 2167.6 MHz
	WCDMA band 11	1478.4 MHz to 1498.4 MHz
	WCDMA band 12	730.4 MHz to 743.6 MHz
	WCDMA band 13	748.4 MHz to 753.6 MHz
	WCDMA band 14	760.4 MHz to 765.6 MHz
	WCDMA band S	2182.4 MHz to 2197.6 MHz
	WCDMA band S170	2180 MHz to 2190 MHz
	WCDMA band S190	2190 MHz to 2200 MHz

WCDMA GEN (R&S®CMW-KG400 option), WCDMA HSPA GEN (R&S®CMW-KG401 option)

Output level range	depends on PAR	see general technical specifications
Output level uncertainty		see general technical specifications
Output level resolution		see general technical specifications

Signal quality		
Error vector magnitude (EVM)	composite EVM	< 2 %, RMS

WCDMA WinIQSIM2™ (R&S®CMW-KW400 option), WCDMA HSDPA WinIQSIM2™ (R&S®CMW-KW401 option), WCDMA HSUPA WinIQSIM2™ (R&S®CMW-KW402 option), WCDMA HSPA+ WinIQSIM2™ (R&S®CMW-KW403 option)

Arbitrary waveform files	with the R&S®CMW-KW400 option	TM4CPICH.WV (PAR = 8.34 dB), 3GPPDEFAULT.WV (PAR = 10.65 dB)
	with the R&S®CMW-KW400 and R&S®CMW-KW401 options	WCDMA_DL_HSDPA.WV (PAR = 10.08 dB)
	with the R&S®CMW-KW400 and R&S®CMW-KW401 and R&S®CMW-KW402 options	WCDMA_DL_HSUPA.WV (PAR = 10.12 dB)

Output level range	depends on PAR	see general technical specifications
Output level uncertainty	with the R&S®CMW-KW400 option, waveform file used: 3GPPDEFAULT.WV	see general technical specifications
	with the R&S®CMW-KW401 option, waveform file used: WCDMA_DL_HSDPA.WV	see general technical specifications
	with the R&S®CMW-KW402 option, waveform file used: WCDMA_DL_HSUPA.WV	see general technical specifications
	with the R&S®CMW-KW400 and R&S®CMW-KW401 and R&S®CMW-KW402 and R&S®CMW-KW403 options	see general technical specifications
Output level resolution		see general technical specifications

[24] R&S®CMW500 and R&S®CMW290 only.

Signal quality		
Error vector magnitude (EVM)	composite EVM, with the R&S®CMW-KW400 option, waveform file used: TM4CPICH.WV	< 2 %, RMS
	composite EVM, with the R&S®CMW-KW401 option, waveform file used: WCDMA_DL_HSDPA.WV	< 2 %, RMS
	composite EVM, with the R&S®CMW-KW402 option, waveform file used: WCDMA_DL_HSUPA.WV	< 2 %, RMS
	with the R&S®CMW-KW400 and R&S®CMW-KW401 and R&S®CMW-KW402 and R&S®CMW-KW403 options	< 2 %, RMS

WCDMA RF analyzer (R&S®CMW-KM400, R&S®CMW-KM401, R&S®CMW-KM403 options)

Frequency range	WCDMA band 1	1922.4 MHz to 1977.6 MHz
	WCDMA band 2	1852.4 MHz to 1907.6 MHz
	WCDMA band 3	1712.4 MHz to 1782.6 MHz
	WCDMA band 4	1712.4 MHz to 1752.6 MHz
	WCDMA band 5	826.4 MHz to 846.6 MHz
	WCDMA band 6	832.4 MHz to 837.6 MHz
	WCDMA band 7	2502.4 MHz to 2567.6 MHz
	WCDMA band 8	882.4 MHz to 912.6 MHz
	WCDMA band 9	1752.4 MHz to 1782.4 MHz
	WCDMA band 10	1712.4 MHz to 1767.6 MHz
	WCDMA band 11	1430.4 MHz to 1450.4 MHz
	WCDMA band 12	700.4 MHz to 713.6 MHz
	WCDMA band 13	779.4 MHz to 784.6 MHz
	WCDMA band 14	790.4 MHz to 795.6 MHz
	WCDMA band S	2002.4 MHz to 2017.6 MHz
	WCDMA band S170	2010 MHz to 2020 MHz
	WCDMA band S190	2000 MHz to 2010 MHz

Statistics		
Statistical count		1 to 1000
Values		current, average, minimum/maximum, standard deviation

Trigger		
Trigger sources		BASE: external TRIG A, BASE: external TRIG B, GPRF: BB generator, WCDMA: free run, WCDMA: free run (fast sync), WCDMA: IF power, WCDMA: DCCH TTI trigger, WCDMA: frame trigger, WCDMA: HS-DPCCH trigger, WCDMA: slot trigger

Modulation analysis

Filter		3.84 MHz, RRC, α = 0.22, WCDMA filter
Level range		–28 dBm to +42 dBm [25]

[25] The maximum permissible continuous power is +34 dBm due to thermal limits.

Analysis modes	with the R&S®CMW-KM400 option	QPSK, WCDMA
	with the R&S®CMW-KM400 and R&S®CMW-KM401 options	WCDMA + HSDPA, WCDMA + HSUPA, WCDMA + HSPA
	with the R&S®CMW-KM400 and R&S®CMW-KM401 and R&S®CMW-KM403 options	WCDMA + HSPA+
Measured parameters	numeric results and standard deviation	error vector magnitude (EVM), magnitude error (ME), phase error (PE), frequency error, I/Q origin offset, I/Q imbalance, UE power, power steps, phase discontinuity, CDP, CDE
	graphical	EVM versus time, EVM versus chip, ME versus time, ME versus chip, PE versus time, PE versus chip, FE versus time, UE versus time, PS versus slot, PD versus slot, CDP versus slot, CDE versus slot, CD monitor

Error vector magnitude (EVM)		
Measurement range		up to 25 %, RMS
Inherent EVM		< 2.5 %, RMS
Measurement length		half-slot, 1 slot, multislot (1 to 120)

Frequency error		
Measurement range		±3 kHz
Frequency measurement uncertainty		< 20 Hz + drift of timebase, see general technical specifications

I/Q origin offset		
Inherent I/Q offset	for average ≥ 10 measurements	< –55 dB

I/Q imbalance		
Inherent I/Q imbalance		< –50 dB

Spectrum measurements

Adjacent channel leakage ratio	RMS detector	
Filter		3.84 MHz, RRC, α = 0.22, WCDMA filter
Dynamic range	first adjacent channel at ±5 MHz	> 54 dB
	second adjacent channel at ±10 MHz	> 57 dB
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	–4 dBm to +42 dBm [26]
Uncertainty	for –33 dBc first adjacent channel level	< 0.5 dB
	for –43 dBc second adjacent channel level	< 0.5 dB
Measurement length		1 slot (2560 chip)

Power meter

UE power measurement	RMS detector	
Filter		bandpass, 6.3 MHz, RRC, α = 0.22
Level range		–55 dBm to +42 dBm [26]
Level uncertainty		see general technical specifications
Measurement length		half-slot, 1 slot

[26] The maximum permissible continuous power is +34 dBm due to thermal limits.

Off power measurement	RMS detector	
Filter		3.84 MHz, RRC, α = 0.22, WCDMA filter
Noise floor		–72 dBm
Level uncertainty		see general technical specifications + uncertainty due to noise floor

3G WCDMA signaling (prerequisite: R&S®CMW-KS400, R&S®CMW-KS410, R&S®CMW-KS425 options, R&S®CMW-B300A or R&S®CMW-B300B or R&S®CMW-B500I option)

Standard		3GPP FDD
Symbol rate		3.84 MHz

Channels		
Physical channels	DL	P-CPICH, P-SCH, S-SCH, P-CCPCH, S-CCPCH, AICH, PICH
	DL OCNS R99	16-channel orthogonal channel noise
	UL	DPCCH, DPDCH, PRACH
Radio bearer	DPCH signaling radio bearer (SRB)	
	DL	1.7 kbps, 2.5 kbps, 3.4 kbps, 13.6 kbps
	UL	1.7 kbps, 2.5 kbps, 3.4 kbps, 13.6 kbps
	DPCH reference measurement channels (RMC) in line with 3GPP TS 34.121	
	DL	12.2 kbps, 64 kbps, 144 kbps, 384 kbps
	UL	12.2 kbps, 64 kbps, 144 kbps, 384 kbps
	DPCH voice echo NB-AMR	
	with the R&S®CMW-KS400 option	12.2 kbps
	with the R&S®CMW-KS400 and R&S®CMW-KS410 options	4.75 kbps, 5.15 kbps, 5.9 kbps, 6.7 kbps, 7.4 kbps, 7.95 kbps 10.2 kbps, 12.2 kbps
	DPCH voice echo WB-AMR	
	with the R&S®CMW-KS400 and R&S®CMW-KS410 options	6.6 kbps, 8.85 kbps, 12.65 kbps, 14.25 kbps, 15.85 kbps, 18.25 kbps, 19.85 kbps, 23.05 kbps, 23.85 kbps
	DPCH video echo	64 kbps

Frequency range		
Bands 1 to 14	with the R&S®CMW-KS400 option	
	DL	see WCDMA RF generator specifications
	UL	see WCDMA RF analyzer specifications
Band S, band S170, band S190	with the R&S®CMW-KS400 and R&S®CMW-KS425 options	
	DL	see WCDMA RF generator specifications
	UL	see WCDMA RF analyzer specifications

Frequency setting		channel number

Output level range	depends on PAR	see general technical specifications
Output level uncertainty		see general technical specifications
Output level resolution		see general technical specifications
Output level setting		total output power

Channel levels	P-CPICH, P-SCH, S-SCH, P-CCPCH, PICH, DPCH, OCNS	–30 dB to +0 dB relative to total power

Signal quality		
Error vector magnitude (EVM)	global EVM for DL RMC in line with 3GPP TS 34.121 C3.1 to C3.4 with DPCH/CPICH = 0 dB	< 2 %, RMS

WCDMA specifications – small cell test [27]

WCDMA RF analyzer (R&S®CMW-KN400)

Frequency range	WCDMA band 1	2112.4 MHz to 2167.6 MHz
	WCDMA band 2	1932.4 MHz to 1987.6 MHz
	WCDMA band 3	1807.4 MHz to 1877.6 MHz
	WCDMA band 4	2112.4 MHz to 2152.6 MHz
	WCDMA band 5	871.4 MHz to 891.6 MHz
	WCDMA band 6	877.4 MHz to 882.6 MHz
	WCDMA band 7	2622.4 MHz to 2687.6 MHz
	WCDMA band 8	927.4 MHz to 957.6 MHz
	WCDMA band 9	1847.4 MHz to 1877.4 MHz
	WCDMA band 10	2112.4 MHz to 2167.6 MHz
	WCDMA band 11	1478.4 MHz to 1498.4 MHz
	WCDMA band 12	730.4 MHz to 743.6 MHz
	WCDMA band 13	748.4 MHz to 753.6 MHz
	WCDMA band 14	760.4 MHz to 765.6 MHz
	WCDMA band S	2182.4 MHz to 2197.6 MHz
	WCDMA band S170	2180 MHz to 2190 MHz
	WCDMA band S190	2190 MHz to 2200 MHz

Statistics		
Statistical count		1 to 1000
Values		current, average, minimum/maximum, standard deviation

Trigger		
Trigger sources		BASE: external TRIG A, BASE: external TRIG B, GPRF: BB generator, WCDMA: free run, WCDMA: free run (fast sync), WCDMA: IF power, WCDMA: DCCH TTI trigger, WCDMA: frame trigger, WCDMA: HS-DPCCH trigger, WCDMA: slot trigger

Modulation analysis

Filter		3.84 MHz, RRC, α = 0.22, WCDMA filter
Level range		–28 dBm to +42 dBm [28]

Analysis modes	with the R&S®CMW-KM400 option	QPSK, WCDMA
Measured parameters	numeric results and standard deviation	error vector magnitude (EVM), magnitude error (ME), phase error (PE), frequency error, I/Q origin offset, I/Q imbalance, UE power, power steps, phase discontinuity, CDP, CDE

[27] R&S®CMW500 only.

[28] The maximum permissible continuous power is +34 dBm due to thermal limits.

	graphical	EVM versus time, EVM versus chip, ME versus time, ME versus chip, PE versus time, PE versus chip, FE versus time, UE versus time, PS versus slot, PD versus slot, CDP versus slot, CDE versus slot, CD monitor

Error vector magnitude (EVM)		
Measurement range		up to 25 %, RMS
Inherent EVM		< 2.5 %, RMS
Measurement length		half-slot, 1 slot, multislot (1 to 120)

Frequency error		
Measurement range		±3 kHz
Frequency measurement uncertainty		< 20 Hz + drift of timebase, see general technical specifications

I/Q origin offset		
Inherent I/Q offset	for average ≥ 10 measurements	< –52 dB

I/Q imbalance		
Inherent I/Q imbalance		< –50 dB

Spectrum measurements

Adjacent channel leakage ratio	RMS detector	
Filter		3.84 MHz, RRC, α = 0.22, WCDMA filter
Dynamic range	first adjacent channel at ±5 MHz	> 52 dB
	second adjacent channel at ±10 MHz	> 52 dB
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	–4 dBm to +42 dBm [29]
Uncertainty	for –33 dBc first adjacent channel level	< 0.5 dB
	for –43 dBc second adjacent channel level	< 0.5 dB
Measurement length		1 slot (2560 chip)

Power meter

UE power measurement	RMS detector	
Filter		bandpass, 6.3 MHz, RRC, α = 0.22
Level range		–55 dBm to +42 dBm [29]
Level uncertainty		see general technical specifications
Measurement length		half-slot, 1 slot

Off power measurement	RMS detector	
Filter		3.84 MHz, RRC, α = 0.22, WCDMA filter
Noise floor		–72 dBm
Level uncertainty		see general technical specifications + uncertainty due to noise floor

[29] The maximum permissible continuous power is +34 dBm due to thermal limits.

LTE specifications – mobile station test with 40/80 MHz bandwidth unit [30]

Standard		LTE FDD and TDD

LTE RF generator (prerequisite: R&S®CMW-B110A or R&S®CMW-B110D option)

Frequency range	E-UTRA band 1, FDD	2110 MHz to 2170 MHz
	E-UTRA band 2, FDD	1930 MHz to 1990 MHz
	E-UTRA band 3, FDD	1805 MHz to 1880 MHz
	E-UTRA band 4, FDD	2110 MHz to 2155 MHz
	E-UTRA band 5, FDD	869 MHz to 894 MHz
	E-UTRA band 6, FDD	875 MHz to 885 MHz
	E-UTRA band 7, FDD	2620 MHz to 2690 MHz
	E-UTRA band 8, FDD	925 MHz to 960 MHz
	E-UTRA band 9, FDD	1844.9 MHz to 1879.9 MHz
	E-UTRA band 10, FDD	2110 MHz to 2170 MHz
	E-UTRA band 11, FDD	1475.9 MHz to 1495.9 MHz
	E-UTRA band 12, FDD	729 MHz to 746 MHz
	E-UTRA band 13, FDD	746 MHz to 756 MHz
	E-UTRA band 14, FDD	758 MHz to 768 MHz
	E-UTRA band 15, FDD	2600 MHz to 2620 MHz
	E-UTRA band 16, FDD	2585 MHz to 2600 MHz
	E-UTRA band 17, FDD	734 MHz to 746 MHz
	E-UTRA band 18, FDD	860 MHz to 875 MHz
	E-UTRA band 19, FDD	875 MHz to 890 MHz
	E-UTRA band 20, FDD	791 MHz to 821 MHz
	E-UTRA band 21, FDD	1495.9 MHz to 1510.9 MHz
	E-UTRA band 22, FDD, prerequisite: R&S®CMW-KB036 option	3510 MHz to 3590 MHz
	E-UTRA band 23, FDD	2180 MHz to 2200 MHz
	E-UTRA band 24, FDD	1525 MHz to 1559 MHz
	E-UTRA band 25, FDD	1930 MHz to 1995 MHz
	E-UTRA band 26, FDD	859 MHz to 894 MHz
	E-UTRA band 27, FDD	852 MHz to 869 MHz
	E-UTRA band 28, FDD	758 MHz to 803 MHz
	E-UTRA band 29, FDD	717 MHz to 728 MHz
	E-UTRA band 30, FDD	2350 MHz to 2360 MHz
	E-UTRA band 31, FDD	462.5 MHz to 467.5 MHz
	E-UTRA band 33, TDD	1900 MHz to 1920 MHz
	E-UTRA band 34, TDD	2010 MHz to 2025 MHz
	E-UTRA band 35, TDD	1850 MHz to 1910 MHz
	E-UTRA band 36, TDD	1930 MHz to 1990 MHz
	E-UTRA band 37, TDD	1910 MHz to 1930 MHz
	E-UTRA band 38, TDD	2570 MHz to 2620 MHz
	E-UTRA band 39, TDD	1880 MHz to 1920 MHz
	E-UTRA band 40, TDD	2300 MHz to 2400 MHz
	E-UTRA band 41, TDD	2496 MHz to 2690 MHz
	E-UTRA band 42, TDD, prerequisite: R&S®CMW-KB036 option	3400 MHz to 3600 MHz
	E-UTRA band 43, TDD, prerequisite: R&S®CMW-KB036 option	3600 MHz to 3800 MHz
	E-UTRA band 44, TDD	703 MHz to 803 MHz

[30] R&S®CMW500 and R&S®CMW290 only.

