# R&S®CMW
# Wideband Radio Communication Tester
# Specifications

R&S®CMW500, R&S®CMW290, R&S®CMW270

ROHDE&SCHWARZ

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Specifications apply under the following conditions:

Data valid for the R&S®CMW500, the R&S®CMW290 and the R&S®CMW270 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.

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Data without tolerance limits is not binding.

# General technical specifications

## RF generator

| | | |
|---|---|---|
| **Frequency range** | | 70 MHz to 3300 MHz,<br>up to 6000 MHz with the<br>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,<br>no overranging | |
|---|---|---|
| RF1 COM, RF2 COM | output level > –120 dBm | |
| | 70 MHz to 100 MHz | < 1.2 dB [1] |
| | 100 MHz to 3300 MHz | < 0.6 dB [1] |
| | 3300 MHz to 6000 MHz | < 1.2 dB [1] |
| RF1 OUT | output level > –112 dBm | |
| | 70 MHz to 100 MHz | < 1.6 dB [1] |
| | 100 MHz to 3300 MHz | < 0.8 dB [1] |
| | 3300 MHz to 6000 MHz | < 1.6 dB [1] |

| **Output level uncertainty** | in temperature range +5 °C to +45 °C,<br>no overranging | |
|---|---|---|
| RF1 COM, RF2 COM | output level > –120 dBm | |
| | 70 MHz to 100 MHz | < 2.0 dB [1] |
| | 100 MHz to 3300 MHz | < 1.0 dB [1] |
| | 3300 MHz to 6000 MHz | < 2.0 dB [1] |
| RF1 OUT | output level > –112 dBm | |
| | 70 MHz to 100 MHz | < 2.0 dB [1] |
| | 100 MHz to 3300 MHz | < 1.0 dB [1] |
| | 3300 MHz to 6000 MHz | < 2.0 dB [1] |

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

| | | |
|---|---|---|
| **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 |

| | | |
|---|---|---|
| **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 |

| | | |
|---|---|---|
| **Attenuation of 2nd 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 3rd 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) |

| | | |
|---|---|---|
| **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 to 16 bit |
| **Sample length** | with 4-bit marker | up to 227.55 Msample |
| **Sample rate** | minimum | 400 Hz |
| | maximum | 100 MHz |
| **Maximum possible RF bandwidth** | depending on arbitrary waveform file | 80 MHz |

| | | |
|---|---|---|
| **Trigger** | | |
| Trigger sources | | BASE: external TRIG A,<br>BASE: external TRIG B |

## RF analyzer

| | | |
|---|---|---|
| **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 |

| | | |
|---|---|---|
| **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** | 2nd 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** | 3rd 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,<br>BASE: external TRIG B,<br>GPRF: free run,<br>GPRF: IF power,<br>BB generators,<br>BB signaling |

## Power meter

| **Frequency range** | | 70 MHz to 3300 MHz,<br>up to 6000 MHz with the<br>R&S®CMW-KB036 option |
|---|---|---|
| **Frequency resolution** | | 0.1 Hz |
| **Resolution bandwidths** | | Gaussian, 1 kHz to 10 MHz, in 1/3/5 steps,<br>bandpass, 1 kHz to 30 MHz, in 1/3/5 steps, RRC, α = 0.1,<br>3.84 MHz, RRC, α = 0.22, WCDMA filter,<br>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 [2] |
| | 100 MHz to 3300 MHz | –47 dBm to +42 dBm [2] |
| | 3300 MHz to 6000 MHz | –37 dBm to +42 dBm [2] |

| **Level range** | | |
|---|---|---|
| RF1 COM, RF2 COM | 70 MHz to 100 MHz | |
| | continuous power (CW) | –74 dBm [3] to +34 dBm |
| | peak envelope power (PEP) | up to +42 dBm [2] |
| | 100 MHz to 3300 MHz | |
| | continuous power (CW) | –84 dBm [3] to +34 dBm |
| | peak envelope power (PEP) | up to +42 dBm [2] |
| | 3300 MHz to 6000 MHz | |
| | continuous power (CW) | –74 dBm [3] to +34 dBm |
| | peak envelope power (PEP) | up to +42 dBm [2] |
| | 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 [4] |
| | 100 MHz to 3300 MHz | < 0.5 dB [4] |
| | 3300 MHz to 6000 MHz | < 1.0 dB [4] |

| **Level uncertainty** | in temperature range +5 °C to +45 °C | |
|---|---|---|
| RF1 COM, RF2 COM | 70 MHz to 100 MHz | < 1.2 dB [4] |
| | 100 MHz to 3300 MHz | < 0.7 dB [4] |
| | 3300 MHz to 6000 MHz | < 1.2 dB [4] |

| **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 |

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

[3] *RBW → 1 kHz.*

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

| | | |
|---|---|---|
| **Dynamic range** | 70 MHz to 3300 MHz, *RBW → 1 kHz*, with fixed expected nominal power setting | > 100 dB |
| **Expected nominal power setting for full dynamic range** | | |
| RF1 COM, RF2 COM | | –8 dBm to +42 dBm [5] |

| | | |
|---|---|---|
| **Dynamic range** | 3300 MHz to 6000 MHz, *RBW → 1 kHz*, with fixed expected nominal power setting | > 97 dB |
| **Expected nominal power setting for full dynamic range** | | |
| RF1 COM, RF2 COM | | +2 dBm to +42 dBm [5] |

## 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) | > 100 dB |
| **Expected nominal power setting for full dynamic range** | | |
| RF1 COM, RF2 COM | | –8 dBm to +42 dBm [5] |

| | | |
|---|---|---|
| **Dynamic range** | 3300 MHz to 6000 MHz, *for FFT length → 16k and span → 5 MHz* (equivalent to RBW → 781 Hz) | > 97 dB |
| **Expected nominal power setting for full dynamic range** | | |
| RF1 COM, RF2 COM | | +2 dBm to +42 dBm [5] |

| | | |
|---|---|---|
| **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, depending on RBW, VBW and span | 500 µs to 2000 s |
| | zero span, depending 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,<br>BASE: external TRIG A, B<br>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 [5] |

| | | |
|---|---|---|
| **Dynamic range** | 3300 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 [5] |

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

| | | |
|---|---|---|
| **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 |

# Possible configurations with two RF paths

Necessary hardware (H570, 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 H570 (RF TRX) and two 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 with 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 H570 (RF TRX) and one 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 [6]

Necessary hardware (H570 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 H570 (RF TRX) and two H590D (RF frontend (ADV.))