LTE WinIQSIM2™ (R&S®CMW-KW500 option)

Arbitrary waveform file	LTE FDD	LTE_FDD_QPSK_10MHZ.WV (PAR = 11.15 dB)
	LTE TDD	LTE_TDD_64QAM_20MHZ.WV (PAR = 11.10 dB)

Output level range	depends on PAR	see general technical specifications
Output level uncertainty	waveform file used: LTE_FDD_QPSK_10MHZ.WV	see general technical specifications
	waveform file used: LTE_TDD_64QAM_20MHZ.WV	see general technical specifications
Output level resolution		see general technical specifications

Signal quality		
Error vector magnitude (EVM)	EVM PDSCH QPSK, bandwidth = 10 MHz, 50 resource blocks, PRB symbol offset = 3, 10 subframes, PCFICH present, waveform file used: LTE_FDD_QPSK_10MHZ.WV	< 2 %, RMS
	EVM PDSCH 64QAM, bandwidth = 20 MHz, 100 resource blocks, PRB symbol offset = 2, uplink/downlink configuration 1, special subframe configuration 7, waveform file used: LTE_TDD_64QAM_20MHZ.WV	< 2 %, RMS

LTE FDD RF analyzer (R&S®CMW-KM500 option)

Bandwidth		1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz

Frequency range	E-UTRA band 1, FDD	1920 MHz to 1980 MHz
	E-UTRA band 2, FDD	1850 MHz to 1910 MHz
	E-UTRA band 3, FDD	1710 MHz to 1785 MHz
	E-UTRA band 4, FDD	1710 MHz to 1755 MHz
	E-UTRA band 5, FDD	824 MHz to 849 MHz
	E-UTRA band 6, FDD	830 MHz to 840 MHz
	E-UTRA band 7, FDD	2500 MHz to 2570 MHz
	E-UTRA band 8, FDD	880 MHz to 915 MHz
	E-UTRA band 9, FDD	1749.9 MHz 1784.9 MHz
	E-UTRA band 10, FDD	1710 MHz to 1770 MHz
	E-UTRA band 11, FDD	1427.9 MHz to 1447.9 MHz
	E-UTRA band 12, FDD	699 MHz to 716 MHz
	E-UTRA band 13, FDD	777 MHz to 787 MHz
	E-UTRA band 14, FDD	788 MHz to 798 MHz
	E-UTRA band 15, FDD	1900 MHz to 1920 MHz
	E-UTRA band 16, FDD	2010 MHz to 2025 MHz
	E-UTRA band 17, FDD	704 MHz to 716 MHz
	E-UTRA band 18, FDD	815 MHz to 830 MHz
	E-UTRA band 19, FDD	830 MHz to 845 MHz
	E-UTRA band 20, FDD	832 MHz to 862 MHz
	E-UTRA band 21, FDD	1447.9 MHz to 1462.9 MHz
	E-UTRA band 22, FDD, prerequisite: R&S®CMW-KB036 option	3410 MHz to 3490 MHz
	E-UTRA band 23, FDD	2000 MHz to 2020 MHz
	E-UTRA band 24, FDD	1625.5 MHz to 1660.5 MHz
	E-UTRA band 25, FDD	1850 MHz to 1915 MHz
	E-UTRA band 26, FDD	814 MHz to 849 MHz
	E-UTRA band 27, FDD	807 MHz to 824 MHz
	E-UTRA band 28, FDD	703 MHz to 748 MHz
	E-UTRA band 30, FDD	2305 MHz to 2315 MHz
	E-UTRA band 31, FDD	452.5 MHz to 457.5 MHz
Level setting		manual mode

Statistics		
Statistical count		1 to 1000
Values		current, average, minimum/maximum, standard deviation

Trigger		
Trigger source		BASE: external TRIG A, BASE: external TRIG B, GPRF: BB generator, LTE: free run (fast sync), LTE: IF power

Power measurement

Slot power	RMS detector	
Level range		–50 dBm to +30 dBm, RMS
Level uncertainty		see general technical specifications

Modulation analysis

Measured parameters	numeric results	error vector magnitude (EVM), magnitude error (ME), phase error (PE), frequency error, I/Q origin offset, TX power, peak power, resource block power (RB power)
	graphical	EVM versus SC-FDMA symbol, ME versus SC-FDMA symbol, PE versus SC-FDMA symbol, EVM versus subcarrier, in-band emissions, spectrum flatness, I/Q constellation

Error vector magnitude (EVM)		
Inherent EVM	allocated resource blocks ≤ 15	
	–34 dBm ≤ input level < +30 dBm, RMS	< 1 %, RMS
	–38 dBm ≤ input level < –34 dBm, RMS	< 1.5 %, RMS
	allocated resource blocks ≤ 50	
	–30 dBm ≤ input level ≤ +30 dBm, RMS	< 1 %, RMS
	–38 dBm ≤ input level < –30 dBm, RMS	< 2 %, RMS
	allocated resource blocks ≤ 100	
	–28 dBm ≤ input level ≤ +30 dBm, RMS	< 1 %, RMS
	–38 dBm ≤ input level < –28 dBm, RMS	< 2.5 %, RMS

Frequency error		
Measurement range		±80 kHz
Frequency measurement uncertainty		< 20 Hz [31] + drift of timebase, see general technical specifications

I/Q origin offset		
Inherent I/Q offset	for average ≥ 10 measurements	< –50 dB

In-band emissions		
Dynamic range	allocated resource blocks ≤ 50, f_{RF} < 3300 MHz	> 50 dB
	allocated resource blocks ≤ 50, f_{RF} > 3300 MHz	> 47 dB
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	see general technical specifications

[31] For frequency error measurements relative to the downlink signal of the same R&S®CMW500, the uncertainty is in line with 3GPP TS 36.521-1 V9.3.0.

Equalizer spectrum flatness	allocated resource blocks ≤ 50	
Level uncertainty		< 0.5 dB

Spectrum measurements

Adjacent channel leakage ratio		
Filter	E-UTRA	rectangle 1.08 MHz, 2.7 MHz, 4.5 MHz, 9 MHz, 13.5 MHz, 18 MHz
	UTRA	3.84 MHz, RRC, α = 0.22, WCDMA filter
Dynamic range	E-UTRA, f_{RF} < 3300 MHz	> 45 dB
	E-UTRA, f_{RF} > 3300 MHz	> 42 dB
	UTRA, f_{RF} < 3300 MHz	> 52 dB
	UTRA, f_{RF} > 3300 MHz	> 49 dB
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	see general technical specifications

Spectrum emission mask (SEM)		
Frequency span		70 MHz
Noise floor	*RBW → 1 MHz*, f_{RF} < 3300 MHz	< –35 dBm
	RBW → 1 MHz, f_{RF} > 3300 MHz	< –32 dBm
	RBW → 100 kHz, f_{RF} < 3300 MHz	< –40 dBm
	RBW → 100 kHz, f_{RF} > 3300 MHz	< –37 dBm
	RBW → 30 kHz, f_{RF} < 3300 MHz	< –45 dBm
	RBW → 30 kHz, f_{RF} > 3300 MHz	< –42 dBm

LTE FDD signaling (prerequisite: R&S®CMW-KS500 option, R&S®CMW-B300A or R&S®CMW-B300B or R&S®CMW-B500I option)

Standard		3GPP E-UTRA FDD

Channels		
Physical channels and signals	DL	RS (cell-specific RS), PSS, SSS, PBCH, PCFICH, PHICH, PDCCH, PDSCH
	UL	RS (demodulation RS), PRACH, PUCCH, PUSCH
Bandwidth		1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz
Modulation schemes	DL PDSCH	QPSK, 16QAM, 64QAM
	UL PUSCH	QPSK, 16QAM

Reference measurement channels	RMCs in line with 3GPP TS 36.521 Annex A.2 (UL) and Annex A.3 (DL)	RMCs for FDD, full and partial RB allocation, modulation: QPSK, 16QAM, 64QAM (DL only)

Frequency range		
Bands 1 to 31	with the R&S®CMW-KS500 option	
	DL	see LTE FDD RF generator specifications
	UL	see LTE FDD RF analyzer specifications

Frequency setting		channel number

DL signal

Output level range	due to PAR	15 dB below max. output level of RF generator, see general technical specifications
Output level uncertainty		see general technical specifications
Output level resolution		0.1 dB
Output level setting	in line with 3GPP TS 36.521 Annex C.0	RS energy per resource element (EPRE) [dBm/15 kHz]

Channel levels	PSS, SSS, PBCH, PCFICH, PHICH, PDCCH, PDSCH	–30 dB to +0 dB relative to RS EPRE
	PHICH	–30 dB to –12 dB relative to RS EPRE

Signal quality		
Error vector magnitude (EVM)	global EVM for cell with bandwidth = 20 MHz	< 2 %, RMS

LTE TDD RF analyzer (R&S®CMW-KM550 option)

Bandwidth		1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz

Frequency range	E-UTRA band 33, TDD	1900 MHz to 1920 MHz
	E-UTRA band 34, TDD	2010 MHz to 2025 MHz
	E-UTRA band 35, TDD	1850 MHz to 1910 MHz
	E-UTRA band 36, TDD	1930 MHz to 1990 MHz
	E-UTRA band 37, TDD	1910 MHz to 1930 MHz
	E-UTRA band 38, TDD	2570 MHz to 2620 MHz
	E-UTRA band 39, TDD	1880 MHz to 1920 MHz
	E-UTRA band 40, TDD	2300 MHz to 2400 MHz
	E-UTRA band 41, TDD	2496 MHz to 2690 MHz
	E-UTRA band 42, TDD, prerequisite: R&S®CMW-KB036 option	3400 MHz to 3600 MHz
	E-UTRA band 43, TDD, prerequisite: R&S®CMW-KB036 option	3600 MHz to 3800 MHz
	E-UTRA band 44, TDD	703 MHz to 803 MHz
Level setting		manual mode

Statistics		
Statistical count		1 to 1000
Values		current, average, minimum/maximum, standard deviation

Trigger		
Trigger source		BASE: external TRIG A, BASE: external TRIG B, GPRF: BB generator, LTE: free run (fast sync), LTE: IF power

Power measurement

Slot power	RMS detector	
Level range		–50 dBm to +30 dBm, RMS
Level uncertainty		see general technical specifications

Modulation analysis

Measured parameters	numeric results	error vector magnitude (EVM), magnitude error (ME), phase error (PE), frequency error, I/Q origin offset, TX power, peak power, resource block power (RB power)
	graphical	EVM versus SC-FDMA symbol, ME versus SC-FDMA symbol, PE versus SC-FDMA symbol, EVM versus subcarrier, in-band emissions, spectrum flatness, I/Q constellation

Error vector magnitude (EVM)		
Inherent EVM	allocated resource blocks ≤ 15	
	–34 dBm ≤ input level < +30 dBm, RMS	< 1 %, RMS
	–38 dBm ≤ input level < –34 dBm, RMS	< 1.5 %, RMS
	allocated resource blocks ≤ 50	
	–30 dBm ≤ input level ≤ +30 dBm, RMS	< 1 %, RMS
	–38 dBm ≤ input level < –30 dBm, RMS	< 2 %, RMS
	allocated resource blocks ≤ 100	
	–28 dBm ≤ input level ≤ +30 dBm, RMS	< 1 %, RMS
	–38 dBm ≤ input level < –28 dBm, RMS	< 2.5 %, RMS

Frequency error		
Measurement range		±80 kHz
Frequency measurement uncertainty		< 20 Hz [32] + drift of timebase, see general technical specifications

I/Q origin offset		
Inherent I/Q offset		< –50 dB

In-band emissions		
Dynamic range	allocated resource blocks ≤ 50, f_{RF} < 3300 MHz	> 50 dB
	allocated resource blocks ≤ 50, f_{RF} > 3300 MHz	> 47 dB
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	see general technical specifications

Equalizer spectrum flatness	allocated resource blocks ≤ 50	
Level uncertainty		< 0.5 dB

Spectrum measurements

Adjacent channel leakage ratio		
Filter	E-UTRA	rectangle 1.08 MHz, 2.7 MHz, 4.5 MHz, 9 MHz, 13.5 MHz, 18 MHz
	UTRA	1.28 MHz, RRC, α = 0.22, WCDMA filter
Dynamic range	E-UTRA, f_{RF} < 3300 MHz	> 45 dB
	E-UTRA, f_{RF} > 3300 MHz	> 42 dB
	UTRA, f_{RF} < 3300 MHz	> 56 dB
	UTRA, f_{RF} > 3300 MHz	> 53 dB
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	see general technical specifications

Spectrum emission mask (SEM)		
Frequency span		70 MHz
Noise floor	*RBW → 1 MHz*, f_{RF} < 3300 MHz	< –35 dBm
	RBW → 1 MHz, f_{RF} > 3300 MHz	< –32 dBm
	RBW → 100 kHz, f_{RF} < 3300 MHz	< –40 dBm
	RBW → 100 kHz, f_{RF} > 3300 MHz	< –37 dBm
	RBW → 30 kHz, f_{RF} < 3300 MHz	< –45 dBm
	RBW → 30 kHz, f_{RF} > 3300 MHz	< –42 dBm

[32] For frequency error measurements relative to the downlink signal of the same R&S®CMW500, the uncertainty is in line with 3GPP TS 36.521-1 V9.3.0.

LTE specifications – small cell test with 40/80 MHz bandwidth unit [33]

Standard		LTE FDD and TDD

LTE FDD eNodeB RF analyzer (R&S®CMW-KN500 option)

Bandwidth		1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz

Frequency range	E-UTRA band 1, FDD	2110 MHz to 2170 MHz
	E-UTRA band 2, FDD	1930 MHz to 1990 MHz
	E-UTRA band 3, FDD	1805 MHz to 1880 MHz
	E-UTRA band 4, FDD	2110 MHz to 2155 MHz
	E-UTRA band 5, FDD	869 MHz to 894 MHz
	E-UTRA band 6, FDD	875 MHz to 885 MHz
	E-UTRA band 7, FDD	2620 MHz to 2690 MHz
	E-UTRA band 8, FDD	925 MHz to 960 MHz
	E-UTRA band 9, FDD	1844.9 MHz 1879.9 MHz
	E-UTRA band 10, FDD	2110 MHz to 2170 MHz
	E-UTRA band 11, FDD	1475.9 MHz to 1495.9 MHz
	E-UTRA band 12, FDD	729 MHz to 746 MHz
	E-UTRA band 13, FDD	746 MHz to 756 MHz
	E-UTRA band 14, FDD	758 MHz to 768 MHz
	E-UTRA band 15, FDD	2600 MHz to 2620 MHz
	E-UTRA band 16, FDD	2585 MHz to 2600 MHz
	E-UTRA band 17, FDD	734 MHz to 746 MHz
	E-UTRA band 18, FDD	860 MHz to 875 MHz
	E-UTRA band 19, FDD	875 MHz to 890 MHz
	E-UTRA band 20, FDD	791 MHz to 821 MHz
	E-UTRA band 21, FDD	1495.9 MHz to 1510.9 MHz
	E-UTRA band 22, FDD, prerequisite: R&S®CMW-KB036 option	3510 MHz to 3590 MHz
	E-UTRA band 23, FDD	2180 MHz to 2200 MHz
	E-UTRA band 24, FDD	1525 MHz to 1559 MHz
	E-UTRA band 25, FDD	1930 MHz to 1995 MHz
	E-UTRA band 26, FDD	859 MHz to 894 MHz
	E-UTRA band 27, FDD	852 MHz to 869 MHz
	E-UTRA band 28, FDD	758 MHz to 803 MHz
	E-UTRA band 29, FDD	717 MHz to 728 MHz
	E-UTRA band 30, FDD	2350 MHz to 2360 MHz
	E-UTRA band 31, FDD	462.5 MHz to 467.5 MHz
Level setting		manual mode

Statistics		
Statistical count		1 to 1000
Values		current, average, minimum/maximum, standard deviation

Trigger		
Trigger source		BASE: external TRIG A, BASE: external TRIG B, GPRF: BB generator, LTE: free run (fast sync), LTE: IF power

Power measurement

Slot power	RMS detector	
Level range		–50 dBm to +30 dBm, RMS
Level uncertainty		see general technical specifications

[33] R&S®CMW500 only.

Modulation analysis

Measured parameters	numeric results	error vector magnitude (EVM), magnitude error (ME), phase error (PE), frequency error, I/Q origin offset, TX power, peak power, reference symbol power, OFDM symbol power
	graphical	EVM versus OFDMA symbol, ME versus OFDMA symbol, PE versus OFDMA symbol, OFDM symbol power spectrum flatness, spectrum ACLR I/Q constellation

Error vector magnitude (EVM)		
Inherent EVM	for average ≥ 10 subframes	
	–20 dBm ≤ input level < +30 dBm, RMS	< 1.5 %, RMS

Frequency error		
Measurement range		±80 kHz
Frequency measurement uncertainty		< 20 Hz [34] + drift of timebase, see general technical specifications

Spectrum measurements

Adjacent channel leakage ratio		
Filter	E-UTRA	rectangle 1.08 MHz, 2.7 MHz, 4.5 MHz, 9 MHz, 13.5 MHz, 18 MHz
	UTRA	1.28 MHz, RRC, α = 0.22, WCDMA filter 3.84 MHz, RRC, α = 0.22, WCDMA filter 7.68 MHz, RRC, α = 0.22, WCDMA filter
Dynamic range	E-UTRA, f_{RF} < 3300 MHz	> 50 dB
	E-UTRA, f_{RF} > 3300 MHz	> 48 dB
	UTRA, f_{RF} < 3300 MHz	> 52 dB
	UTRA, f_{RF} > 3300 MHz	> 52 dB
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	see general technical specifications

Spectrum emission mask (SEM)		
Frequency span		70 MHz
Noise floor	*RBW → ≤ 1 MHz*, expected nominal power < 12 dBm, f_{RF} < 3300 MHz	< –58 dBm
	RBW → ≤ 1 MHz, expected nominal power < 12 dBm, f_{RF} > 3300 MHz	< –55 dBm

[34] For frequency error measurements relative to the downlink signal of the same R&S®CMW500, the uncertainty is in line with 3GPP TS 36.521-1 V9.3.0.

LTE TDD eNodeB RF analyzer (R&S®CMW-KN550 option)

Bandwidth		1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz

Frequency range	E-UTRA band 33, TDD	1900 MHz to 1920 MHz
	E-UTRA band 34, TDD	2010 MHz to 2025 MHz
	E-UTRA band 35, TDD	1850 MHz to 1910 MHz
	E-UTRA band 36, TDD	1930 MHz to 1990 MHz
	E-UTRA band 37, TDD	1910 MHz to 1930 MHz
	E-UTRA band 38, TDD	2570 MHz to 2620 MHz
	E-UTRA band 39, TDD	1880 MHz to 1920 MHz
	E-UTRA band 40, TDD	2300 MHz to 2400 MHz
	E-UTRA band 41, TDD	2496 MHz to 2690 MHz
	E-UTRA band 42, TDD, prerequisite: R&S®CMW-KB036 option	3400 MHz to 3600 MHz
	E-UTRA band 43, TDD, prerequisite: R&S®CMW-KB036 option	3600 MHz to 3800 MHz
	E-UTRA band 44, TDD	703 MHz to 803 MHz
Level setting		manual mode

Statistics		
Statistical count		1 to 1000
Values		current, average, minimum/maximum, standard deviation

Trigger		
Trigger source		BASE: external TRIG A, BASE: external TRIG B, GPRF: BB generator, LTE: free run (fast sync), LTE: IF power

Power measurement

Slot power	RMS detector	
Level range		–50 dBm to +30 dBm, RMS
Level uncertainty		see general technical specifications

Modulation analysis

Measured parameters	numeric results	error vector magnitude (EVM), magnitude error (ME), phase error (PE), frequency error, I/Q origin offset, TX power, peak power, reference symbol power, OFDM symbol power
	graphical	EVM versus OFDMA symbol, ME versus OFDMA symbol, PE versus OFDMA symbol, OFDM symbol power spectrum flatness, spectrum ACLR, I/Q constellation

Error vector magnitude (EVM)		
Inherent EVM	for average ≥ 10 subframes	
	–20 dBm ≤ input level < +30 dBm, RMS	< 1.5 %, RMS

Frequency error		
Measurement range		±80 kHz
Frequency measurement uncertainty		< 20 Hz [35] + drift of timebase, see general technical specifications

Spectrum measurements

Adjacent channel leakage ratio		
Filter	E-UTRA	rectangle 1.08 MHz, 2.7 MHz, 4.5 MHz, 9 MHz, 13.5 MHz, 18 MHz
	UTRA	1.28 MHz, RRC, α = 0.22, WCDMA filter 3.84 MHz, RRC, α = 0.22, WCDMA filter 7.68 MHz, RRC, α = 0.22, WCDMA filter
Dynamic range	E-UTRA, f_{RF} < 3300 MHz	> 50 dB
	E-UTRA, f_{RF} > 3300 MHz	> 47 dB
	UTRA128, f_{RF} < 3300 MHz	> 52 dB
	UTRA384, f_{RF} < 3300 MHz	> 52 dB
	UTRA768, f_{RF} < 3300 MHz	> 49 dB
	UTRA128, f_{RF} > 3300 MHz	> 52 dB
	UTRA384_1, f_{RF} > 3300 MHz	> 50 dB
	UTRA384_2, f_{RF} > 3300 MHz	> 52 dB
	UTRA768, f_{RF} > 3300 MHz	> 49 dB
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	see general technical specifications

Spectrum emission mask (SEM)		
Frequency span		70 MHz
Noise floor	*RBW → ≤ 1 MHz*, expected nominal power < 12 dBm, f_{RF} < 3300 MHz	< –58 dBm
	RBW → ≤ 1 MHz, expected nominal power < 12 dBm, f_{RF} > 3300 MHz	< –55 dBm

[35] For frequency error measurements relative to the downlink signal of the same R&S®CMW500, the uncertainty is in line with 3GPP TS 36.521-1 V9.3.0.

LTE specifications – mobile station test with 160 MHz bandwidth unit [36]

Standard		LTE FDD and TDD

LTE RF generator

Frequency range	E-UTRA band 1, FDD	2110 MHz to 2170 MHz
	E-UTRA band 2, FDD	1930 MHz to 1990 MHz
	E-UTRA band 3, FDD	1805 MHz to 1880 MHz
	E-UTRA band 4, FDD	2110 MHz to 2155 MHz
	E-UTRA band 5, FDD	869 MHz to 894 MHz
	E-UTRA band 6, FDD	875 MHz to 885 MHz
	E-UTRA band 7, FDD	2620 MHz to 2690 MHz
	E-UTRA band 8, FDD	925 MHz to 960 MHz
	E-UTRA band 9, FDD	1844.9 MHz to 1879.9 MHz
	E-UTRA band 10, FDD	2110 MHz to 2170 MHz
	E-UTRA band 11, FDD	1475.9 MHz to 1495.9 MHz
	E-UTRA band 12, FDD	729 MHz to 746 MHz
	E-UTRA band 13, FDD	746 MHz to 756 MHz
	E-UTRA band 14, FDD	758 MHz to 768 MHz
	E-UTRA band 15, FDD	2600 MHz to 2620 MHz
	E-UTRA band 16, FDD	2585 MHz to 2600 MHz
	E-UTRA band 17, FDD	734 MHz to 746 MHz
	E-UTRA band 18, FDD	860 MHz to 875 MHz
	E-UTRA band 19, FDD	875 MHz to 890 MHz
	E-UTRA band 20, FDD	791 MHz to 821 MHz
	E-UTRA band 21, FDD	1495.9 MHz to 1510.9 MHz
	E-UTRA band 22, FDD, prerequisite: R&S®CMW-KB036 option	3510 MHz to 3590 MHz
	E-UTRA band 23, FDD	2180 MHz to 2200 MHz
	E-UTRA band 24, FDD	1525 MHz to 1559 MHz
	E-UTRA band 25, FDD	1930 MHz to 1995 MHz
	E-UTRA band 26, FDD	859 MHz to 894 MHz
	E-UTRA band 27, FDD	852 MHz to 869 MHz
	E-UTRA band 28, FDD	758 MHz to 803 MHz
	E-UTRA band 29, FDD	717 MHz to 728 MHz
	E-UTRA band 30, FDD	2350 MHz to 2360 MHz
	E-UTRA band 31, FDD	462.5 MHz to 467.5 MHz
	E-UTRA band 33, TDD	1900 MHz to 1920 MHz
	E-UTRA band 34, TDD	2010 MHz to 2025 MHz
	E-UTRA band 35, TDD	1850 MHz to 1910 MHz
	E-UTRA band 36, TDD	1930 MHz to 1990 MHz
	E-UTRA band 37, TDD	1910 MHz to 1930 MHz
	E-UTRA band 38, TDD	2570 MHz to 2620 MHz
	E-UTRA band 39, TDD	1880 MHz to 1920 MHz
	E-UTRA band 40, TDD	2300 MHz to 2400 MHz
	E-UTRA band 41, TDD	2496 MHz to 2690 MHz
	E-UTRA band 42, TDD, prerequisite: R&S®CMW-KB036 option	3400 MHz to 3600 MHz
	E-UTRA band 43, TDD, prerequisite: R&S®CMW-KB036 option	3600 MHz to 3800 MHz
	E-UTRA band 44, TDD	703 MHz to 803 MHz

LTE WinIQSIM2™ (R&S®CMW-KW500 option)

Arbitrary waveform file	LTE FDD	LTE_FDD_QPSK_10MHZ.WV (PAR = 11.15 dB)
	LTE TDD	LTE_TDD_64QAM_20MHZ.WV (PAR = 11.10 dB)

[36] R&S®CMW500 and R&S®CMW290 only.

Output level range	depends on PAR	see general technical specifications
Output level uncertainty	waveform file used: LTE_FDD_QPSK_10MHZ.WV	see general technical specifications
	waveform file used: LTE_TDD_64QAM_20MHZ.WV	see general technical specifications
Output level resolution		see general technical specifications

Signal quality		
Error vector magnitude (EVM)	EVM PDSCH QPSK, bandwidth = 10 MHz, 50 resource blocks, PRB symbol offset = 3, 10 subframes, PCFICH present, waveform file used: LTE_FDD_QPSK_10MHZ.WV	< 2 %, RMS
	EVM PDSCH 64QAM, bandwidth = 20 MHz, 100 resource blocks, PRB symbol offset = 2, uplink/downlink configuration 1, special subframe configuration 7, waveform file used: LTE_TDD_64QAM_20MHZ.WV	< 2 %, RMS

LTE FDD RF analyzer (R&S®CMW-KM500 option)

Bandwidth		1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz

Frequency range	E-UTRA band 1, FDD	1920 MHz to 1980 MHz
	E-UTRA band 2, FDD	1850 MHz to 1910 MHz
	E-UTRA band 3, FDD	1710 MHz to 1785 MHz
	E-UTRA band 4, FDD	1710 MHz to 1755 MHz
	E-UTRA band 5, FDD	824 MHz to 849 MHz
	E-UTRA band 6, FDD	830 MHz to 840 MHz
	E-UTRA band 7, FDD	2500 MHz to 2570 MHz
	E-UTRA band 8, FDD	880 MHz to 915 MHz
	E-UTRA band 9, FDD	1749.9 MHz 1784.9 MHz
	E-UTRA band 10, FDD	1710 MHz to 1770 MHz
	E-UTRA band 11, FDD	1427.9 MHz to 1447.9 MHz
	E-UTRA band 12, FDD	699 MHz to 716 MHz
	E-UTRA band 13, FDD	777 MHz to 787 MHz
	E-UTRA band 14, FDD	788 MHz to 798 MHz
	E-UTRA band 15, FDD	1900 MHz to 1920 MHz
	E-UTRA band 16, FDD	2010 MHz to 2025 MHz
	E-UTRA band 17, FDD	704 MHz to 716 MHz
	E-UTRA band 18, FDD	815 MHz to 830 MHz
	E-UTRA band 19, FDD	830 MHz to 845 MHz
	E-UTRA band 20, FDD	832 MHz to 862 MHz
	E-UTRA band 21, FDD	1447.9 MHz to 1462.9 MHz
	E-UTRA band 22, FDD, prerequisite: R&S®CMW-KB036 option	3410 MHz to 3490 MHz
	E-UTRA band 23, FDD	2000 MHz to 2020 MHz
	E-UTRA band 24, FDD	1625.5 MHz to 1660.5 MHz
	E-UTRA band 25, FDD	1850 MHz to 1915 MHz
	E-UTRA band 26, FDD	814 MHz to 849 MHz
	E-UTRA band 27, FDD	807 MHz to 824 MHz
	E-UTRA band 28, FDD	703 MHz to 748 MHz
	E-UTRA band 30, FDD	2305 MHz to 2315 MHz
	E-UTRA band 31, FDD	452.5 MHz to 457.5 MHz
Level setting		manual mode

Statistics		
Statistical count		1 to 1000
Values		current, average, minimum/maximum, standard deviation

Trigger		
Trigger source		BASE: external TRIG A, BASE: external TRIG B, GPRF: BB generator, LTE: free run (fast sync), LTE: IF power

Power measurement

Slot power	RMS detector	
Level range		–50 dBm to +30 dBm, RMS
Level uncertainty		see general technical specifications

Modulation analysis

Measured parameters	numeric results	error vector magnitude (EVM), magnitude error (ME), phase error (PE), frequency error, I/Q origin offset, TX power, peak power, resource block power (RB power)
	graphical	EVM versus SC-FDMA symbol, ME versus SC-FDMA symbol, PE versus SC-FDMA symbol, EVM versus subcarrier, in-band emissions, spectrum flatness, I/Q constellation

Error vector magnitude (EVM)		
Inherent EVM	allocated resource blocks ≤ 15	
	–34 dBm ≤ input level < +30 dBm, RMS	< 1 %, RMS
	–38 dBm ≤ input level < –34 dBm, RMS	< 1.5 %, RMS
	allocated resource blocks ≤ 50	
	–30 dBm ≤ input level ≤ +30 dBm, RMS	< 1 %, RMS
	–38 dBm ≤ input level < –30 dBm, RMS	< 2 %, RMS
	allocated resource blocks ≤ 100	
	–28 dBm ≤ input level ≤ +30 dBm, RMS	< 1 %, RMS
	–38 dBm ≤ input level < –28 dBm, RMS	< 2.5 %, RMS

Frequency error		
Measurement range		±80 kHz
Frequency measurement uncertainty		< 20 Hz [37] + drift of timebase, see general technical specifications

I/Q origin offset		
Inherent I/Q offset	for average ≥ 10 measurements	< –50 dB

In-band emissions		
Dynamic range	allocated resource blocks ≤ 50	> 50 dB
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	see general technical specifications

Equalizer spectrum flatness	allocated resource blocks ≤ 50	
Level uncertainty		< 0.5 dB

[37] For frequency error measurements relative to the downlink signal of the same R&S®CMW500, the uncertainty is in line with 3GPP TS 36.521-1 V9.3.0.

Spectrum measurements

Adjacent channel leakage ratio		
Filter	E-UTRA	rectangle 1.08 MHz, 2.7 MHz, 4.5 MHz, 9 MHz, 13.5 MHz, 18 MHz
	UTRA	3.84 MHz, RRC, α = 0.22, WCDMA filter
Dynamic range	E-UTRA	> 45 dB
	UTRA	> 52 dB
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	see general technical specifications

Spectrum emission mask (SEM)		
Frequency span		70 MHz
Noise floor	*RBW → 1 MHz*	< –35 dBm
	RBW → 100 kHz	< –40 dBm
	RBW → 30 kHz	< –45 dBm

LTE FDD signaling (prerequisite: R&S®CMW-KS500 option, R&S®CMW-B300A or R&S®CMW-B300B or R&S®CMW-B500I option)

Standard		3GPP E-UTRA FDD

Channels		
Physical channels and signals	DL	RS (cell-specific RS), PSS, SSS, PBCH, PCFICH, PHICH, PDCCH, PDSCH
	UL	RS (demodulation RS), PRACH, PUCCH, PUSCH
Bandwidth		1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz
Modulation schemes	DL PDSCH	QPSK, 16QAM, 64QAM
	UL PUSCH	QPSK, 16QAM

Reference measurement channels	RMCs in line with 3GPP TS 36.521 Annex A.2 (UL) and Annex A.3 (DL)	RMCs for FDD, full and partial RB allocation, modulation: QPSK, 16QAM, 64QAM (DL only)

Frequency range		
Bands 1 to 31	with the R&S®CMW-KS500 option	
	DL	see LTE FDD RF generator specifications
	UL	see LTE FDD RF analyzer specifications

Frequency setting		channel number

DL signal

Output level range	due to PAR	15 dB below max. output level of RF generator, see general technical specifications
Output level uncertainty		see general technical specifications
Output level resolution		0.1 dB
Output level setting	in line with 3GPP TS 36.521 Annex C.0	RS energy per resource element (EPRE) [dBm/15 kHz]

Channel levels	PSS, SSS, PBCH, PCFICH, PHICH, PDCCH, PDSCH	–30 dB to +0 dB relative to RS EPRE
	PHICH	–30 dB to –12 dB relative to RS EPRE

Signal quality		
Error vector magnitude (EVM)	global EVM for cell with bandwidth = 20 MHz	< 2 %, RMS

LTE TDD RF analyzer (R&S®CMW-KM550 option)

Bandwidth		1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz

Frequency range	E-UTRA band 33, TDD	1900 MHz to 1920 MHz
	E-UTRA band 34, TDD	2010 MHz to 2025 MHz
	E-UTRA band 35, TDD	1850 MHz to 1910 MHz
	E-UTRA band 36, TDD	1930 MHz to 1990 MHz
	E-UTRA band 37, TDD	1910 MHz to 1930 MHz
	E-UTRA band 38, TDD	2570 MHz to 2620 MHz
	E-UTRA band 39, TDD	1880 MHz to 1920 MHz
	E-UTRA band 40, TDD	2300 MHz to 2400 MHz
	E-UTRA band 41, TDD	2496 MHz to 2690 MHz
	E-UTRA band 42, TDD, prerequisite: R&S®CMW-KB036 option	3400 MHz to 3600 MHz
	E-UTRA band 43, TDD, prerequisite: R&S®CMW-KB036 option	3600 MHz to 3800 MHz
	E-UTRA band 44, TDD	703 MHz to 803 MHz
Level setting		manual mode

Statistics		
Statistical count		1 to 1000
Values		current, average, minimum/maximum, standard deviation

Trigger		
Trigger source		BASE: external TRIG A, BASE: external TRIG B, GPRF: BB generator, LTE: free run (fast sync), LTE: IF power

Power measurement

Slot power	RMS detector	
Level range		–50 dBm to +30 dBm, RMS
Level uncertainty		see general technical specifications

Modulation analysis

Measured parameters	numeric results	error vector magnitude (EVM), magnitude error (ME), phase error (PE), frequency error, I/Q origin offset, TX power, peak power, resource block power (RB power)
	graphical	EVM versus SC-FDMA symbol, ME versus SC-FDMA symbol, PE versus SC-FDMA symbol, EVM versus subcarrier, in-band emissions, spectrum flatness, I/Q constellation

Error vector magnitude (EVM)		
Inherent EVM	allocated resource blocks ≤ 15	
	–34 dBm ≤ input level < +30 dBm, RMS	< 1 %, RMS
	–38 dBm ≤ input level < –34 dBm, RMS	< 1.5 %, RMS
	allocated resource blocks ≤ 50	
	–30 dBm ≤ input level ≤ +30 dBm, RMS	< 1 %, RMS
	–38 dBm ≤ input level < –30 dBm, RMS	< 2 %, RMS
	allocated resource blocks ≤ 100	
	–28 dBm ≤ input level ≤ +30 dBm, RMS	< 1 %, RMS
	–38 dBm ≤ input level < –28 dBm, RMS	< 2.5 %, RMS

Frequency error		
Measurement range		±80 kHz
Frequency measurement uncertainty		< 20 Hz [38] + drift of timebase, see general technical specifications

I/Q origin offset		
Inherent I/Q offset		< –50 dB

In-band emissions		
Dynamic range	allocated resource blocks ≤ 50	> 50 dB
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	see general technical specifications

Equalizer spectrum flatness	allocated resource blocks ≤ 50	
Level uncertainty		< 0.5 dB

Spectrum measurements

Adjacent channel leakage ratio		
Filter	E-UTRA	rectangle 1.08 MHz, 2.7 MHz, 4.5 MHz, 9 MHz, 13.5 MHz, 18 MHz
	UTRA	1.28 MHz, RRC, α = 0.22, WCDMA filter
Dynamic range	E-UTRA	> 45 dB
	UTRA	> 56 dB
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	see general technical specifications

Spectrum emission mask (SEM)		
Frequency span		70 MHz
Noise floor	*RBW → 1 MHz*	< –35 dBm
	RBW → 100 kHz	< –40 dBm
	RBW → 30 kHz	< –45 dBm

[38] For frequency error measurements relative to the downlink signal of the same R&S®CMW500, the uncertainty is in line with 3GPP TS 36.521-1 V9.3.0.