The three R&S®CMW-B570 options and 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 |

[6] R&S®CMW500 only.

| | | |
|---|---|---|
| Level range | | see general technical specifications,<br>+ 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,<br>+ 0.2 dB |
| | 3300 MHz to 6000 MHz | see general technical specifications,<br>+ 0.3 dB |
| Expected nominal power setting range | | see general technical specifications,<br>+ 3 dB for lower level limit value |
| Expected nominal power setting for full dynamic range | | see general technical specifications,<br>+ 3 dB for lower level limit value |
| Level range | | see general technical specifications,<br>+ 3 dB (typ. + 2 dB) for lower level limit value |

# Timebase

## Timebase TCXO

| | | |
|---|---|---|
| **Max. frequency drift** | in temperature range +5 °C to +45 °C | $\pm 1 \times 10^{-6}$ |
| **Max. aging** | at +25 °C,<br>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,<br>after 24 hours power on /<br>2 hours power off / 1 hour power on | $\pm 2 \times 10^{-8}$ |
| **Max. aging** | at +25 °C,<br>after 10 days of continuous operation | $\pm 1 \times 10^{-7}$/year,<br>$\pm 1 \times 10^{-9}$/day |
| **Warm-up time** | at +25 °C,<br>the frequency is in the range that is<br>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,<br>referenced to +25 °C | $\pm 5 \times 10^{-9}$ |
| | with instrument orientation | $\pm 1 \times 10^{-9}$ |
| **Retrace** | at +25 °C,<br>after 24 hours power on /<br>2 hours power off / 1 hour power on | $\pm 5 \times 10^{-9}$ |
| **Max. aging** | at +25 °C,<br>after 10 days of continuous operation | $\pm 3 \times 10^{-8}$/year,<br>$\pm 5 \times 10^{-10}$/day |
| **Warm-up time** | at +25 °C,<br>the frequency is in the range that is<br>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 bits 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 [7]

## GSM RF generator (prerequisite: R&S®CMW-B110A/R&S®CMW-B110D 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 |

### GSM GEN (R&S®CMW-KG200 option)

| | | |
|---|---|---|
| **Output level range** | depending 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 EVO 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** | depending 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 |

[7] R&S®CMW500 and R&S®CMW290 only.

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

# GSM RF analyzer (R&S®CMW-KM200 option) and GSM EDGE EVO 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,<br>BASE: external TRIG B,<br>GPRF: BB generator,<br>GSM: free run,<br>GSM: IF power,<br>GSM: acquisition |

## Modulation analysis

| Level range | | –28 dBm to +42 dBm [8] |
|---|---|---|
| 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,<br>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 |

[8] 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,*<br>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 [9] |

| | | |
|---|---|---|
| **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 [9] |
| 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 [9] |
| Test method | | relative measurement, averaging |
| Filter | | Gaussian, 30 kHz, 5 pole |
| Measurement | at an offset of ± | 100/200/250/400/600/800/1000/1200/<br>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 [9] |
| 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-B200A, R&S®CMW-B210A options; additionally R&S®CMW-KS210 option and R&S®CMW-KS211)

| | | |
|---|---|---|
| **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** | depending on PAR and additional 6 dB level margin | see general technical specifications |
| | with DLDC: depending 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 |

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

# GSM specifications – small cell test [10]

## 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,<br>BASE: external TRIG B,<br>GPRF: BB generator,<br>GSM: free run,<br>GSM: IF power,<br>GSM: acquisition |

### Modulation analysis

| | | |
|---|---|---|
| **Level range** | | –28 dBm to +42 dBm [11] |
| **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,<br>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,*<br>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 [11] |

| | | |
|---|---|---|
| **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 [11] |
| Level uncertainty | *filter → 500 kHz or 1 MHz, Gaussian* | see general technical specifications |

[10] R&S®CMW500 only.

[11] 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 [12] |
| 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 [12] |
| 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 |

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

# WCDMA specifications – mobile station (UE) test [13]

| | | |
|---|---|---|
| **Standard** | | 3GPP FDD |

## WCDMA RF generator (prerequisite: R&S®CMW-B110A/R&S®CMW-B110D option)

| | | |
|---|---|---|
| **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** | depending 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** | depending 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 |

[13] R&S®CMW500 and R&S®CMW290 only.

| Signal quality | | |
|---|---|---|
| Error vector magnitude (EVM) | composite EVM,<br>with the R&S®CMW-KW400 option,<br>waveform file used:<br>TM4CPICH.WV | < 2 %, RMS |
| | composite EVM,<br>with the R&S®CMW-KW401 option,<br>waveform file used:<br>WCDMA_DL_HSDPA.WV | < 2 %, RMS |
| | composite EVM,<br>with the R&S®CMW-KW402 option,<br>waveform file used:<br>WCDMA_DL_HSUPA.WV | < 2 %, RMS |
| | with the R&S®CMW-KW400 and<br>R&S®CMW-KW401 and<br>R&S®CMW-KW402 and<br>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,<br>BASE: external TRIG B,<br>GPRF: BB generator,<br>WCDMA: free run,<br>WCDMA: free run (fast sync),<br>WCDMA: IF power,<br>WCDMA: DCCH TTI trigger,<br>WCDMA: frame trigger,<br>WCDMA: HS-DPCCH trigger,<br>WCDMA: slot trigger |

## Modulation analysis

| Filter | | 3.84 MHz, RRC, α = 0.22, WCDMA filter |
|---|---|---|
| Level range | | –28 dBm to +42 dBm [14] |

[14] 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),<br>magnitude error (ME),<br>phase error (PE),<br>frequency error,<br>I/Q origin offset,<br>I/Q imbalance,<br>UE power,<br>power steps,<br>phase discontinuity,<br>CDP,<br>CDE |
| | graphical | EVM versus time, EVM versus chip,<br>ME versus time, ME versus chip,<br>PE versus time, PE versus chip,<br>FE versus time,<br>UE versus time,<br>PS versus slot,<br>PD versus slot,<br>CDP versus slot,<br>CDE versus slot,<br>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,<br>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 [15] |
| 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 [15] |
| Level uncertainty | | see general technical specifications |
| Measurement length | | half-slot, 1 slot |

[15] 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-B300A/R&S®CMW-B300B options; additionally R&S®CMW-KS410 and R&S®CMW-KS425 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** | depending 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 [16]

## 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,<br>BASE: external TRIG B,<br>GPRF: BB generator,<br>WCDMA: free run,<br>WCDMA: free run (fast sync),<br>WCDMA: IF power,<br>WCDMA: DCCH TTI trigger,<br>WCDMA: frame trigger,<br>WCDMA: HS-DPCCH trigger,<br>WCDMA: slot trigger |

### Modulation analysis

| | | |
|---|---|---|
| **Filter** | | 3.84 MHz, RRC, α = 0.22, WCDMA filter |
| **Level range** | | –28 dBm to +42 dBm [17] |

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

[16] R&S®CMW500 only.

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

| | | |
|---|---|---|
| | graphical | EVM versus time, EVM versus chip,<br>ME versus time, ME versus chip,<br>PE versus time, PE versus chip,<br>FE versus time,<br>UE versus time,<br>PS versus slot,<br>PD versus slot,<br>CDP versus slot,<br>CDE versus slot,<br>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,<br>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 [18] |
| 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 [18] |
| 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 +<br>uncertainty due to noise floor |

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

# LTE specifications – mobile station test [19]

| | | |
|---|---|---|
| **Standard** | | LTE FDD and TDD |

## LTE RF generator (prerequisite: R&S®CMW-B110A/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,<br>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,<br>prerequisite: R&S®CMW-KB036 option | 3400 MHz to 3600 MHz |
| | E-UTRA band 43, TDD,<br>prerequisite: R&S®CMW-KB036 option | 3600 MHz to 3800 MHz |
| | E-UTRA band 44, TDD | 703 MHz to 803 MHz |

[19] 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<br>(PAR = 11.15 dB) |
| | LTE TDD | LTE_TDD_64QAM_20MHZ.WV<br>(PAR = 11.10 dB) |

| | | |
|---|---|---|
| **Output level range** | depending on PAR | see general technical specifications |
| **Output level uncertainty** | waveform file used:<br>LTE_FDD_QPSK_10MHZ.WV | see general technical specifications |
| | waveform file used:<br>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,<br>bandwidth = 10 MHz, 50 resource blocks, PRB symbol offset = 3, 10 subframes, PCFICH present,<br>waveform file used:<br>LTE_FDD_QPSK_10MHZ.WV | < 2 %, RMS |
| | EVM PDSCH 64QAM,<br>bandwidth = 20 MHz, 100 resource blocks, PRB symbol offset = 2, uplink/downlink configuration 1, special subframe configuration 7,<br>waveform file used:<br>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,<br>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,<br>BASE: external TRIG B,<br>GPRF: BB generator,<br>LTE: free run (fast sync),<br>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),<br>magnitude error (ME),<br>phase error (PE),<br>frequency error,<br>I/Q origin offset,<br>TX power,<br>peak power,<br>resource block power (RB power) |
|---|---|---|
| | graphical | EVM versus SC-FDMA symbol,<br>ME versus SC-FDMA symbol,<br>PE versus SC-FDMA symbol,<br>EVM versus subcarrier,<br>in-band emissions,<br>spectrum flatness,<br>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 [20] + drift of timebase,<br>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,<br>$f_{RF}$ < 3300 MHz | > 50 dB |
| | allocated resource blocks ≤ 50,<br>$f_{RF}$ > 3300 MHz | > 47 dB |
| Expected nominal power setting for full dynamic range | RF1 COM, RF2 COM | see general technical specifications |

[20] 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, R&S®CMW-B300A/R&S®CMW-B300B options)

| | | |
|---|---|---|
| **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,<br>BASE: external TRIG B,<br>GPRF: BB generator,<br>LTE: free run (fast sync),<br>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),<br>magnitude error (ME),<br>phase error (PE),<br>frequency error,<br>I/Q origin offset,<br>TX power,<br>peak power,<br>resource block power (RB power) |
| | graphical | EVM versus SC-FDMA symbol,<br>ME versus SC-FDMA symbol,<br>PE versus SC-FDMA symbol,<br>EVM versus subcarrier,<br>in-band emissions,<br>spectrum flatness,<br>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 [21] + 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 |

[21] 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 [22]

| | | |
|---|---|---|
| **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,<br>BASE: external TRIG B,<br>GPRF: BB generator,<br>LTE: free run (fast sync),<br>LTE: 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 only.

## Modulation analysis

| | | |
|---|---|---|
| **Measured parameters** | numeric results | error vector magnitude (EVM),<br>magnitude error (ME),<br>phase error (PE),<br>frequency error,<br>I/Q origin offset,<br>TX power,<br>peak power,<br>reference symbol power,<br>OFDM symbol power |
| | graphical | EVM versus OFDMA symbol,<br>ME versus OFDMA symbol,<br>PE versus OFDMA symbol,<br>OFDM symbol power<br>spectrum flatness,<br>spectrum ACLR<br>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 [23] + drift of timebase,<br>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<br>3.84 MHz, RRC, α = 0.22, WCDMA filter<br>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 |