LTE specifications – small cell test with 160 MHz bandwidth unit [39]

Standard		LTE FDD and TDD

LTE FDD eNodeB RF analyzer (R&S®CMW-KN500 option)

Bandwidth		1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz

Frequency range	E-UTRA band 1, FDD	2110 MHz to 2170 MHz
	E-UTRA band 2, FDD	1930 MHz to 1990 MHz
	E-UTRA band 3, FDD	1805 MHz to 1880 MHz
	E-UTRA band 4, FDD	2110 MHz to 2155 MHz
	E-UTRA band 5, FDD	869 MHz to 894 MHz
	E-UTRA band 6, FDD	875 MHz to 885 MHz
	E-UTRA band 7, FDD	2620 MHz to 2690 MHz
	E-UTRA band 8, FDD	925 MHz to 960 MHz
	E-UTRA band 9, FDD	1844.9 MHz 1879.9 MHz
	E-UTRA band 10, FDD	2110 MHz to 2170 MHz
	E-UTRA band 11, FDD	1475.9 MHz to 1495.9 MHz
	E-UTRA band 12, FDD	729 MHz to 746 MHz
	E-UTRA band 13, FDD	746 MHz to 756 MHz
	E-UTRA band 14, FDD	758 MHz to 768 MHz
	E-UTRA band 15, FDD	2600 MHz to 2620 MHz
	E-UTRA band 16, FDD	2585 MHz to 2600 MHz
	E-UTRA band 17, FDD	734 MHz to 746 MHz
	E-UTRA band 18, FDD	860 MHz to 875 MHz
	E-UTRA band 19, FDD	875 MHz to 890 MHz
	E-UTRA band 20, FDD	791 MHz to 821 MHz
	E-UTRA band 21, FDD	1495.9 MHz to 1510.9 MHz
	E-UTRA band 22, FDD, prerequisite: R&S®CMW-KB036 option	3510 MHz to 3590 MHz
	E-UTRA band 23, FDD	2180 MHz to 2200 MHz
	E-UTRA band 24, FDD	1525 MHz to 1559 MHz
	E-UTRA band 25, FDD	1930 MHz to 1995 MHz
	E-UTRA band 26, FDD	859 MHz to 894 MHz
	E-UTRA band 27, FDD	852 MHz to 869 MHz
	E-UTRA band 28, FDD	758 MHz to 803 MHz
	E-UTRA band 29, FDD	717 MHz to 728 MHz
	E-UTRA band 30, FDD	2350 MHz to 2360 MHz
	E-UTRA band 31, FDD	462.5 MHz to 467.5 MHz
Level setting		manual mode

Statistics		
Statistical count		1 to 1000
Values		current, average, minimum/maximum, standard deviation

Trigger		
Trigger source		BASE: external TRIG A, BASE: external TRIG B, GPRF: BB generator, LTE: free run (fast sync), LTE: IF power

Power measurement

Slot power	RMS detector	
Level range		–50 dBm to +30 dBm, RMS
Level uncertainty		see general technical specifications

[39] R&S®CMW500 only.

Modulation analysis

Measured parameters	numeric results	error vector magnitude (EVM), magnitude error (ME), phase error (PE), frequency error, I/Q origin offset, TX power, peak power, reference symbol power, OFDM symbol power
	graphical	EVM versus OFDMA symbol, ME versus OFDMA symbol, PE versus OFDMA symbol, OFDM symbol power spectrum flatness, spectrum ACLR I/Q constellation

Error vector magnitude (EVM)		
Inherent EVM	for average ≥ 10 subframes	
	–20 dBm ≤ input level < +30 dBm, RMS	< 1.5 %, RMS

Frequency error		
Measurement range		±80 kHz
Frequency measurement uncertainty		< 20 Hz [40] + drift of timebase, see general technical specifications

Spectrum measurements

Adjacent channel leakage ratio		
Filter	E-UTRA	rectangle 1.08 MHz, 2.7 MHz, 4.5 MHz, 9 MHz, 13.5 MHz, 18 MHz
	UTRA	1.28 MHz, RRC, α = 0.22, WCDMA filter 3.84 MHz, RRC, α = 0.22, WCDMA filter 7.68 MHz, RRC, α = 0.22, WCDMA filter
Dynamic range	E-UTRA	> 50 dB
	UTRA	> 52 dB
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	see general technical specifications

Spectrum emission mask (SEM)		
Frequency span		70 MHz
Noise floor	*RBW → ≤ 1 MHz*, expected nominal power < 12 dBm	< –58 dBm

[40] For frequency error measurements relative to the downlink signal of the same R&S®CMW500, the uncertainty is in line with 3GPP TS 36.521-1 V9.3.0.

LTE TDD eNodeB RF analyzer (R&S®CMW-KN550 option)

Bandwidth		1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz

Frequency range	E-UTRA band 33, TDD	1900 MHz to 1920 MHz
	E-UTRA band 34, TDD	2010 MHz to 2025 MHz
	E-UTRA band 35, TDD	1850 MHz to 1910 MHz
	E-UTRA band 36, TDD	1930 MHz to 1990 MHz
	E-UTRA band 37, TDD	1910 MHz to 1930 MHz
	E-UTRA band 38, TDD	2570 MHz to 2620 MHz
	E-UTRA band 39, TDD	1880 MHz to 1920 MHz
	E-UTRA band 40, TDD	2300 MHz to 2400 MHz
	E-UTRA band 41, TDD	2496 MHz to 2690 MHz
	E-UTRA band 42, TDD, prerequisite: R&S®CMW-KB036 option	3400 MHz to 3600 MHz
	E-UTRA band 43, TDD, prerequisite: R&S®CMW-KB036 option	3600 MHz to 3800 MHz
	E-UTRA band 44, TDD	703 MHz to 803 MHz
Level setting		manual mode

Statistics		
Statistical count		1 to 1000
Values		current, average, minimum/maximum, standard deviation

Trigger		
Trigger source		BASE: external TRIG A, BASE: external TRIG B, GPRF: BB generator, LTE: free run (fast sync), LTE: IF power

Power measurement

Slot power	RMS detector	
Level range		–50 dBm to +30 dBm, RMS
Level uncertainty		see general technical specifications

Modulation analysis

Measured parameters	numeric results	error vector magnitude (EVM), magnitude error (ME), phase error (PE), frequency error, I/Q origin offset, TX power, peak power, reference symbol power, OFDM symbol power
	graphical	EVM versus OFDMA symbol, ME versus OFDMA symbol, PE versus OFDMA symbol, OFDM symbol power spectrum flatness, spectrum ACLR, I/Q constellation

Error vector magnitude (EVM)		
Inherent EVM	for average ≥ 10 subframes	
	–20 dBm ≤ input level < +30 dBm, RMS	< 1.5 %, RMS

Frequency error		
Measurement range		±80 kHz
Frequency measurement uncertainty		< 20 Hz [41] + drift of timebase, see general technical specifications

Spectrum measurements

Adjacent channel leakage ratio		
Filter	E-UTRA	rectangle 1.08 MHz, 2.7 MHz, 4.5 MHz, 9 MHz, 13.5 MHz, 18 MHz
	UTRA	1.28 MHz, RRC, α = 0.22, WCDMA filter 3.84 MHz, RRC, α = 0.22, WCDMA filter 7.68 MHz, RRC, α = 0.22, WCDMA filter
Dynamic range	E-UTRA	> 50 dB
	UTRA128	> 52 dB
	UTRA384	> 52 dB
	UTRA768	> 49 dB
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	see general technical specifications

Spectrum emission mask (SEM)		
Frequency span		70 MHz
Noise floor	*RBW → ≤ 1 MHz*, expected nominal power < 12 dBm	< –58 dBm

[41] For frequency error measurements relative to the downlink signal of the same R&S®CMW500, the uncertainty is in line with 3GPP TS 36.521-1 V9.3.0.

Bluetooth® specifications

Standard	standard	Bluetooth® Core Specification Version 5.0
	test standard	Bluetooth® RF Test Specification RF.TS.5.0.0, Bluetooth® Low Energy RF PHY Test Specification, RF-PHY.TS.5.0.0

Bluetooth® RF generator (prerequisite: R&S®CMW-B110A/R&S®CMW-B110D option with 40/80 MHz bandwidth unit; included with 160 MHz bandwidth unit)

Frequency range	Bluetooth®	2402 MHz to 2480 MHz

Bluetooth® WinIQSIM2™ (R&S®CMW-KW610 option)

Arbitrary waveform file	basic rate	BLUETOOTH_11110000_DH5.WV LAP: 123456, (PAR = 0.00 dB)
	enhanced data rate (EDR)	BLUETOOTH_PRBS9_3-DH5.WV LAP: 123456, (PAR = 3.20 dB)

Output level range	depends on PAR	
RF1 COM, RF2 COM	peak envelope power (PEP)	up to –5 dBm
	overranging (PEP)	up to 0 dBm
RF1 OUT	peak envelope power (PEP)	up to +3 dBm
	overranging (PEP)	up to +8 dBm
Output level uncertainty	including overranging, waveform files used: BLUETOOTH_11110000_DH5.WV, BLUETOOTH_PRBS_3-DH5.WV	see general technical specifications
Output level resolution		see general technical specifications

Signal quality		
Modulation index uncertainty	basic rate, frequency deviation Δf1 max. = 160 kHz, waveform file used: BLUETOOTH_11110000_DH5.WV	< 1 %
Differential error vector magnitude (DEVM)	enhanced data rate, waveform file used: BLUETOOTH_PRBS9_3-DH5.WV	< 1.5 %, RMS

Bluetooth® RF analyzer (R&S®CMW-KM610 option)

Frequency range	Bluetooth®	2402 MHz to 2480 MHz

Statistics		
Statistical count		1 to 1000
Values		current, average, maximum, minimum, standard deviation

Trigger		
Trigger sources		Bluetooth®: IF power

Modulation analysis

Filter	*filter bandwidth → wide*	bandpass 2.0 MHz
	filter bandwidth → narrow	bandpass 1.3 MHz
Level range		–35 dBm to +42 dBm [42]
Supported packet types	basic rate	DH1, DH3, DH5
	enhanced data rate (EDR)	2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3, 3-DH5

[42] The maximum permissible continuous power is +34 dBm due to thermal limits.

Measured parameters	basic rate, numeric results and standard deviation	Δf2 99.9 %, frequency accuracy, frequency drift, maximum drift rate, frequency deviation Δf1 average, frequency deviation Δf1 minimum, frequency deviation Δf1 maximum, frequency deviation Δf2 average, frequency deviation Δf2 minimum, frequency deviation Δf2 maximum, nominal power
Measured parameters	enhanced data rate (EDR), numeric results and standard deviation	99 % DEVM, frequency stability ω_i, frequency stability $(\omega_o + \omega_i)_{max}$, frequency stability $\omega_{o\,max}$, RMS DEVM, peak RMS, nominal power

Total measurement range for frequency accuracy, frequency deviation and frequency drift	basic rate	±250 kHz

Frequency accuracy	basic rate	
Measurement range	for nominal deviation of 160 kHz	±100 kHz
Uncertainty	for deviation ≤ 160 kHz	< 2 kHz

Frequency deviation	basic rate	
Measurement range	without frequency offset	≤ 210 kHz
Uncertainty	for modulation index 0.22 to 0.42	< 1 %

Frequency drift	basic rate	
Measurement range		±50 kHz
Uncertainty	measured in burst relative to frequency offset in preamble, with 10101010 pattern	< 2 kHz
	referenced to measured frequency offset in preamble (relative frequency drift)	≤ 1 kHz

Frequency stability ω_i	enhanced data rate	
Measurement range		±100 kHz
Uncertainty	for ω_i ≤ 75 kHz, for deviation ≤ 160 kHz	< 2 kHz

Frequency stability $\omega_{o\,max}$	enhanced data rate	
Measurement range		±15 kHz
Uncertainty	for ω_o ≤ 10 kHz	< 1 kHz

Differential error vector magnitude (DEVM)	enhanced data rate	
Inherent DEVM	for PRBS pattern	< 1.5 %, RMS < 3.0 %, peak

Bluetooth® RF analyzer (R&S®CMW-KM611 option)

Frequency range	Bluetooth®	2402 MHz to 2480 MHz

Statistics		
Statistical count		1 to 1000
Values		current, average, maximum, minimum, standard deviation

Trigger		
Trigger sources		Bluetooth®: IF power

Modulation analysis

Filter	filter bandwidth: wide	2.0 MHz bandpass
	filter bandwidth: narrow	1.3 MHz bandpass
Level range		–35 dBm to +42 dBm [43]
Supported packet types		RF PHY Test Reference Packets

Measured parameters	numeric results and standard deviation	Δf2 99.9%, frequency accuracy, frequency offset, initial frequency drift, frequency drift, max drift rate, frequency deviation Δf1 average, frequency deviation Δf1 minimum, frequency deviation Δf1 maximum, frequency deviation Δf2 average, frequency deviation Δf2 minimum, frequency deviation Δf2 maximum, nominal power

Total measurement range for frequency accuracy, offset, deviation and drift measurements		±350 kHz

Frequency accuracy (using preamble)		
Measurement range	for nominal deviation of 250 kHz	±175 kHz
Uncertainty	for deviation ≤ 250 kHz	< 2 kHz

Frequency offset		
Measurement range	for nominal deviation of 250 kHz	±175 kHz
Uncertainty	for deviation ≤ 250 kHz	< 2 kHz

Frequency deviation		
Measurement range	without frequency offset	≤ 350 kHz
Uncertainty	for modulation index 0.40 to 0.60	< 1.0 %

Frequency drift		
Measurement range		±75 kHz
Uncertainty	measured in burst relative to frequency offset in preamble, with 10101010 pattern	< 2 kHz
	referenced to measured frequency offset in preamble (relative frequency drift)	≤ 1 kHz

Bluetooth® RF analyzer (R&S®CMW-KM721 option)

Frequency range	Bluetooth®	2402 MHz to 2480 MHz

Statistics		
Statistical count		1 to 1000
Values		current, average, maximum, minimum, standard deviation

Trigger		
Trigger source		Bluetooth®: IF power

Modulation analysis

Filter	filter bandwidth: wide (LE 2 Msymbol/s)	4.0 MHz bandpass
	filter bandwidth: wide (LE long range)	2.0 MHz bandpass
	filter bandwidth: narrow (LE 2 Msymbol/s)	2.6 MHz bandpass
	filter bandwidth: narrow (LE long range)	1.3 MHz bandpass
Level range		–35 dBm to +42 dBm [43]
Supported packet types		RF PHY Test Reference Packets

[43] The maximum permissible continuous power is +34 dBm due to thermal limits.