[23] 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,<br>BASE: external TRIG B,<br>GPRF: BB generator,<br>LTE: free run (fast sync),<br>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),<br>magnitude error (ME),<br>phase error (PE),<br>frequency error,<br>I/Q origin offset,<br>TX power,<br>peak power,<br>reference symbol power,<br>OFDM symbol power |
| | graphical | EVM versus OFDMA symbol,<br>ME versus OFDMA symbol,<br>PE versus OFDMA symbol,<br>OFDM symbol power<br>spectrum flatness,<br>spectrum ACLR,<br>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 [24] + 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<br>3.84 MHz, RRC, α = 0.22, WCDMA filter<br>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 |

[24] 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 2.1 + EDR, Version 4.0 + LE |
| | test standard | Radio Frequency Test Specification V1.2/V2.0/V2.0+EDR/V2.1/V2.1+EDR, Bluetooth® Low Energy RF PHY Test Specification, RF-PHY.TS/4.0.1 |

## Bluetooth® RF generator (prerequisite: R&S®CMW-B110A/R&S®CMW-B110D option)

| | | |
|---|---|---|
| **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** | depending on PAR | see general technical specifications |
| **Output level uncertainty** | 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 | | BT: 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 [25] |
| **Supported packet types** | basic rate | DH1, DH3, DH5 |
| | enhanced data rate (EDR) | 2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3, 3-DH5 |

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

| | | |
|---|---|---|
| **Measured parameters** | basic rate,<br>numeric results and standard deviation | Δf2 99.9 %,<br>frequency accuracy,<br>frequency drift,<br>maximum drift rate,<br>frequency deviation Δf1 average,<br>frequency deviation Δf1 minimum,<br>frequency deviation Δf1 maximum,<br>frequency deviation Δf2 average,<br>frequency deviation Δf2 minimum,<br>frequency deviation Δf2 maximum,<br>nominal power |
| **Measured parameters** | enhanced data rate (EDR),<br>numeric results and standard deviation | 99 % DEVM,<br>frequency stability $\omega_i$,<br>frequency stability $(\omega_o + \omega_i)_{max}$,<br>frequency stability $\omega_{o\,max}$,<br>RMS DEVM,<br>peak RMS,<br>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 average** | 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 related to frequency offset in preamble,<br>with 10101010 pattern | < 2 kHz |
| | referenced to frequency offset value in preamble | ≤ 1 kHz |

| | | |
|---|---|---|
| **Frequency stability $\omega_i$** | enhanced data rate | |
| Measurement range | | ±100 kHz |
| Uncertainty | for $\omega_i$ ≤ 75 kHz, for deviation ≤ 160 kHz | < 2 kHz |

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

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

# Bluetooth® signaling (prerequisite: R&S®CMW-KS600, R&S®CMW-KS610 or CMW-KS611 )

| | | |
|---|---|---|
| **Standard** | | Bluetooth® Core Specification<br>Version 2.1 + EDR<br>Version 4.0 + LE |

| | | |
|---|---|---|
| **Frequency range** | channels 0 to 78 | 2402 MHz to 2480 MHz |

| | | |
|---|---|---|
| **Output level range** | depending on PAR | see general technical specifications |
| **Output level uncertainty** | | see general technical specifications |
| **Output level resolution** | | see general technical specifications |

| | | |
|---|---|---|
| **GFSK modulation** | | |
| Modulation index uncertainty | basic rate,<br>11110000 pattern,<br>160 kHz frequency deviation | < 1 % |
| | low energy,<br>11110000 pattern<br>250 kHz frequency deviation | < 1 % |

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

| | | |
|---|---|---|
| **Dirty TX** | prerequisites: R&S CMW-KS610 or CMW-KS611 | |
| Drift uncertainty | basic rate | < 0.5kHz |
| | enhanced data rate | < 0.5kHz |
| | low energy | < 0.5kHz |
| 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 [26] |

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

# 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 | | BT: IF power |

## Modulation analysis

| | | |
|---|---|---|
| **Filter** | *filter bandwidth → wide* | bandpass 2.0 MHz |
| | *filter bandwidth → narrow* | bandpass 1.3 MHz |
| **Level range** | | –100 dBm to +42 dBm [27] |
| **Supported packet types** | | RF PHY Test Reference Packets |

| | | |
|---|---|---|
| **Measured parameters** | numeric results and standard deviation | Δf2 99.9%,<br>frequency accuracy,<br>frequency offset,<br>initial frequency drift,<br>frequency drift,<br>max drift rate,<br>frequency deviation Δf1 average,<br>frequency deviation Δf1 minimum,<br>frequency deviation Δf1 maximum,<br>frequency deviation Δf2 average,<br>frequency deviation Δf2 minimum,<br>frequency deviation Δf2 maximum,<br>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 average** | | |
| Measurement range | without frequency offset | ≤ 350 kHz |
| Uncertainty | for modulation index 0.40 to 0.60 | < 1.0 % |

| | | |
|---|---|---|
| **Initial frequency drift** | | |
| Measurement range | | ±75 kHz |
| Uncertainty | measured in burst related to frequency offset in preamble,<br>with 10101010 pattern | < 2 kHz |
| | referenced to frequency offset value in preamble | ≤ 1 kHz |

| | | |
|---|---|---|
| **Frequency drift** | | |
| Measurement range | | ±75 kHz |
| Uncertainty | measured in burst related to frequency offset in preamble,<br>with 10101010 pattern | < 2 kHz |

[27] 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)

| | | |
|---|---|---|
| **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** | depending 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)

| | | |
|---|---|---|
| **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** | depending 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)

| | | |
|---|---|---|
| **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<br>(PAR = 0.00 dB) |

| | | |
|---|---|---|
| **Output level range** | depending on PAR | see general technical specifications |
| **Output level uncertainty** | waveform file used:<br>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:<br>FM_M_M1K0_D75K0.WV | < 1 % |

# WLAN specifications

| | | |
|---|---|---|
| **Standard** | | IEEE 802.11a, IEEE 802.11b,<br>IEEE 802.11g, IEEE 802.11n,<br>IEEE 802.11ac |

## WLAN RF generator (prerequisite: R&S®CMW-B110A/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),<br>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<br>(PAR = 10.01 dB) |
| | in line with IEEE 802.11b CCK DQPSK | WLAN_B_CCK_DQPSK.WV<br>(PAR = 1.48 dB) |
| | in line with IEEE 802.11n 64QAM,<br>code rate 5/6 | WLAN_N_64QAM_5_6.WV<br>(PAR = 10.01 dB) |

| | | |
|---|---|---|
| **Output level range** | depending on PAR | see general technical specifications |
| **Output level uncertainty** | waveform files used:<br>WLAN_A_G_OFDM_64QAM.WV,<br>WLAN_B_CCK_DQPSK.WV<br>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,<br>EVM,<br>waveform file used:<br>WLAN_B_CCK_DQPSK.WV | < 4 %, peak |
| | IEEE 802.11a/g,<br>EVM all carriers,<br>waveform file used:<br>WLAN_A_G_OFDM_64QAM.WV | < –40 dB, RMS |
| | IEEE 802.11n,<br>EVM all carriers,<br>waveform file used:<br>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,<br>20 MHz, code rate 3/4 | WLAN_VHT_BW20_MCS8_LEN4096.WV<br>(PAR = 9.57 dB) |
| | in line with IEEE 802.11ac 256QAM,<br>40 MHz, code rate 3/4 | WLAN_VHT_BW40_MCS8_LEN4096.WV<br>(PAR = 11.22534 dB) |
| | in line with IEEE 802.11ac 256QAM,<br>80 MHz, code rate 3/4 | WLAN_VHT_BW80_MCS8_LEN4096.WV<br>(PAR = 10.23565 dB) |

| | | |
|---|---|---|
| **Output level range** | depending on PAR | see general technical specifications |
| **Output level uncertainty** | waveform files used:<br>WLAN_VHT_BW20_MCS8_LEN4096.WV<br>WLAN_VHT_BW40_MCS8_LEN4096.WV<br>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,<br>EVM all carriers,<br>waveform file used:<br>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,<br>prerequisite: R&S®CMW-KB036 option | 5000 MHz to 6000 MHz,<br>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,<br>WLAN: IF power |

## Modulation analysis

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

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

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

| **Error vector magnitude (EVM)** | | |
|---|---|---|
| Inherent EVM [29] | 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 [30], RMS | < –40 dB, RMS [31] |
| 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 [30] |
| | IEEE 802.11a (5 GHz band) | +12 dBm to +42 dBm [30] |

## 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,<br>WLAN: IF power |

[29] Measured with channel estimation based on payload.

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

[31] 3 dB less with R&S®CMW-H590D RF frontend (ADV.).

| | | |
|---|---|---|
| **High throughput (HT)** | | |
| PPDU format | | legacy mode,<br>mixed mode,<br>greenfield mode |

## Modulation analysis

| | | |
|---|---|---|
| **Bandwidth** | | 20 MHz, 40 MHz |
| **Level range** | | –28 dBm to +42 dBm [32] |
| **Payload length** | | ≥ 16 symbol |
| **Analysis modes** | | BPSK code rate 1/2 (MCS0),<br>BPSK code rate 3/4,<br>QPSK code rate 1/2 (MCS1),<br>QPSK code rate 3/4 (MCS2),<br>16QAM code rate 1/2 (MCS3),<br>16QAM code rate 3/4 (MCS4),<br>64QAM code rate 1/2,<br>64QAM code rate 2/3 (MCS5),<br>64QAM code rate 3/4 (MCS6),<br>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,<br>EVM all carriers,<br>EVM data carriers,<br>EVM pilot carriers,<br>center frequency error,<br>symbol clock error,<br>I/Q offset,<br>gain imbalance,<br>quadrature error |
| | graphical | EVM versus symbol,<br>EVM versus carrier,<br>spectrum flatness |

| | | |
|---|---|---|
| **Error vector magnitude (EVM)** | | |
| Inherent EVM [33] | IEEE 802.11n (2.4 GHz band) | |
| | –28 dBm ≤ input level ≤ +42 dBm [32], RMS | < –40 dB, RMS [34] |
| | IEEE 802.11n (5 GHz band) | |
| | –18 dBm ≤ input level ≤ +42 dBm [32], RMS | < –40 dB, RMS [34] |
| Measurement length | | entire PPDU |

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

| | | |
|---|---|---|
| **Symbol clock error** | | |
| Uncertainty | | < 1 ppm |

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

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

[33] Measured with channel estimation based on payload.

[34] 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 [35] |
| | IEEE 802.11n (5 GHz band) | +12 dBm to +42 dBm [35] |

## 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,<br>greenfield mode |

### Modulation analysis

| Bandwidth | | 20 MHz, 40MHz |
|---|---|---|
| Level range | | –28 dBm to +42 dBm [35] |
| Payload length | | ≥ 16 symbol (max. 1024) |
| Analysis modes [36] | | MCS0 to MCS7: data and pilot,<br>MCS8 to MCS31: pilot only,<br>MCS33 to MCS76: pilot only |
| Measured parameters | numeric results and standard deviation | total power, STS1 to STS4 power,<br>EVM all carriers,<br>EVM data carriers,<br>EVM pilot carriers,<br>center frequency error |

| Error vector magnitude (EVM) | | |
|---|---|---|
| Inherent EVM [37] | IEEE 802.11n (2.4 GHz band) | |
| | –28 dBm ≤ input level ≤ +42 dBm [35], RMS | < –40 dB, RMS [38] |
| | IEEE 802.11n (5 GHz band) | |
| | –18 dBm ≤ input level ≤ +42 dBm [35], RMS | < –40 dB, RMS [38] |
| Measurement length | | entire PPDU |

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

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

[37] Measured with channel estimation based on payload.