Measured parameters	numeric results and standard deviation (common)	frequency accuracy, frequency offset, initial frequency drift, frequency drift, max drift rate, frequency deviation Δf1 average, frequency deviation Δf1 minimum, frequency deviation Δf1 maximum, nominal power
	numeric results and standard deviation (LE 2 Msymbol/s)	Δf_2 99.9 % frequency deviation Δf2 average, frequency deviation Δf2 minimum, frequency deviation Δf2 maximum,
	numeric results and standard deviation (LE long range)	Δf_1 99.9 %

Total measurement range for frequency accuracy, offset, deviation and drift measurements	LE 2 Msymbol/s	±700 kHz
	LE long range	±350 kHz

Frequency accuracy (using preamble)		
Measurement range	for nominal deviation of 500 kHz (LE 2 Msymbol/s)	±175 kHz
	for nominal deviation of 250 kHz (LE long range)	
Uncertainty	for deviation ≤ 500 kHz (LE 2 Msymbol/s)	< 2 kHz
	for deviation ≤ 250 kHz (LE long range)	

Frequency offset		
Measurement range	for nominal deviation of 500 kHz (LE 2 Msymbol/s)	±175 kHz
	for nominal deviation of 250 kHz (LE long range)	
Uncertainty	for deviation ≤ 500 kHz (LE 2 Msymbol/s)	< 2 kHz
	for deviation ≤ 250 kHz (LE long range)	

Frequency deviation		
Measurement range	without frequency offset (LE 2 Msymbol/s)	≤ 700 kHz
	without frequency offset (LE long range)	≤ 350 kHz
Uncertainty	for modulation index 0.40 to 0.60	< 0.5 %

Frequency drift		
Measurement range		±75 kHz
Uncertainty	measured in burst referenced to frequency offset in preamble	< 2 kHz
	referenced to measured frequency offset value in preamble (relative frequency drift)	≤ 1 kHz

Bluetooth® signaling (prerequisite: R&S®CMW-KS600 option, R&S®CMW-KS610 or R&S®CMW-KS611 or R&S®CMW-KS721 option, R&S®CMW-B200A or R&S®CMW-B500I option)

Standard		Bluetooth® Core Specification Version 5.0

Frequency range	channels 0 to 78	2402 MHz to 2480 MHz

Output level range	depends on PAR	
RF1 COM, RF2 COM	peak envelope power (PEP)	up to –5 dBm
	overranging (PEP)	up to 0 dBm
RF1 OUT	peak envelope power (PEP)	up to +3 dBm
	overranging (PEP)	up to +8 dBm
Output level uncertainty	including overranging	see general technical specifications
Output level resolution		see general technical specifications

GFSK modulation		
Modulation index uncertainty	basic rate, 11110000 pattern, 160 kHz frequency deviation	< 1 %
	low energy (1 Msymbol/s and long range), 11110000 pattern, 250 kHz frequency deviation	< 1 %
	low energy (2 Msymbol/s), 11110000 pattern, 500 kHz frequency deviation	< 1 %

DPSK modulation		
Modulation uncertainty (DEVM)	enhanced data rate	< 1.5 %, RMS

Dirty TX	prerequisites: R&S®CMW-KS610 or R&S®CMW-KS611	
Drift uncertainty	basic rate	< 0.5 kHz
	enhanced data rate	< 0.5 kHz
	low energy	< 0.5 kHz
Symbol time error uncertainty		same as timebase, see general technical specifications

Input level range	basic rate, enhanced data rate, low energy	–60 dBm to +42 dBm [44]

[44] The maximum permissible continuous power is +34 dBm due to thermal limits.

GPS specifications

Standard		GPS

GPS RF generator (prerequisite: R&S®CMW-B110A/R&S®CMW-B110D option with 40/80 MHz bandwidth unit; included with 160 MHz bandwidth unit)

Frequency range	GPS band	
	L1	1575.42 MHz
	L2	1227.6 MHz

GPS WinIQSIM2™ (R&S®CMW-KW620 option)

Arbitrary waveform file		GPS_DEFAULT.WV (PAR = 3.66 dB)

Output level range	depends on PAR	see general technical specifications
Output level uncertainty	waveform file used: GPS_DEFAULT.WV	see general technical specifications
Output level resolution		see general technical specifications

DVB specifications

Standard		DVB-T

DVB RF generator (prerequisite: R&S®CMW-B110A/R&S®CMW-B110D option with 40/80 MHz bandwidth unit; included with 160 MHz bandwidth unit)

Frequency range	VHF band III	
	channels 5 to 12	174 MHz to 230 MHz
	UHF band IV	
	channels 21 to 34	470 MHz to 582 MHz
	UHF band V	
	channels 35 to 69	582 MHz to 862 MHz

DVB WinIQSIM2™ (R&S®CMW-KW630 option)

Arbitrary waveform file		DVB-T_SCRAMBLED_16QAM_3SEC_ TESTFILE.WV (PAR = 13.23 dB)

Output level range	depends on PAR	see general technical specifications
Output level uncertainty	waveform file used: DVB-T_SCRAMBLED_16QAM_3SEC_ TESTFILE.WV	see general technical specifications
Output level resolution		see general technical specifications

FM STEREO RADIO specifications

Standard		FM STEREO RADIO

FM STEREO RADIO generator (prerequisite: R&S®CMW-B110A/R&S®CMW-B110D option with 40/80 MHz bandwidth unit; included with 160 MHz bandwidth unit)

Frequency range	FM	70 MHz to 110 MHz

FM STEREO RADIO waveforms (R&S®CMW-KV645 option)

Arbitrary waveform file		FM_M_M1K0_D75K0.WV (PAR = 0.00 dB)

Output level range	depends on PAR	see general technical specifications
Output level uncertainty	waveform file used: FM_M_M1K0_D75K0.WV	see general technical specifications
Output level resolution		see general technical specifications

Signal quality	RMS detector *SQRT(2)	
Deviation error	waveform file used: FM_M_M1K0_D75K0.WV	< 1 %

WLAN specifications with 40/80 MHz bandwidth unit

Standard		IEEE 802.11a, IEEE 802.11b, IEEE 802.11g, IEEE 802.11n, IEEE 802.11ac

WLAN RF generator (prerequisite: R&S®CMW-B110A or R&S®CMW-B110D option)

Frequency range	WLAN IEEE 802.11b/g/n (2.4 GHz band)	2412 MHz to 2484 MHz
	WLAN IEEE 802.11a/n (5 GHz band), prerequisite: R&S®CMW-KB036 option	5000 MHz to 6000 MHz

WLAN ABG WinIQSIM2™ (R&S®CMW-KW650 option)

Arbitrary waveform files	in line with IEEE 802.11a/g OFDM 64QAM	WLAN_A_G_OFDM_64QAM.WV (PAR = 10.01 dB)
	in line with IEEE 802.11b CCK DQPSK	WLAN_B_CCK_DQPSK.WV (PAR = 1.48 dB)
	in line with IEEE 802.11n 64QAM, code rate 5/6	WLAN_N_64QAM_5_6.WV (PAR = 10.01 dB)

Output level range	depends on PAR	see general technical specifications
Output level uncertainty	waveform files used: WLAN_A_G_OFDM_64QAM.WV, WLAN_B_CCK_DQPSK.WV WLAN_N_64QAM_5_6.WV	see general technical specifications
Output level resolution		see general technical specifications

Signal quality		
Error vector magnitude (EVM)	IEEE 802.11b, EVM, waveform file used: WLAN_B_CCK_DQPSK.WV	< 4 %, peak
	IEEE 802.11a/g, EVM all carriers, waveform file used: WLAN_A_G_OFDM_64QAM.WV	< –40 dB, RMS
	IEEE 802.11n, EVM all carriers, waveform file used: WLAN_N_64QAM_5_6.WV	< –40 dB, RMS

WLAN AC WinIQSIM2™ (R&S®CMW-KW656 option)

Arbitrary waveform files	in line with IEEE 802.11ac 256QAM, 20 MHz, code rate 3/4	WLAN_VHT_BW20_MCS8_LEN4096.WV (PAR = 9.57 dB)
	in line with IEEE 802.11ac 256QAM, 40 MHz, code rate 3/4	WLAN_VHT_BW40_MCS8_LEN4096.WV (PAR = 11.22534 dB)
	in line with IEEE 802.11ac 256QAM, 80 MHz, code rate 3/4	WLAN_VHT_BW80_MCS8_LEN4096.WV (PAR = 10.23565 dB)

Output level range	depends on PAR	see general technical specifications
Output level uncertainty	waveform files used: WLAN_VHT_BW20_MCS8_LEN4096.WV WLAN_VHT_BW40_MCS8_LEN4096.WV WLAN_VHT_BW80_MCS8_LEN4096.WV	see general technical specifications
Output level resolution		see general technical specifications

Signal quality		
Error vector magnitude (EVM)	IEEE 802.11ac, EVM all carriers, waveform file used: WLAN_VHT_BW20_MCS8_LEN4096.WV	< –40 dB, RMS
	WLAN_VHT_BW40_MCS8_LEN4096.WV	< –40 dB, RMS
	WLAN_VHT_BW80_MCS8_LEN4096.WV	< –37 dB, RMS

WLAN ABG RF analyzer (R&S®CMW-KM650 option)

Frequency range	WLAN IEEE 802.11b/g	2412 MHz to 2484 MHz
	WLAN IEEE 802.11a, prerequisite: R&S®CMW-KB036 option	5000 MHz to 6000 MHz, for frequency exceptions for inherent spurious response, see general technical specifications

Statistics		
Statistical count		1 to 1000
Values		current, average, maximum, standard deviation

Trigger		
Trigger sources		WLAN: free run, WLAN: IF power

Modulation analysis

Filter		20 MHz
Level range		–28 dBm to +42 dBm [45]
Payload length		≥ 16 symbol
Analysis modes	DSSS	1 Mbps DBPSK, 2 Mbps DQPSK, 5.5 Mbps CCK, 11 Mbps CCK
	OFDM	6 Mbps BPSK, 9 Mbps BPSK, 12 Mbps QPSK, 18 Mbps QPSK, 24 Mbps 16QAM, 36 Mbps 16QAM, 48 Mbps 64QAM, 54 Mbps 64QAM

Measured parameters	DSSS, numeric results and standard deviation	burst power, error vector magnitude (EVM) peak, error vector magnitude (EVM) RMS, center frequency error, chip clock error, I/Q offset, gain imbalance, quadrature error
	DSSS, graphical	EVM versus chip, I/Q constellation
	OFDM, numeric results and standard deviation	burst power, EVM all carriers, EVM data carriers, EVM pilot carriers, center frequency error, symbol clock error, I/Q offset, gain imbalance, quadrature error
	OFDM, graphical	EVM versus symbol, EVM versus carrier, I/Q constellation, spectrum flatness

[45] The maximum permissible continuous power is +34 dBm due to thermal limits.

Error vector magnitude (EVM)		
Inherent EVM [46]	DSSS, IEEE 802.11b/g	< 5 %, peak
		< 2 %, RMS
	OFDM, IEEE 802.11g	< –40 dB, RMS
	OFDM, IEEE 802.11a	
	–18 dBm ≤ input level ≤ +42 dBm [47], RMS	< –40 dB, RMS [48]
Measurement length	DSSS	1000 samples
	OFDM	entire PPDU

Center frequency error		
Frequency measurement uncertainty	DSSS, IEEE 802.11b/g	< 20 Hz + drift of timebase, see general technical specifications
	OFDM, IEEE 802.11g, for ≥ 100 symbol (400 µs)	< 20 Hz + drift of timebase, see general technical specifications
	OFDM, IEEE 802.11a, for ≥ 100 symbol (400 µs)	< 35 Hz + drift of timebase, see general technical specifications

Chip clock error	DSSS	
Uncertainty		< 1 ppm

Symbol clock error	OFDM	
Uncertainty		< 1 ppm

I/Q offset		
Inherent I/Q offset	DSSS, for average ≥ 10 measurements	< –50 dB
	OFDM, for average ≥ 10 measurements	< –45 dB

Spectrum flatness		
Level uncertainty	OFDM, IEEE 802.11g (2.4 GHz band)	< 0.5 dB
	OFDM, IEEE 802.11a (5 GHz band)	< 0.8 dB

Spectrum measurements

Transmit spectrum mask		
Frequency span		80 MHz
Dynamic range	DSSS	in line with IEEE 802.11b
	OFDM	in line with IEEE 802.11a/g
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	
	IEEE 802.11g (2.4 GHz band)	+2 dBm to +42 dBm [47]
	IEEE 802.11a (5 GHz band)	+12 dBm to +42 dBm [47]

WLAN N RF analyzer (R&S®CMW-KM651 option)

Frequency range	WLAN IEEE 802.11n (2.4 GHz band)	2412 MHz to 2484 MHz
	WLAN IEEE 802.11n (5 GHz band), prerequisite: R&S®CMW-KB036 option	5000 MHz to 6000 MHz, for frequency exceptions for inherent spurious response, see general technical specifications

Statistics		
Statistical count		1 to 1000
Values		current, average, maximum, standard deviation

Trigger		
Trigger sources		WLAN: free run, WLAN: IF power

[46] Measured with channel estimation based on payload.

[47] The maximum permissible continuous power is +34 dBm due to thermal limits.

[48] 3 dB less with R&S®CMW-H590D RF frontend (ADV.).

High throughput (HT)		
PPDU format		legacy mode, mixed mode, greenfield mode

Modulation analysis

Bandwidth		20 MHz, 40 MHz
Level range		–28 dBm to +42 dBm [49]
Payload length		≥ 16 symbol
Analysis modes		BPSK code rate 1/2 (MCS0), BPSK code rate 3/4, QPSK code rate 1/2 (MCS1), QPSK code rate 3/4 (MCS2), 16QAM code rate 1/2 (MCS3), 16QAM code rate 3/4 (MCS4), 64QAM code rate 1/2, 64QAM code rate 2/3 (MCS5), 64QAM code rate 3/4 (MCS6), 64QAM code rate 5/6 (MCS7)
	for optional 40 MHz MCS format	BPSK code rate 1/2 (MCS32)

Measured parameters	numeric results and standard deviation	burst power, EVM all carriers, EVM data carriers, EVM pilot carriers, center frequency error, symbol clock error, I/Q offset, gain imbalance, quadrature error
	graphical	EVM versus symbol, EVM versus carrier, spectrum flatness

Error vector magnitude (EVM)		
Inherent EVM [50]	IEEE 802.11n (2.4 GHz band)	
	–28 dBm ≤ input level ≤ +42 dBm [49], RMS	< –40 dB, RMS [51]
	IEEE 802.11n (5 GHz band)	
	–18 dBm ≤ input level ≤ +42 dBm [49], RMS	< –40 dB, RMS [51]
Measurement length		entire PPDU

Center frequency error		
Frequency measurement uncertainty	IEEE 802.11n (2.4 GHz band), for ≥ 100 symbol (400 µs)	< 20 Hz + drift of timebase, see general technical specifications
	IEEE 802.11n (5 GHz band), for ≥ 100 symbol (400 µs)	< 35 Hz + drift of timebase, see general technical specifications

Symbol clock error		
Uncertainty		< 1 ppm

I/Q offset		
Inherent I/Q offset	for average ≥ 10 measurements	< –45 dB

[49] The maximum permissible continuous power is +34 dBm due to thermal limits.

[50] Measured with channel estimation based on payload.

[51] 3 dB less with R&S®CMW-H590D RF frontend (ADV.).

Spectrum flatness		
Level uncertainty	IEEE 802.11n (2.4 GHz band)	
	bandwidth 20 MHz	< 0.5 dB
	bandwidth 40 MHz	< 0.8 dB
	IEEE 802.11n (5 GHz band)	
	bandwidth 20 MHz	< 0.8 dB
	bandwidth 40 MHz	< 1.0 dB

Spectrum measurements

Transmit spectrum mask		
Frequency span		up to 160 MHz
Dynamic range		in line with IEEE 802.11n
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	
	IEEE 802.11n (2.4 GHz band)	+2 dBm to +42 dBm [52]
	IEEE 802.11n (5 GHz band)	+12 dBm to +42 dBm [52]

WLAN N MISO RF analyzer (R&S®CMW-KM652 option)

Frequency range	WLAN IEEE 802.11n (2.4 GHz band)	2412 MHz to 2484 MHz
	WLAN IEEE 802.11n (5 GHz band), prerequisite: R&S®CMW-KB036 option	5000 MHz to 6000 MHz, for frequency exceptions for inherent spurious response, see general technical specifications

Statistics		
Statistical count		1 to 1000
Values		current, average, maximum, standard deviation

Trigger		
Trigger sources		WLAN: IF power

High throughput		
PPDU format		mixed mode, greenfield mode

Modulation analysis

Bandwidth		20 MHz, 40MHz
Level range		–28 dBm to +42 dBm [52]
Payload length		≥ 16 symbol (max. 1024)
Analysis modes [53]		MCS0 to MCS7: data and pilot, MCS8 to MCS31: pilot only, MCS33 to MCS76: pilot only
Measured parameters	numeric results and standard deviation	total power, STS1 to STS4 power, EVM all carriers, EVM data carriers, EVM pilot carriers, center frequency error

Error vector magnitude (EVM)		
Inherent EVM [54]	IEEE 802.11n (2.4 GHz band)	
	–28 dBm ≤ input level ≤ +42 dBm [52], RMS	< –40 dB, RMS [55]
	IEEE 802.11n (5 GHz band)	
	–18 dBm ≤ input level ≤ +42 dBm [52], RMS	< –40 dB, RMS [55]
Measurement length		entire PPDU

[52] The maximum permissible continuous power is +34 dBm due to thermal limits.

[53] Modulation analysis on data possible after initial acquisition of training data.

[54] Measured with channel estimation based on payload.

[55] 3 dB less with R&S®CMW-H590D RF frontend (ADV.).