[38] 3 dB less with R&S®CMW-H590D RF frontend (ADV.).

| Center frequency error | | |
|---|---|---|
| Frequency measurement uncertainty | IEEE 802.11n (2.4 GHz band),<br>for ≥ 100 symbol (400 µs) | < 20 Hz + drift of timebase,<br>see general technical specifications |
| | IEEE 802.11n (5 GHz band),<br>for ≥ 100 symbol (400 µs) | < 35 Hz + drift of timebase,<br>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),<br>prerequisite: R&S®CMW-KB036 option | 5000 MHz to 6000 MHz,<br>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,<br>greenfield mode |

## Modulation analysis

| Bandwidth | | 20 MHz, 40 MHz |
|---|---|---|
| Level range | | –28 dBm to +42 dBm [39] |
| Payload length | | ≥ 16 symbol |
| Analysis modes | | BPSK code rate 1/2 (MCS0),<br>BPSK code rate 3/4,<br>QPSK code rate 1/2 (MCS1),<br>QPSK code rate 3/4 (MCS2),<br>16QAM code rate 1/2 (MCS3),<br>16QAM code rate 3/4 (MCS4),<br>64QAM code rate 1/2,<br>64QAM code rate 2/3 (MCS5),<br>64QAM code rate 3/4 (MCS6),<br>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,<br>EVM all carriers,<br>EVM data carriers,<br>EVM pilot carriers,<br>center frequency error,<br>symbol clock error, |
| | numeric results for each spatial stream | EVM all carriers,<br>EVM data carriers,<br>EVM pilot carriers<br>power<br>I/Q offset |

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

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

| | | |
|---|---|---|
| **Frequency range** | WLAN IEEE 802.11p,<br>prerequisite: R&S®CMW-KB036 option | 5000 MHz to 6000 MHz,<br>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 |

## Modulation analysis

| | | |
|---|---|---|
| **Filter** | | 5 MHz, 10 MHz, 20 MHz |
| **Level range** | | –28 dBm to +42 dBm [40] |
| **Payload length** | | ≥ 16 symbol |
| **Analysis modes** | OFDM 5 MHz channel spacing | 1.5 Mbps BPSK,<br>2.25 Mbps BPSK,<br>3 Mbps QPSK,<br>4.5 Mbps QPSK,<br>6 Mbps 16QAM,<br>9 Mbps 16QAM,<br>12 Mbps 64QAM,<br>13.5 Mbps 64QAM |
| | OFDM 10 MHz channel spacing | 3 Mbps BPSK,<br>4.5 Mbps BPSK,<br>6 Mbps QPSK,<br>9 Mbps QPSK,<br>12 Mbps 16QAM,<br>18 Mbps 16QAM,<br>24 Mbps 64QAM,<br>27 Mbps 64QAM |
| | OFDM 20 MHz channel spacing | 6 Mbps BPSK,<br>9 Mbps BPSK,<br>12 Mbps QPSK,<br>18 Mbps QPSK,<br>24 Mbps 16QAM,<br>36 Mbps 16QAM,<br>48 Mbps 64QAM,<br>54 Mbps 64QAM |

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

| | | |
|---|---|---|
| **Error vector magnitude (EVM)** | | |
| Inherent EVM [41] | –18 dBm ≤ input level ≤ +42 dBm [40], RMS | < –40 dB, RMS [42] |
| Measurement length | | entire PPDU |

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

[41] Measured with channel estimation based on payload.

[42] 3 dB less with R&S®CMW-H590D RF frontend (ADV.).

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

| **Symbol clock error** | | |
|---|---|---|
| Uncertainty | | < 1 ppm |

| **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 [43] |

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

| **Frequency range** | WLAN IEEE 802.11ac (5 GHz band),<br>prerequisite: R&S®CMW-KB036 option | 5000 MHz to 6000 MHz,<br>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 [43] |
| **Payload length** | | ≥ 1 symbol |
| **Analysis modes** | | BPSK code rate 1/2 (MCS0),<br>BPSK code rate 3/4,<br>QPSK code rate 1/2 (MCS1),<br>QPSK code rate 3/4 (MCS2),<br>16QAM code rate 1/2 (MCS3),<br>16QAM code rate 3/4 (MCS4),<br>64QAM code rate 1/2,<br>64QAM code rate 2/3 (MCS5),<br>64QAM code rate 3/4 (MCS6),<br>64QAM code rate 5/6 (MCS7)<br>256QAM code rate 3/4 (MCS8)<br>256QAM code rate 5/6 (MCS9) |

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

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

| | | |
|---|---|---|
| **Error vector magnitude (EVM)** | | |
| Inherent EVM [44] | bandwidth 20 MHz, 40 MHz, 80 MHz | |
| | –18 dBm ≤ input level ≤ +42 dBm [45], RMS | < –38 dB, RMS [46] |
| | bandwidth 160 MHz | |
| | –15 dBm ≤ input level ≤ +42 dBm [45], RMS | typ. < –38 dB, RMS [46] |
| Measurement length | | entire PPDU |

| | | |
|---|---|---|
| **Center frequency error** | | |
| Frequency measurement uncertainty | for ≥ 100 symbol (400 µs) | < 35 Hz + drift of timebase,<br>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 [45] |

[44] Measured with channel estimation based on payload.

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

[46] 3 dB less with R&S®CMW-H590D RF frontend (ADV.).

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

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

| | | |
|---|---|---|
| **Frequency range** | WLAN IEEE 802.11n (2.4 GHz band),<br>WLAN IEEE 802.11g (OFDM),<br>(2.4 GHz band) | 2412 MHz to 2484 MHz |
| | WLAN IEEE 802.11a (5 GHz band),<br>WLAN IEEE 802.11n (5 GHz band),<br>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 |
| **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<br>(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 0,<br>All 1,<br>bit pattern: 0101,<br>bit pattern: 1010,<br>pseudo random,<br>PN9 to PN32 |
| **Mobile capabilities** | | MAC address,<br>MAC version |

## Features

| | | |
|---|---|---|
| **Connection status** | status indication | signal on,<br>associated,<br>authenticated,<br>probed,<br>deauthenticated |
| **Trigger output** | WLAN signaling: frame trigger | adjustable pulse width,<br>invertible |
| | WLAN signaling: RX trigger | invertible |