Center frequency error		
Frequency measurement uncertainty	IEEE 802.11n (2.4 GHz band), for ≥ 100 symbol (400 µs)	< 20 Hz + drift of timebase, see general technical specifications
	IEEE 802.11n (5 GHz band), for ≥ 100 symbol (400 µs)	< 35 Hz + drift of timebase, see general technical specifications

WLAN N switched MIMO RF analyzer (R&S®CMW-KM653 option)

Frequency range	WLAN IEEE 802.11n (2.4 GHz band)	2412 MHz to 2484 MHz
	WLAN IEEE 802.11n (5 GHz band), prerequisite: R&S®CMW-KB036 option	5000 MHz to 6000 MHz, for frequency exceptions for inherent spurious response, see general technical specifications

Statistics		
Statistical count		1 to 1000
Values		current, average, maximum, standard deviation

Trigger		
Trigger sources		WLAN: IF power

High throughput (HT)		
PPDU format		mixed mode, greenfield mode

Modulation analysis

Bandwidth		20 MHz, 40 MHz
Level range		–28 dBm to +42 dBm [56]
Payload length		≥ 16 symbol
Analysis modes		BPSK code rate 1/2 (MCS0), BPSK code rate 3/4, QPSK code rate 1/2 (MCS1), QPSK code rate 3/4 (MCS2), 16QAM code rate 1/2 (MCS3), 16QAM code rate 3/4 (MCS4), 64QAM code rate 1/2, 64QAM code rate 2/3 (MCS5), 64QAM code rate 3/4 (MCS6), 64QAM code rate 5/6 (MCS7)
	for optional 40 MHz MCS format	BPSK code rate 1/2 (MCS32)
Measured parameters	numeric results and standard deviation	total power, EVM all carriers, EVM data carriers, EVM pilot carriers, center frequency error, symbol clock error,
	numeric results for each spatial stream	EVM all carriers, EVM data carriers, EVM pilot carriers power I/Q offset

WLAN P RF analyzer (R&S®CMW-KM655 option)

Frequency range	WLAN IEEE 802.11p, prerequisite: R&S®CMW-KB036 option	5000 MHz to 6000 MHz, for frequency exceptions for inherent spurious response, see general technical specifications

[56] The maximum permissible continuous power is +34 dBm due to thermal limits.

Statistics		
Statistical count		1 to 1000
Values		current, average, maximum, standard deviation

Trigger		
Trigger sources		WLAN: IF power

Modulation analysis

Filter		5 MHz, 10 MHz, 20 MHz
Level range		–28 dBm to +42 dBm [57]
Payload length		≥ 16 symbol
Analysis modes	OFDM 5 MHz channel spacing	1.5 Mbps BPSK, 2.25 Mbps BPSK, 3 Mbps QPSK, 4.5 Mbps QPSK, 6 Mbps 16QAM, 9 Mbps 16QAM, 12 Mbps 64QAM, 13.5 Mbps 64QAM
	OFDM 10 MHz channel spacing	3 Mbps BPSK, 4.5 Mbps BPSK, 6 Mbps QPSK, 9 Mbps QPSK, 12 Mbps 16QAM, 18 Mbps 16QAM, 24 Mbps 64QAM, 27 Mbps 64QAM
	OFDM 20 MHz channel spacing	6 Mbps BPSK, 9 Mbps BPSK, 12 Mbps QPSK, 18 Mbps QPSK, 24 Mbps 16QAM, 36 Mbps 16QAM, 48 Mbps 64QAM, 54 Mbps 64QAM

Measured parameters	OFDM, numeric results and standard deviation	burst power, EVM all carriers, EVM data carriers, EVM pilot carriers, center frequency error, symbol clock error, I/Q offset, gain imbalance, quadrature error
	OFDM, graphical	EVM versus symbol, EVM versus carrier, I/Q constellation, spectrum flatness

Error vector magnitude (EVM)		
Inherent EVM [58]	–18 dBm ≤ input level ≤ +42 dBm [57], RMS	< –40 dB, RMS [59]
Measurement length		entire PPDU

Center frequency error		
Frequency measurement uncertainty	for ≥ 100 symbol (400 µs)	< 35 Hz + drift of timebase, see general technical specifications

Symbol clock error		
Uncertainty		< 1 ppm

[57] The maximum permissible continuous power is +34 dBm due to thermal limits.

[58] Measured with channel estimation based on payload.

[59] 3 dB less with R&S®CMW-H590D RF frontend (ADV.).

I/Q offset		
Inherent I/Q offset	for average ≥ 10 measurements	< –45 dB

Spectrum flatness		
Level uncertainty		< 0.8 dB

Spectrum measurements

Transmit spectrum mask		
Frequency span		up to 80 MHz
Dynamic range		in line with IEEE 802.11p up to class B
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	+12 dBm to +42 dBm [60]

WLAN AC RF analyzer (R&S®CMW-KM656 option)

Frequency range	WLAN IEEE 802.11ac (5 GHz band), prerequisite: R&S®CMW-KB036 option	5000 MHz to 6000 MHz, for frequency exceptions for inherent spurious response, see general technical specifications

Statistics		
Statistical count		1 to 1000
Values		current, average, maximum, standard deviation

Trigger		
Trigger sources		WLAN: IF power

High throughput (HT)		
PPDU format		mixed mode

Modulation analysis

Bandwidth		20 MHz, 40 MHz, 80 MHz, 160 MHz
Level range		–28 dBm to +42 dBm [60]
Payload length		≥ 1 symbol
Analysis modes		BPSK code rate 1/2 (MCS0), BPSK code rate 3/4, QPSK code rate 1/2 (MCS1), QPSK code rate 3/4 (MCS2), 16QAM code rate 1/2 (MCS3), 16QAM code rate 3/4 (MCS4), 64QAM code rate 1/2, 64QAM code rate 2/3 (MCS5), 64QAM code rate 3/4 (MCS6), 64QAM code rate 5/6 (MCS7) 256QAM code rate 3/4 (MCS8) 256QAM code rate 5/6 (MCS9)

Measured parameters	numeric results and standard deviation	burst power, EVM all carriers, EVM data carriers, EVM pilot carriers, center frequency error, symbol clock error, I/Q offset
	graphical	EVM versus symbol, spectrum flatness, I/Q constellation, transmit spectrum mask

[60] The maximum permissible continuous power is +34 dBm due to thermal limits.

Error vector magnitude (EVM)		
Inherent EVM [61]	bandwidth 20 MHz, 40 MHz, 80 MHz	
	–18 dBm ≤ input level ≤ +42 dBm [62], RMS	< –38 dB, RMS [63]
	bandwidth 160 MHz	
	–15 dBm ≤ input level ≤ +42 dBm [62], RMS	typ. < –38 dB, RMS [63]
Measurement length		entire PPDU

Center frequency error		
Frequency measurement uncertainty	for ≥ 100 symbol (400 µs)	< 35 Hz + drift of timebase, see general technical specifications

Symbol clock error		
Uncertainty	for ≥ 100 symbol (400 µs)	< 1 ppm

I/Q offset		
Inherent I/Q offset	for average ≥ 10 measurements	< –45 dB

Spectrum flatness		
Level uncertainty	bandwidth 20 MHz	< 0.8 dB
	bandwidth 40 MHz	< 1.0 dB
	bandwidth 80 MHz	< 1.5 dB
	bandwidth 160 MHz	typ. < 1.5 dB

Spectrum measurements

Transmit spectrum mask		
Frequency span		up to 640 MHz
Dynamic range		in line with IEEE 802.11ac
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	
		+12 dBm to +42 dBm [62]

WLAN signaling access point emulator (prerequisite: R&S®CMW-KS650, R&S®CMW-KS651, R&S®CMW-B200A options, R&S®CMW-B270A or R&S®CMW-B500I option)

Standard		IEEE 802.11a, g (OFDM), n
Physical layer mode		OFDM

Frequency range	WLAN IEEE 802.11n (2.4 GHz band), WLAN IEEE 802.11g (OFDM), (2.4 GHz band)	2412 MHz to 2484 MHz
	WLAN IEEE 802.11a (5 GHz band), WLAN IEEE 802.11n (5 GHz band), prerequisite: R&S®CMW-KB036 option	5180 MHz to 5825 MHz

Output level range		
RF1 COM, RF2 COM	2.4 GHz band	burst power (RMS) up to –16 dBm
	5 GHz band	burst power (RMS) up to –26 dBm
		burst power (RMS) up to –16 dBm (overranging)
RF1 OUT	2.4 GHz band	burst power (RMS) up to –3 dBm
	5 GHz band	burst power (RMS) up to –13 dBm
		burst power (RMS) up to –3 dBm (overranging)
Output level uncertainty		see general technical specifications
Output level resolution		see general technical specifications
Modulation accuracy (EVM)	2.4 GHz band	< –38 dB
	5 GHz band	< –38 dB

[61] Measured with channel estimation based on payload.

[62] The maximum permissible continuous power is +34 dBm due to thermal limits.

[63] 3 dB less with R&S®CMW-H590D RF frontend (ADV.).

Minimum input level	RF1 COM, RF2 COM	down to –40 dBm

Physical layer OFDM

FFT size		64
Bandwidth		20 MHz
Cyclic prefix		800 ns
Physical layer mode		SISO
Modulation	IEEE 802.11a, g (OFDM)	BPSK, QPSK, 16QAM, 64QAM (bit rate: 6/9/12/18/24/36/48/54 Mbps)
	IEEE 802.11n	MCS 0 to 7
Channel coding		BCC

Measurements

PER		
Measurement range	graphically displayed, stop on limit fail	0 % to 100 %
Payload mode		data interval, payload size
Acknowledge type		ACK
Data	DL	all 0s, all 1s, bit pattern: 0101, bit pattern: 1010, pseudorandom, PN9 to PN32
Mobile capabilities		MAC address, MAC version

Features

Connection status	status indication	signal on, associated, authenticated, probed, deauthenticated
Trigger output	WLAN signaling: frame trigger	adjustable pulse width, invertible
	WLAN signaling: RX trigger	invertible

WLAN specifications with 160 MHz bandwidth unit

WLAN RF generator

Standards	IEEE 802.11a/g/p/n OFDM	R&S®CMW-KW650 option
	IEEE 802.11b/g DSSS	R&S®CMW-KW650 option
	IEEE 802.11ac	R&S®CMW-KW656 option

Bandwidth		up to 160 MHz

Frequency range	2.4 GHz band, IEEE 802.11b/g/p/n	2412 MHz to 2484 MHz
	5 GHz band, IEEE 802.11a/n/ac, prerequisite: R&S®CMW-K046 option	5000 MHz to 6000 MHz

Output level range	depends on PAR	see general technical specifications
Output level uncertainty		see general technical specifications
Output level resolution		see general technical specifications

Signal quality		
Error vector magnitude (EVM)	IEEE 802.11 a/g/p/n/ac	
	bandwidth: 5 MHz	< –42 dB RMS
	bandwidth: 10, 20, 40 MHz	< –44 dB RMS
	bandwidth: 80, 80+80 MHz	< –42 dB RMS
	bandwidth: 160 MHz	< –40 dB RMS
	IEEE 802.11 b/g DSSS	< 4 %, peak
Prerequisites	channel estimation (OFDM)	based on payload

Arbitrary waveform files	IEEE 802.11a/g OFDM	WLAN_A_G_OFDM_64QAM.WV (PAR = 10.01 dB)
	IEEE 802.11b DSSS	WLAN_B_CCK_DQPSK.WV (PAR = 1.48 dB)
	IEEE 802.11n	WLAN_N_64QAM_5_6.WV (PAR = 10.01 dB)
	IEEE 802.11ac 20 MHz	WLAN_VHT_BW20_MCS8_LEN4096.WV (PAR = 9.57 dB)
	IEEE 802.11ac 40 MHz	WLAN_VHT_BW40_MCS8_LEN4096.WV (PAR = 11.23 dB)
	IEEE 802.11ac 80 MHz	WLAN_VHT_BW80_MCS8_LEN4096.WV (PAR = 10.24 dB)
	IEEE 802.11ac 160 MHz	WLAN_VHT_BW160_MCS9_SYM20.WV (PAR = 10.45 dB)

WLAN OFDM RF analyzer

Standards	IEEE 802.11a/g	R&S®CMW-KM650 option
	IEEE 802.11n	R&S®CMW-KM651 option
	IEEE 802.11p	R&S®CMW-KM655 option
	IEEE 802.11ac	R&S®CMW-KM656 option

Receive modes	SISO	requires above options for standards
	composite MIMO	R&S®CMW-KM652 option
	switched MIMO	R&S®CMW-KM653 option

Bandwidth	IEEE 802.11a/g	20 MHz
	IEEE 802.11n	20, 40 MHz
	IEEE 802.11p	5, 10, 20 MHz
	IEEE 802.11ac	20, 40, 80, 80+80, 160 MHz
		80+80 MHz can be measured simultaneously on same or on separate antenna ports with any channel spacing

Frequency range	2.4 GHz band, IEEE 802.11g/p/n	2412 MHz to 2484 MHz
	5 GHz band IEEE 802.11a/n/ac prerequisite: R&S®CMW-K046 option	5000 MHz to 6000 MHz, for frequency exceptions for inherent spurious response, see general technical specifications

Statistics		
Statistical count		1 to 1000
Values		current, average, maximum, minimum, standard deviation

Trigger		
Trigger sources		WLAN: IF power, BASE: external trigger, GPRF: waveform marker

Modulation analysis

Level range		–28 dBm to +42 dBm [64]
Payload length		1 to 1377 data symbols
Modulations		BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM
Burst types	IEEE 802.11a/g/p	non HT
	IEEE 802.11n	HT mixed-format, HT Greenfield
	IEEE 802.11ac	VHT mixed-format
MIMO	switched and composite	up to 8x8

Measured results	scalar SISO results	burst and signal field information, burst power, peak power, crest factor, EVM all carriers, EVM data carriers, EVM pilot carriers, center frequency error, symbol clock error, I/Q offset, DC power, gain imbalance, quadrature error timing error
	graphical SISO results	EVM versus symbol, EVM versus carrier, I/Q constellation, spectrum flatness, power versus time
	switched MIMO results	same as SISO results, SISO results per antenna or stream
	composite MIMO results	EVM all carriers, EVM data carriers, EVM pilot carriers, total power, total peak power, power per space time stream, center frequency error

Error vector magnitude (EVM)		
Inherent EVM (RMS)	IEEE 802.11 a/g/p/n/ac	
	bandwidth: 5 MHz	< –44 dB
	bandwidth: 10, 20, 40 MHz	< –46 dB
	bandwidth: 80, 80+80 MHz	< –44 dB
	bandwidth: 160 MHz	< –42 dB

[64] The maximum permissible continuous power is +34 dBm due to thermal limits.

Prerequisites	expected nominal power setting	≥ –8 dBm for 2.4 GHz band
		≥ +2 dBm for 5 GHz band
	channel estimation	based on payload
	burst length	> 16 symbols
	average	> 20 packets

Center frequency error		
Frequency measurement uncertainty	2.4 GHz band	< 20 Hz + drift of timebase, see general technical specifications
	5 GHz band	< 35 Hz + drift of timebase, see general technical specifications
Prerequisites	measurement length	≥ 100 symbols

Symbol clock error		
Uncertainty		< 1 ppm

I/Q offset		
Inherent I/Q offset	for average ≥ 10 measurements	< –45 dB

Spectrum flatness		
Level uncertainty	bandwidth: 5, 10, 20 MHz	≤ 0.8 dB
	bandwidth: 40, 80, 160 MHz	≤ 1.0 dB

Spectrum measurements

Transmit spectrum mask		
Frequency span	4 × of used WLAN bandwidth	40 MHz to 640 MHz
Limit masks		IEEE, ETSI, ARIB
Resolution bandwidth	IEEE, ARIB	100 kHz
	ETSI	1 MHz
Dynamic range		in line with IEEE standard
Expected nominal power setting for full dynamic range	2.4 GHz band	+2 dBm to +42 dBm [65]
	5 GHz band	+12 dBm to +42 dBm [65]

WLAN DSSS RF analyzer

Standards	IEEE 802.11b/g	R&S®CMW-KM650 option

Frequency range	2.4 GHz band	2412 MHz to 2484 MHz

Statistics		
Statistical count		1 to 1000
Values		current, average, maximum, standard deviation

Trigger		
Trigger sources		WLAN: IF power, BASE: external trigger, GPRF: waveform maker

Modulation analysis

Level range		–28 dBm to +42 dBm [65]
Payload length		1000 to 362472 chips
Modulations		1 Mbps DBPSK, 2 Mbps DQPSK, 5.5 Mbps CCK, 11 Mbps CCK

[65] The maximum permissible continuous power is +34 dBm due to thermal limits.

Measured parameters	scalar results	burst and signal field information, burst power, EVM peak, EVM RMS, center frequency error, chip clock error, I/Q offset, gain imbalance, quadrature error, rise/fall time
	graphical results	EVM versus chip, I/Q constellation, power versus time

Error vector magnitude (EVM)		
Inherent EVM		< 5 %, peak
		< 2 %, RMS
Prerequisites	input level	–18 dBm ≤ input level ≤ +42 dBm [66], RMS
	measurement length	1000 chips

Center frequency error		
Frequency measurement uncertainty		< 20 Hz + drift of timebase, see general technical specifications

Chip clock error		
Uncertainty		< 1 ppm

I/Q offset		
Inherent I/Q offset	OFDM, for average ≥ 10 measurements	< –45 dB

Spectrum measurements

Transmit spectrum mask		
Frequency span		80 MHz
Resolution bandwidth	IEEE	100 kHz
Dynamic range		in line with IEEE standard
Limit masks		IEEE
Expected nominal power setting for full dynamic range		+2 dBm to +42 dBm [66]

WLAN signaling access point emulator / station emulator (prerequisite: R&S®CMW-B500l option)

Standard	WLAN IEEE 802.11a, b, g	R&S®CMW-KS650 option
	WLAN IEEE 802.11n	R&S®CMW-KS651 option
	WLAN IEEE 802.11ac	R&S®CMW-KS656 option
Physical layer mode		DSS, OFDM, OFDMA

Frequency range	WLAN IEEE 802.11b, g, WLAN IEEE 802.11n (mixed format only)	2412 MHz to 2484 MHz
	WLAN IEEE 802.11a, WLAN IEEE 802.11n (mixed format only), WLAN IEEE 802.11ac, prerequisite: R&S®CMW-KB036 option	5180 MHz to 5825 MHz

Output level range		
RF1 COM, RF2 COM	2.4 GHz band	burst power (RMS) up to –16 dBm
	5 GHz band, prerequisite: R&S®CMW-KB036 option	burst power (RMS) up to –26 dBm
		burst power (RMS) up to –16 dBm (overranging)
RF1 OUT	2.4 GHz band	burst power (RMS) up to –3 dBm
	5 GHz band, prerequisite: R&S®CMW-KB036 option	burst power (RMS) up to –13 dBm
		burst power (RMS) up to –3 dBm (overranging)

[66] The maximum permissible continuous power is +34 dBm due to thermal limits.