# WiMAX™ specifications – mobile station and base station test [47]

| | | |
|---|---|---|
| **Standard** | | IEEE 802.16e-2005, OFDMA |

## WiMAX™ RF generator (prerequisite: R&S®CMW-B110A/R&S®CMW-B110D option)

| | | |
|---|---|---|
| **Frequency range** | WiMAX™ band 1 | 2300 MHz to 2800 MHz |
| | WiMAX™ band 2,<br>prerequisite: R&S®CMW-KB036 option | 3300 MHz to 3800 MHz |
| | WiMAX™ band 3,<br>prerequisite: R&S®CMW-KB036 option | 5100 MHz to 5850 MHz |

### WiMAX™ WinIQSIM2™ (R&S®CMW-KW700 option)

| | | |
|---|---|---|
| **Arbitrary waveform file** | in line with IEEE 802.16e-2005,<br>OFDMA average power | WIMAX_DL_3-BURST_46_5MS.WV<br>(PAR = 11.11 dB) |

| | | |
|---|---|---|
| **Output level range** | depending on PAR | see general technical specifications |
| **Output level uncertainty** | waveform file used:<br>WIMAX_DL_3-BURST_46_5MS.WV | see general technical specifications |
| **Output level resolution** | | see general technical specifications |

| | | |
|---|---|---|
| **Signal quality** | | |
| Error vector magnitude (EVM) | ID_Cell = 0, permbase = 0, prbs_id = 0,<br>cp = 1/8, BW = 10 MHz,<br>bursts: FCH, DL-MAP, data PN15,<br>modulation type and coding rate<br>QPSK 1/2;<br>waveform file used:<br>WIMAX_DL_3BURST_46_5MS.WV | < –40 dB, RMS |

## WiMAX™ RF analyzer (R&S®CMW-KM700, R&S®CMW-KM701 options)

| | | |
|---|---|---|
| **FFT size** | | 512, 1024 |
| **Bandwidth** | | 3.5 MHz, 5 MHz, 7 MHz, 8.75 MHz,<br>10 MHz |
| **Link direction** | | uplink, downlink |
| **Subcarrier allocation** | | DL PUSC, UL PUSC,<br>uplink collaborative MIMO |

| | | |
|---|---|---|
| **Frequency range** | WiMAX™ band 1 | 2300 MHz to 2800 MHz |
| | WiMAX™ band 2,<br>prerequisite: R&S®CMW-KB036 option | 3300 MHz to 3800 MHz |
| | WiMAX™ band 3,<br>prerequisite: R&S®CMW-KB036 option | 5100 MHz to 5850 MHz,<br>for frequency exceptions for inherent spurious response, see general technical specifications |
| **Level setting** | | manual mode |
| **Level range** | RF1 COM, RF2 COM | –40 dBm to +27 dBm, RMS |

| | | |
|---|---|---|
| **Statistics** | | |
| Statistical count | | 1 to 1000 |
| Values | | current, average, minimum, maximum |

| | | |
|---|---|---|
| **Trigger** | | |
| Trigger source | | BASE: external TRIG A,<br>BASE: external TRIG B,<br>GPRF: BB generator,<br>WiMAX™: IF power,<br>WiMAX™ signaling: frame trigger |

[47] R&S®CMW500 and R&S®CMW270 only

| | | |
|---|---|---|
| **Measured parameters** | numeric results | RMS power (subframe, burst, preamble),<br>subcarrier power,<br>crest factor,<br>error vector magnitude<br>(all carriers, pilot carriers, data carriers),<br>unmodulated EVM,<br>frequency error,<br>sample clock error,<br>I/Q DC offset,<br>I/Q imbalance gain,<br>I/Q imbalance quadrature,<br>RSSI,<br>CINR,<br>spectrum flatness,<br>spectrum flatness, neighbor,<br>occupied bandwidth,<br>spectrum emission mask,<br>adjacent channel power |
| | graphical<br>with the R&S®CMW-KM700 option | power versus time,<br>constellation diagram |
| | graphical<br>with the R&S®CMW-KM700 and<br>R&S®CMW-KM701 options | FFT,<br>spectral flatness,<br>spectral flatness, neighbor,<br>spectrum emission mask,<br>adjacent channel power,<br>CCDF,<br>EVM versus carrier,<br>EVM versus symbol |

## Power measurement

| | | |
|---|---|---|
| **Power** | RMS detector | |
| Level uncertainty | | see general technical specifications [48] |

## Modulation analysis

| | | |
|---|---|---|
| **Error vector magnitude** | | |
| Measurement range | | from inherent EVM up to –12 dB |
| Inherent EVM [48] | WiMAX™ band 1 UL | |
| | –15 dBm ≤ input level ≤ +27 dBm | < –40 dB, RMS |
| | –35 dBm ≤ input level < –15 dBm | < –36 dB, RMS |
| | WiMAX™ band 2 UL | |
| | –15 dBm ≤ input level ≤ +27 dBm | < –38 dB, RMS |
| | –35 dBm ≤ input level < –15 dBm | < –35 dB, RMS |
| | WiMAX™ band 3 UL | |
| | –15 dBm ≤ input level ≤ +27 dBm | < –38 dB, RMS |
| | –35 dBm ≤ input level < –15 dBm | < –35 dB, RMS |
| | WiMAX™ band 1 DL | |
| | –18 dBm ≤ input level ≤ +27 dBm | < –38 dB, RMS |
| | WiMAX™ band 2 DL | |
| | –18 dBm ≤ input level ≤ +27 dBm | < –36 dB, RMS |
| | WiMAX™ band 3 DL | |
| | –18 dBm ≤ input level ≤ +27 dBm | < –36 dB, RMS |

| | | |
|---|---|---|
| **Frequency error** | | |
| Measurement range | FFT size 512, BW = 3.5 MHz | –27.34 kHz to +27.34 kHz |
| | FFT size 512, BW = 5 MHz | –38.28 kHz to +38.28 kHz |
| | FFT size 1024, BW = 7 MHz | –27.34 kHz to +27.34 kHz |
| | FFT size 1024, BW = 8.75 MHz | –34.18 kHz to +34.18 kHz |
| | FFT size 1024, BW = 10 MHz | –38.28 kHz to +38.28 kHz |
| Frequency measurement uncertainty | | < 10 Hz + drift of timebase,<br>see general technical specifications [48] |