Output level uncertainty		see general technical specifications
Output level resolution		see general technical specifications
Modulation accuracy (EVM)	IEEE 802.11 ac, 80 MHz bandwidth	< –38 dB
Minimum input level	RF1 COM, RF2 COM	down to –40 dBm

Physical layer OFDM

Bandwidth	WLAN IEEE 802.11a	20 MHz
	WLAN IEEE 802.11n (mixed format only)	20 MHz, 40 MHz
	WLAN IEEE 802.11ac	20 MHz, 40 MHz, 80 MHz
Physical layer mode		SISO
Modulation	IEEE 802.11a, g (OFDM)	BPSK, QPSK, 16QAM, 64QAM (bit rate: 6/9/12/18/24/36/48/54 Mbps)
	IEEE 802.11n (mixed format only)	MCS 0 to 7
	IEEE 802.11ac	MCS 0 to 9
Channel coding		BCC

Measurements

PER		
Measurement range	graphically displayed, stop on limit fail	0 % to 100 %
Payload mode		data interval, payload size
Acknowledge type		ACK
Data	DL	all 0s, all 1s, bit pattern: 0101, bit pattern: 1010, pseudorandom, PN9 to PN32

Features

Connection status	status indication	signal on, associated, authenticated, probed, deauthenticated
Trigger output	WLAN signaling: frame trigger	adjustable pulse width, invertible
	WLAN signaling: RX trigger	invertible

TD-SCDMA specifications – mobile station (UE) test [67]

Standard		TD-SCDMA CWTS

TD-SCDMA RF generator (prerequisite: R&S®CMW-B110A/R&S®CMW-B110D option with 40/80 MHz bandwidth unit; included with 160 MHz bandwidth unit)

Frequency range [68]	TD-SCDMA band A	
	channels 10054 to 10121	2010.8 MHz to 2024.2 MHz
	TD-SCDMA band E	
	channels 11504 to 11996	2300.8 MHz to 2399.2 MHz
	TD-SCDMA band F	
	channels 9404 to 9596	1880.8 MHz to 1919.2 MHz

TD-SCDMA WinIQSIM2™ (R&S®CMW-KW750 option) and TD-SCDMA ENH. WinIQSIM2™ (R&S®CMW-KW751 option)

Arbitrary waveform files	with the R&S®CMW-KW750 option	TD-SCDMA_DEFAULT.WV (PAR = 3.14 dB), TD-SCDMA_PTWLOW.WV (PAR = 2.67 dB)
	with the R&S®CMW-KW750 and R&S®CMW-KW751 options	TD-SCDMA-DL_12K2.WV (PAR = 5.41 dB)

Output level range	depends on PAR	see general technical specifications
Output level uncertainty	waveform file used: TD-SCDMA_PTWLOW.WV	see general technical specifications
Output level resolution		see general technical specifications

Signal quality		
Error vector magnitude (EVM)	composite EVM, waveform file used: TD-SCDMA_DEFAULT.WV	< 4 %, RMS

TD-SCDMA RF analyzer (R&S®CMW-KM750 option)

Frequency range [68]	TD-SCDMA band A	
	channels 10054 to 10121	2010.8 MHz to 2024.2 MHz
	TD-SCDMA band E	
	channels 11504 to 11996	2300.8 MHz to 2399.2 MHz
	TD-SCDMA band F	
	channels 9404 to 9596	1880.8 MHz to 1919.2 MHz

Statistics		
Statistical count		1 to 1000
Values		current, average, minimum/maximum, standard deviation

Trigger		
Trigger sources		BASE: external TRIG A, BASE: external TRIG B, GPRF: BB generator, TD-SCDMA: free run, TD-SCDMA: IF power

[67] R&S®CMW500 and R&S®CMW290 only.

[68] Bands A, E, F in line with the CCSA standard.

Modulation analysis

Filter		1.28 MHz, RRC, α = 0.22, TD-SCDMA filter
Level range		–28 dBm to +42 dBm [69]
Analysis modes	TD-SCDMA uplink	QPSK, DPCH, QPSK, DPCH + HSDPA, 16QAM, DPCH + HSUPA
Measured parameters	numeric results and standard deviation	error vector magnitude (EVM), magnitude error (ME), phase error (PE), frequency error, I/Q origin offset, I/Q imbalance, UE power
	graphical	EVM versus time, ME versus time, PE versus time

Error vector magnitude (EVM)		
Measurement range		up to 25 %, RMS
Inherent EVM		< 2.5 %, RMS
Measurement length		1 slot, multislot (1 to 112)

Frequency error		
Measurement range		±3 kHz
Frequency measurement uncertainty		< 20 Hz + drift of timebase, see general technical specifications

I/Q origin offset		
Inherent I/Q offset	for average ≥ 10 measurements	< –55 dB

I/Q imbalance		
Inherent I/Q imbalance		< –50 dB

Code domain

Filter		1.28 MHz, RRC, α = 0.22, TD-SCDMA filter
Level range		–28 dBm to +42 dBm [69]
Analysis modes	TD-SCDMA uplink	QPSK, DPCH, QPSK, DPCH + HSDPA, 16QAM, DPCH + HSUPA
Measured parameters	numeric results and standard deviation	code domain error (CDE)
	graphical	code domain power versus code

Code domain power versus code		
Uncertainty		< 0.4 dB
Measurement length		1 slot

Code domain error (CDE)		
Uncertainty		< 0.4 dB
Measurement length		1 slot

Spectrum measurements

Adjacent channel leakage ratio	RMS detector	
Filter		1.28 MHz, RRC, α = 0.22, TD-SCDMA filter
Dynamic range	first adjacent channel at ±1.6 MHz	> 53 dB
	second adjacent channel at ±3.2 MHz	> 61 dB
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	–3 dBm to +42 dBm [69]

[69] The maximum permissible continuous power is +34 dBm due to thermal limits.

Uncertainty	for –33 dBc first adjacent channel level	< 0.5 dB
	for –43 dBc second adjacent channel level	< 0.5 dB
Measurement length		1 slot

Power meter

Measured parameters	numeric current RMS values	UE power

UE power	RMS detector	
Filter		bandpass, 2.1 MHz, RRC, α = 0.22
Level range		–55 dBm to +42 dBm [70]
Level uncertainty		see general technical specifications
Measurement length		1 slot

TD-SCDMA signaling (prerequisite: R&S®CMW-KS750 option, R&S®CMW-B300A or R&S®CMW-B300B option)

Standard		3GPP TDD
Symbol rate		1.28 MHz

Channels		
Physical channels	DL	P-CCPCH, S-CCPCH, DwPCH, FPACH, PICH, DPCH
	UL	UpPCH, PRACH, DPCH
Radio bearer	DPCH signaling radio bearer (SRB)	
	DL	2.5 kbps, 3.4 kbps
	UL	2.5 kbps, 3.4 kbps
	DPCH reference measurement channels (RMC) in line with 3GPP TS 34.122	
	DL	12.2 kbps
	UL	12.2 kbps
	DPCH voice echo	12.2 kbps
	DPCH voice echo NB-AMR	4.75 kbps, 5.15 kbps, 5.9 kbps, 6.7 kbps, 7.4 kbps, 7.95 kbps 10.2 kbps, 12.2 kbps
	DPCH video echo	64 kbps

Frequency range		
Bands A, E, F	with the R&S®CMW-KS750 option	
	DL	see TD-SCDMA RF generator specifications
	UL	see TD-SCDMA RF analyzer specifications

Frequency setting		channel number

Output level range	P-CCPCH, depends on PAR	see general technical specifications
Output level uncertainty	P-CCPCH	see general technical specifications
Output level resolution	P-CCPCH	see general technical specifications
Output level setting	P-CCPCH	total output power

Channel levels	S-CCPCH, DwPCH, FPACH, PICH, DPCH	–30 dB to +0 dB relative to total power

Signal quality		
Error vector magnitude (EVM)	global EVM for DL RMC in line with 3GPP TS 34.122 C3.1 to C3.4	< 2 %, RMS

[70] The maximum permissible continuous power is +34 dBm due to thermal limits.

CDMA2000® 1xRTT specifications – mobile station test [71]

Standard	CDMA2000® standards	TIA/EIA IS-2000 Rev. 0
	CDMA2000® test standards	TIA/EIA IS-98-F
Symbol rate		1.2288 Mcps

CDMA2000® 1xRTT RF generator (prerequisite: R&S®CMW-B110A/R&S®CMW-B110D option with 40/80 MHz bandwidth unit; included with 160 MHz bandwidth unit)

Frequency range	band class 0	860.025 MHz to 893.985 MHz
	band class 1	1930.000 MHz to 1990.000 MHz
	band class 2	917.0125 MHz to 959.9875 MHz
	band class 3	832.0125 MHz to 869.9875 MHz
	band class 4	1840.000 MHz to 1870.000 MHz
	band class 5	421.675 MHz to 493.480 MHz
	band class 6	2110.000 MHz to 2169.950 MHz
	band class 7	746.000 MHz to 764.000 MHz
	band class 8	1805.000 MHz to 1879.950 MHz
	band class 9	925.000 MHz to 958.750 MHz
	band class 10	851.000 MHz to 939.975 MHz
	band class 11	421.675 MHz to 493.475 MHz
	band class 12	915.0125 MHz to 920.9875 MHz
	band class 13	2620.000 MHz to 2690 MHz
	band class 14	1930.000 MHz to 1995.000 MHz
	band class 15	2110.000 MHz to 2155.000 MHz
	band class 16	2624.000 MHz to 2690.000 MHz
	band class 17	2624.000 MHz to 2690.000 MHz
	band class 18	757.000 MHz to 769.000 MHz
	band class 19	728.000 MHz to 746.000 MHz
	band class 20	1525.000 MHz to 1559.000 MHz
	band class 21	2190.000 MHz to 2200.000 MHz

CDMA2000® GEN (R&S®CMW-KG800 option)

Output level range	depends on PAR	see general technical specifications
Output level uncertainty		see general technical specifications
Output level resolution		see general technical specifications

Signal quality		
Waveform quality (rho)		> 0.99

CDMA2000® WinIQSIM2™ (R&S®CMW-KW800 option)

Arbitrary waveform files		CDMA_OQPSK.WV (PAR = 5.54 dB) or CDMA_HPSK.WV (PAR = 6.97 dB)

Output level range	depends on PAR	see general technical specifications
Output level uncertainty	waveform file used: CDMA_OQPSK.WV or CDMA_HPSK.WV	see general technical specifications
Output level resolution		see general technical specifications

Signal quality		
Waveform quality (rho)	waveform file used: CDMA_OQPSK.WV or CDMA_HPSK.WV	> 0.99

[71] R&S®CMW500 and R&S®CMW290 only.

CDMA2000® RF analyzer (R&S®CMW-KM800 option)

Frequency range	band class 0	815.025 MHz to 848.985 MHz
	band class 1	1850.000 MHz to 1910.000 MHz
	band class 2	872.0125 MHz to 914.9875 MHz
	band class 3	887.0125 MHz to 924.9875 MHz
	band class 4	1750.000 MHz to 1780.000 MHz
	band class 5	411.675 MHz to 483.480 MHz
	band class 6	1920.000 MHz to 1979.950 MHz
	band class 7	776.000 MHz to 794.000 MHz
	band class 8	1710.000 MHz to 1784.950 MHz
	band class 9	880.000 MHz to 913.750 MHz
	band class 10	806.000 MHz to 900.975 MHz
	band class 11	411.675 MHz to 483.475 MHz
	band class 12	870.0125 MHz to 875.9875 MHz
	band class 13	2500.000 MHz to 2570.000 MHz
	band class 14	1850.000 MHz to 1915.000 MHz
	band class 15	1710.000 MHz to 1755.000 MHz
	band class 16	2502.000 MHz to 2568.000 MHz
	band class 17	2502.000 MHz to 2567.950 MHz
	band class 18	787.000 MHz to 700.000 MHz
	band class 19	698.000 MHz to 716.000 MHz
	band class 20	1626.500 MHz to 1660.500 MHz
	band class 21	2000.000 MHz to 2029.950 MHz

Statistics		
Statistical count		1 to 1000
Values		current, average, minimum/maximum, standard deviation

Trigger		
Trigger sources		BASE: external TRIG A, BASE: external TRIG B, GPRF: BB generator, C2K: free run, CDMA2000® signaling: superframe (80 ms)

Modulation analysis

Filter		1.23 MHz, RRC, α = 0.22, CDMA filter
Level range		–28 dBm to +42 dBm [72]
Analysis modes		OQPSK, HPSK
Measured parameters	numeric results and standard deviation	error vector magnitude (EVM), magnitude error (ME), phase error (PE), frequency error, rho, carrier feedthrough, I/Q imbalance, power, wideband power (8 MHz), narrowband power (1.23 MHz)
	graphical	EVM versus time, ME versus time, PE versus time

Waveform quality (rho)		
Uncertainty	for rho 0.9 to 1	< 0.003
Measurement length		616 chip (0.5 ms)

Error vector magnitude (EVM)		
Measurement range		up to 25 %, RMS
Inherent EVM		< 2.5 %, RMS

[72] The maximum permissible continuous power is +34 dBm due to thermal limits.

Measurement length		0.5 ms

Frequency error		
Measurement range		±3 kHz
Frequency measurement uncertainty		< 20 Hz + drift of timebase, see general technical specifications

Carrier feedthrough		
Inherent carrier feedthrough	for average ≥ 10 measurements	< –55 dB

I/Q imbalance		
Inherent I/Q imbalance		< –50 dB

Code domain

Filter		1.23 MHz, RRC, α = 0.22, CDMA filter
Level range		–28 dBm to +42 dBm [73]
Measured parameters	numeric values of current, average, max. and min. values	code domain power (CDP), code domain error (CDE)
	graphical	code domain power versus code, code domain error versus code

Code domain power versus code		
Uncertainty		< 0.4 dB
Measurement length		616 chip (0.5 ms)

Code domain error versus code		
Measurement uncertainty		< 0.4 dB
Measurement length		616 chip (0.5 ms)

Spectrum measurements

Adjacent channel power	RMS detector, at the selected frequency offsets	
Filter	Gaussian	1 kHz, 6.25 kHz, 10 kHz, 12.5 kHz, 25 kHz, 30 kHz, 50 kHz
	Nyquist	100 kHz, 1 MHz, 1.23 MHz
Frequency offset interval	up to 20 adjacent channels on each side	–4 MHz to +4 MHz
Dynamic range		> 70 dB
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	+1 dBm to +42 dBm [73]
Uncertainty	for –43 dBc adjacent channel level	< 0.5 dB
Measurement length	one power control group	1536 chip (1.25 ms)

Power meter

MS power		
Filter	narrowband	bandpass, 1.25 MHz
Filter	wideband	bandpass, 8 MHz
Level range		–55 dBm to +42 dBm [73]
Level uncertainty		see general technical specifications
Measurement length		616 chip (0.5 ms)

CDMA2000® 1xRTT signaling (prerequisite: R&S®CMW-KS800, R&S®CMW-B200A or R&S®CMW-B200H, R&S®CMW-B220A options)

Frequency range		
Band class 0 to band class 21	DL	see CDMA2000® 1xRTT RF generator specifications
	UL	see CDMA2000® 1xRTT RF analyzer specifications

Output level range	depends on PAR	see general technical specifications
Output level uncertainty		see general technical specifications

[73] The maximum permissible continuous power is +34 dBm due to thermal limits.

Output level resolution		see general technical specifications

Modulation		
Dual BPSK, multiple QPSK		1.2288 Mcps
Waveform quality (rho)		> 0.99
Code channel level uncertainty	relative to the total CDMA output power	
	PICH, PCH, FCH, SCH0	approx. 0.1 dB
	all other channels	approx. 0.25 dB
Code channel resolution		0.1 dB
Code channel level range	relative to the total CDMA output power	
	PICH, PCH, FCH, SCH0, SYNC	–20 dB to –1 dB

Supported service options		
Loopback service options		SO 2, 9, 55
Speech service options		SO 1, 3, 17, 68, 70, 73, 0x8000
Test data service option		SO 32
Packet data service option	prerequisite: R&S®CMW-B450D	SO 33

Speech codecs	prerequisite: R&S®CMW-B400B and R&S®CMW-B405A options	
Supported standards		8k (SO 1), 8k enhanced or EVRC-A (SO 3), 13k or QCELP (SO 17), EVRC-B (SO 68), EVRC-WB (SO 70), EVRC-NW (SO 73)

CDMA2000® 1xEV-DO specifications – access terminal test [74]

Standard	CDMA2000® 1xEV-DO standards	TIA/EIA 856-2
	CDMA2000® 1xEV-DO test standards	TIA/EIA 866-A, TIA/EIA 866-B
Symbol rate		1.2288 Mcps

CDMA2000® 1xEV-DO RF generator (prerequisite: R&S®CMW-B110A/R&S®CMW-B110D option with 40/80 MHz bandwidth unit; included with 160 MHz bandwidth unit)

Frequency range	band class 0	860.025 MHz to 893.985 MHz
	band class 1	1930.000 MHz to 1990.000 MHz
	band class 2	917.0125 MHz to 959.9875 MHz
	band class 3	832.0125 MHz to 869.9875 MHz
	band class 4	1840.000 MHz to 1870.000 MHz
	band class 5	421.675 MHz to 493.480 MHz
	band class 6	2110.000 MHz to 2169.950 MHz
	band class 7	746.000 MHz to 764.000 MHz
	band class 8	1805.000 MHz to 1879.950 MHz
	band class 9	925.000 MHz to 958.750 MHz
	band class 10	851.000 MHz to 939.975 MHz
	band class 11	421.675 MHz to 493.475 MHz
	band class 12	915.0125 MHz to 920.9875 MHz
	band class 13	2620.000 MHz to 2690 MHz
	band class 14	1930.000 MHz to 1995.000 MHz
	band class 15	2110.000 MHz to 2155.000 MHz
	band class 16	2624.000 MHz to 2690.000 MHz
	band class 17	2624.000 MHz to 2690.000 MHz
	band class 18	757.000 MHz to 769.000 MHz
	band class 19	728.000 MHz to 746.000 MHz
	band class 20	1525.000 MHz to 1559.000 MHz
	band class 21	2190.000 MHz to 2200.000 MHz

1xEV-DO WinIQSIM2™ (R&S®CMW-KW880 option)

Arbitrary waveform file		EVDO_DEFAULT.WV (PAR = 4.85 dB)

Output level range	depends on PAR	see general technical specifications
Output level uncertainty	waveform file used: EVDO_DEFAULT.WV	see general technical specifications
Output level resolution		see general technical specifications

Signal quality		
Waveform quality (rho)	waveform file used: EVDO_DEFAULT.WV	> 0.99

CDMA2000® 1xEV-DO RF analyzer (R&S®CMW-KM880 option)

Frequency range	band class 0	815.025 MHz to 848.985 MHz
	band class 1	1850.000 MHz to 1910.000 MHz
	band class 2	872.0125 MHz to 914.9875 MHz
	band class 3	887.0125 MHz to 924.9875 MHz
	band class 4	1750.000 MHz to 1780.000 MHz
	band class 5	411.675 MHz to 483.480 MHz
	band class 6	1920.000 MHz to 1979.950 MHz
	band class 7	776.000 MHz to 794.000 MHz
	band class 8	1710.000 MHz to 1784.950 MHz
	band class 9	880.000 MHz to 913.750 MHz
	band class 10	806.000 MHz to 900.975 MHz
	band class 11	411.675 MHz to 483.475 MHz
	band class 12	870.0125 MHz to 875.9875 MHz
	band class 13	2500.000 MHz to 2570.000 MHz
	band class 14	1850.000 MHz to 1915.000 MHz
	band class 15	1710.000 MHz to 1755.000 MHz
	band class 16	2502.000 MHz to 2568.000 MHz

[74] R&S®CMW500 and R&S®CMW290 only.

	band class 17	2502.000 MHz to 2567.950 MHz
	band class 18	787.000 MHz to 700.000 MHz
	band class 19	698.000 MHz to 716.000 MHz
	band class 20	1626.500 MHz to 1660.500 MHz
	band class 21	2000.000 MHz to 2029.950 MHz

Statistics		
Statistical count		1 to 1000
Values		current, average, minimum/maximum, standard deviation

Trigger		
Trigger sources		BASE: external TRIG A, BASE: external TRIG B, GPRF: BB generator, 1xEV-DO: free run, 1xEV-DO signaling: superframe (80 ms)

Modulation analysis

Filter		1.23 MHz, RRC, α = 0.22, CDMA filter
Level range		–28 dBm to +42 dBm [75]
Analysis modes		dual BPSK
Multicarrier		single carrier or 3 carriers within –8 MHz to +8 MHz
Measured parameters	numeric results and standard deviation	error vector magnitude (EVM), magnitude error (ME), phase error (PE), frequency error, rho, carrier feedthrough, I/Q imbalance, power, wideband power (8 MHz for single carrier or 16 MHz for multicarrier), narrowband power (1.23 MHz)
	graphical	EVM versus time, ME versus time, PE versus time

Waveform quality (rho)		
Uncertainty	for rho 0.9 to 1	< 0.003
Measurement length	half-slot	1024 chip (833.33 µs)

Error vector magnitude (EVM)		
Measurement range		up to 25 %, RMS
Inherent EVM		< 2.5 %, RMS
Measurement length	half-slot	1024 chip (833.33 µs)

Frequency error		
Measurement range		±3 kHz
Frequency measurement uncertainty		< 20 Hz + drift of timebase, see general technical specifications

Carrier feedthrough		
Inherent carrier feedthrough	for average ≥ 10 measurements	< –55 dB

I/Q imbalance		
Inherent I/Q imbalance		< –50 dB

[75] The maximum permissible continuous power is +34 dBm due to thermal limits.

Code domain

Filter		1.23 MHz, RRC, α = 0.22, CDMA filter
Level range		–28 dBm to +42 dBm [76]
Measured parameters	numeric values of current, average, max. and min. values	code domain power (CDP), code domain error (CDE)
	graphical	code domain power versus code, code domain error versus code

Code domain power versus code		
Uncertainty		< 0.4 dB
Measurement length	half-slot	1024 chip (833.33 µs)

Code domain error versus code		
Measurement uncertainty		< 0.4 dB
Measurement length	half-slot	1024 chip (833.33 µs)

Spectrum measurements

Adjacent channel power	RMS detector, at the selected frequency offsets	
Filter	Gaussian	1 kHz, 6.25 kHz, 10 kHz, 12.5 kHz, 25 kHz, 30 kHz, 50 kHz
	Nyquist	100 kHz, 1 MHz, 1.23 MHz
Frequency offset interval	up to 20 adjacent channels on each side	–4 MHz to +4 MHz to each carrier
Dynamic range		> 70 dB
Expected nominal power setting for full dynamic range	RF1 COM, RF2 COM	+1 dBm to +42 dBm [76]
Uncertainty	for –43 dBc adjacent channel level	< 0.5 dB
Measurement length	half-slot	1024 chip (833.33 µs)

Power meter

MS power		
Filter	narrowband	bandpass, 1.25 MHz
Filter	wideband	bandpass, 8 MHz for single carrier or 16 MHz for multicarrier
Level range		–55 dBm to +42 dBm [76]
Level uncertainty		see general technical specifications
Measurement length	half-slot	1024 chip (833.33 µs)

CDMA2000® 1xEV-DO signaling (prerequisite: R&S®CMW-KS880, R&S®CMW-KS881, R&S®CMW-B200A or R&S®CMW-B200H, R&S®CMW-B230A options)

Frequency range		
Band class 0 to band class 21	DL	see CDMA2000® 1xEV-DO RF generator specifications
	UL	see CDMA2000® 1xEV-DO RF analyzer specifications

Output level range	depends on PAR	see general technical specifications
Output level uncertainty		see general technical specifications
Output level resolution		see general technical specifications

Modulation		
Dual BPSK		1.2288 Mcps
Waveform quality (rho)		> 0.99

Supported applications		
Test applications		FTAP/RTAP, FETAP/RETAP
	prerequisite: R&S®CMW-KS881	FMCTAP/RMCTAP
Packet applications	prerequisite: R&S®CMW-B450D	

[76] The maximum permissible continuous power is +34 dBm due to thermal limits.

Data application unit – DAU (R&S®CMW-B450B or R&S®CMW-B450D or R&S®CMW-B450H option)

The R&S®CMW-B450B/D/H option provides data test capabilities and a Gigabit Ethernet connector on the rear of the instrument.

Data application

IP configuration		IPv4 address configuration, IPv6 address configuration
File transfer protocol (FTP)		FTP server, FTP traffic generator
Hypertext transfer protocol (HTTP)		HTTP server
Domain name service (DNS)		DNS server

DAU throughput

R&S®CMW-B450B option		max. 350 Mbit
R&S®CMW-B450D option		max. 900 Mbit
R&S®CMW-B450H option		max. 2000 Mbit

DAU LAN Ethernet interface

R&S®CMW-B450D option		Ethernet RJ-45 connector, 100 Mbps, 1 Gbps
R&S®CMW-B450H option		Ethernet RJ-45 connector, 1 Gbps, 10 Gbps

DAU USB interface

R&S®CMW-B450H option		USB 3.0

Digital I/Q 1 to 4 (R&S®CMW-B510F option) and digital I/Q 5 to 8 (R&S®CMW-B520F option) [77]

The R&S®CMW-B510F option makes the first digital I/Q interface and AUX interface and the R&S®CMW-B520F option makes the second digital I/Q interface and AUX interface available on the rear of the instrument.

Digital I/Q interface

The digital I/Q interface can be used to connect the R&S®CMW to the digital I/Q interface of other Rohde & Schwarz instruments (e.g. R&S®AMU200A, R&S®EX-IQ-Box).

DIG I/Q IN 1/3/5/7	input	26-pin MDR connector
Level		LVDS
Clock rate in		100 MHz
Clock rate out		100 MHz

DIG I/Q OUT 2/4/6/8	output	26-pin MDR connector
Level		LVDS
Clock rate		100 MHz

Control signals	general-purpose control, for future use	
	6 signals	100 MHz

I/Q data		
Resolution	for clock rate up to 100 MHz	18 bit for I and 18 bit for Q

I/Q sample rate		
Source		internal, digital input, digital output,
Range		1.92 Msample/s to 100 Msample/s
Predefined values [78]	standard-independent	100 Msample/s
	WCDMA, LTE	1.92 Msample/s, 3.84 Msample/s, 7.68 Msample/s, 9.6 Msample/s, 15.36 Msample/s, 19.2 Msample/s, 30.72 Msample/s

I/Q enable/request rate		
Digital input	transfer mode 1 (enable mode)	75 MHz, 100 MHz
	transfer mode 2 (request mode)	0 Hz to 100 MHz
Digital output	transfer mode 1 (enable mode)	100 MHz
	transfer mode 2 (request mode)	0 Hz to 100 MHz

AUX interface

The AUX interface can be used to connect the R&S®CMW to other instruments, e.g. to trigger, clock and enable signals.

AUX A/B/C/D	bidirectional, half-duplex	BNC connectors
Level		3.3 V TTL
Clock rate		0 Hz to 100 MHz

Included extras

Digital I/Q cable (two sets)	same cable as included in R&S®SMU-Z6	26-pin MDR connector

[77] R&S®CMW500 and R&S®CMW270 only. Not possible with R&S®CMW-B500I SUA option.

[78] Further values in the range from 400 sample/s to 100 Msample/s can be provided on request.

General data

RF connectors (front panel)		SnapN female, 50 Ω, compatible with N female connectors
RF1 COM, RF2 COM		combined RF input and RF output
RF1 OUT		RF output

Remote control interfaces (front panel)		
LAN		Ethernet RJ-45 connector, 1000 Mbps

Remote control interfaces (rear panel)		
IEEE 488	R&S®CMW-B612A IEEE bus (single) interface option	IEC 60625-2 (IEEE 488.2), 24-pin Amphenol connector
	R&S®CMW-B612B IEEE bus (dual) interface option	2 × IEC 60625-2 (IEEE 488.2), 24-pin Amphenol connector
LAN REMOTE		Ethernet RJ-45 connector, 1000 Mbps
USB REMOTE		USB 2.0 type B connector

Further interfaces (front panel)		
USB	for keyboard, mouse, USB stick	3 × USB 2.0 type A connector
SENSOR		for R&S®NRP-Zxx power sensors
DIGITAL MONITOR	for external monitor, only included in R&S®CMW-S600A or R&S®CMW-S600C or R&S®CMW-S600G configuration (front panel without display or keypad)	DVI-D connector

Further interfaces (rear panel)		
USB	for keyboard, mouse, USB stick	2 × USB 2.0 type A connector
DVI	for external monitor, R&S®CMW-B620A DVI interface option	DVI-D connector
TRIG A, TRIG B	trigger input/output	2 × BNC connector
	output trigger sources	standard-specific internal trigger sources

Environmental conditions		
Temperature	operating temperature range	+5 °C to +45 °C
	storage temperature range	–25 °C to +60 °C
Damp heat		+40 °C, 80 % rel. humidity, steady state, in line with EN 60068-2-78

Product conformity		
Electromagnetic compatibility	EU: in line with EMC Directive 2004/108/EC	applied harmonized standards: • EN 61326-1 (industrial environment) • EN 61326-2-1 • EN 55011 (class A)
Electrical safety	EU: in line with Low Voltage Directive 2006/95/EC	applied harmonized standard: EN 61010-1
	USA/Canada	applied harmonized standards: • UL 61010-1 • CAN C22.2 No. 61010.1
International safety approvals	VDE – Association for Electrical, Electronic and Information Technologies	GS mark
	CSA – Canadian Standards Association	CSA_{UL} mark

Mechanical resistance	nonoperating mode	
Vibration	sinusoidal	5 Hz to 55 Hz, 0.3 mm double amplitude const., 55 Hz to 150 Hz, 0.5 g const., in line with EN 60068-2-6
Vibration	random	10 Hz to 300 Hz, acceleration 1.2 g RMS, in line with EN 60068-2-64
Shock		40 g shock spectrum, in line with MIL-STD-810E, method 516.4, procedure I

Power rating		
Rated voltage		100 V to 240 V AC (± 10 %)
Rated frequency		50 Hz to 60 Hz (± 5 %)
Rated power	with R&S®CMW-PS505 models .02/.04 or R&S®CMW-PS275 model .02 or R&S®CMW-PS290 model .02	max. 850 VA
	with R&S®CMW-PS505 model .06 or R&S®CMW-PS275 model .06 or R&S®CMW-PS291 model .06	max. 1050 VA
	standby	max. 13 W
Power consumption	single tester, nonsignaling	approx. 200 W

Display		selected with R&S®CMW-S600B or R&S®CMW-S600D or R&S®CMW-S600H configuration (front panel with display and keypad)
Size		21 cm TFT color display (8.4")
Resolution		800 × 600 pixel (SVGA resolution)
Pixel failure rate		$< 1.1 \times 10^{-5}$

Dimensions	W × H × D, overall	465.1 mm × 197.3 mm × 517.0 mm (18.31 in × 7.77 in × 20.35 in)
	for rackmounting	19" 1/1, 4 HU, 450
Weight	single tester, nonsignaling	approx. 14 kg (approx. 31 lb)
	with typical options	approx. 18 kg (approx. 40 lb)

Calibration interval	12 months	recommended for highest accuracy, see specified RF generator and RF analyzer level uncertainty
	24 months	add 0.2 dB to specified RF generator and RF analyzer level uncertainty

Ordering information

Designation	Type	Order No.
Wideband Radio Communication Tester Base unit with following accessories: power cord, operating manual (quick start guide), comprehensive documentation on CD-ROM	R&S®CMW500	1201.0002K50
Wireless Connectivity Tester Base unit with following accessories: power cord, operating manual (quick start guide), comprehensive documentation on CD-ROM	R&S®CMW270	1201.0002K75
Functional Radio Communication Tester Base unit with following accessories: power cord, operating manual (quick start guide), comprehensive documentation on CD-ROM	R&S®CMW290	1201.0002K29

For more ordering information about available options, please see our product brochure (PD 5214.2833.12) or ask your local Rohde & Schwarz expert to find the solution that best meets your needs.

Recommended extras

Designation	Type	Order No.
19" Rack Adapter	R&S®ZZA-411	1096.3283.00
Cable TVR 290, 26-pin MDR connector; additional cable for R&S®CMW-B510F used with e.g. R&S®AMU200A, R&S®EX-IQ-Box	R&S®SMU-Z6 [79]	1415.0201.02

Service options

Service options		
Extended Warranty, one year	R&S®WE1	Please 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 [80]. 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 [80] 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 [80] and accredited calibration at the recommended intervals as well as any accredited calibration carried out during repairs or option upgrades.

[79] R&S®CMW500 and R&S®CMW270 only.

[80] Excluding defects caused by incorrect operation or handling and force majeure. Wear-and-tear parts are not included.

Service that adds value

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

Rohde&Schwarz

The Rohde&Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, monitoring and network testing. Founded more than 80 years ago, the independent company which is headquartered in Munich, Germany, has an extensive sales and service network with locations in more than 70 countries.

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 GmbH&Co. KG
www.rohde-schwarz.com

Rohde&Schwarz training
www.training.rohde-schwarz.com

Regional contact

- Europe, Africa, Middle East | +49 89 4129 12345
  customersupport@rohde-schwarz.com
- North America | 1 888 TEST RSA (1 888 837 87 72)
  customer.support@rsa.rohde-schwarz.com
- Latin America | +1 410 910 79 88
  customersupport.la@rohde-schwarz.com
- Asia Pacific | +65 65 13 04 88
  customersupport.asia@rohde-schwarz.com
- China | +86 800 810 82 28 | +86 400 650 58 96
  customersupport.china@rohde-schwarz.com

PD 5213.9211.22 | Version 14.00 | January 2018 (ch)
R&S®CMW Wideband Radio Communication Tester

5213921122

5213.9211.22 14.00 PDP 1 en