[48] Averaging across 100 bursts, UL: BW = 10 MHz, zone length = 18 symbols / 210 slots; DL: BW = 10 MHz, zone length = 34 symbols / 30 subchannels, channel estimation = payload.

| **Sample clock error** [49] | | |
|---|---|---|
| Measurement range | | –5 ppm to +5 ppm |
| Sample clock measurement uncertainty | | < 0.1 ppm |

| **I/Q imbalance** [49] | | |
|---|---|---|
| Inherent I/Q gain imbalance | | < 0.1 dB |
| Inherent I/Q quadrature imbalance | | < 0.1° |

| **Spectrum flatness, neighbor** [49] | | |
|---|---|---|
| Level uncertainty | inner carriers/outer carriers | < 0.5 dB |
| | neighbor subcarriers | < 0.1 dB |

### Spectrum measurements

| **Adjacent channel power** | RMS detector | |
|---|---|---|
| Filter | | rectangle 5 MHz, 10 MHz<br>3.84 MHz or 7.68 MHz, RRC, α = 0.22, WCDMA |
| Dynamic range | adjacent channels | > 45 dB |
| Expected nominal power setting for full dynamic range | RF1 COM, RF2 COM | > –3 dBm |

| **Spectrum emission mask (SEM)** | RMS detector | |
|---|---|---|
| Frequency span | | 60 MHz |
| Supported masks | | IEEE, WiMAX Forum®, TTA, user-defined |
| Dynamic range | relative limit of IEEE mask | > 50 dB |
| Expected nominal power setting for full dynamic range | RF1 COM, RF2 COM | > –3 dBm |

## WiMAX™ signaling base station emulator (SISO prerequisite: R&S®CMW-KS700, R&S®CMW-B200A, R&S®CMW-B270A options, MIMO prerequisite: R&S®CMW-KS700, R&S®CMW-KS701, R&S®CMW-KS702, R&S®CMW-B200A, R&S®CMW-B270A options)

| **Standard** | | IEEE 802.16e |
|---|---|---|
| **Physical layer mode** | | OFDMA |

| **Frequency range** | | |
|---|---|---|
| WiMAX™ band 1, WiMAX™ band 2, WiMAX™ band 3 | DL | see WiMAX™ RF generator specifications |
| | UL | see WiMAX™ RF analyzer specifications |

| **Output level range** | | |
|---|---|---|
| RF1 COM, RF2 COM, RF1 OUT | peak envelope power (PEP) | see general technical specifications |
| | preamble power | up to –17.7 dBm [50] offset to peak envelope power |
| | single data subcarrier power | up to –51.2 dBm [50] offset to peak envelope power |
| **Output level uncertainty** | | see general technical specifications |
| **Output level resolution** | | see general technical specifications |
| **Output level setting** | | manual mode |
| **Output level reference** | DL | single data subcarrier power |

[49] Averaging across 100 bursts, UL: BW = 10 MHz, zone length = 18 symbols / 210 slots; DL: BW = 10 MHz, zone length = 34 symbols / 30 subchannels, channel estimation = payload.

[50] BW = 10 MHz, all subchannels used.

## Physical layer

| | | |
|---|---|---|
| **FFT size** | | 512, 1024 |
| **Bandwidth** | | 3.5 MHz, 5 MHz, 7 MHz, 8.75 MHz, 10 MHz |
| **Duplexing** | | TDD mode |
| **Frame duration** | | 5 ms |
| **Cyclic prefix** | | 1/8 |
| **Number of OFDMA symbols** | | 26 to 35 |
| **Link mode** | | SISO,<br>MIMO – Matrix A,<br>MIMO – Matrix B,<br>MIMO – collaborative pattern A,<br>MIMO – collaborative pattern B |
| **Zone** | DL | first zone, second zone |
| | UL | first zone, second zone |
| **Segmentation** | DL | first zone |
| **Subcarrier allocation** | | first zone: PUSC<br>second DL zone: PUSC, FUSC, AMC 2x3<br>second UL zone: PUSC, AMC 2x3 |
| **Modulation** | FEC code type: DL | QPSK 1/2, QPSK 3/4, 16QAM 1/2, 16QAM 3/4, 64QAM 1/2, 64QAM 2/3, 64QAM 3/4, 64QAM 5/6 |
| | FEC code type: UL | QPSK 1/2, QPSK 3/4, 16QAM 1/2, 16QAM 3/4, 64QAM 5/6 |
| **Channel coding** | | convolutional (CC), turbo (CTC) |

## Measurements

| | | |
|---|---|---|
| **PER** | | |
| Measurement range | graphically displayed, stop on limit fail | 0 % to 100 % |
| Payload mode | auto mode and user-defined mode | region, data interval, payload size |
| Acknowledge type | | ARQ, HARQ, ping |
| Number of HARQ subbursts | HARQ, ARQ in HARQ, ICMP in HARQ | 2 |
| Data | DL | All 0,<br>All 1,<br>bit pattern: 0101,<br>bit pattern: 1010,<br>pseudo random,<br>PN9 to PN23 |
| Estimated BER | | ARQ, HARQ, ping |
| **Physical parameters** | graphically displayed | power,<br>frequency offset,<br>timing offset |
| **Mobile capabilities** | | MAC address,<br>DL service flows,<br>UL service flows,<br>time adjustment,<br>carrier frequency error<br>max. TX power,<br>carrier permutation support summary,<br>ARQ type support summary,<br>mobility feature support summary |
| **Measurement reports** | reported from DUT | RSSI, CINR (mean and SD), TX power |
| **CQICH** | | physical and effective CINR |

### Features

| | | |
|---|---|---|
| **Connection status** | status indication | signal on,<br>network entry completed,<br>waiting for CDMA RNG-RSP,<br>waiting for initial RNG-RSP,<br>waiting for SBC-RSP,<br>waiting for REG-RSP,<br>deregistered,<br>MS disconnected |
| **MS capability tests** | | sleep mode,<br>idle mode,<br>cell reselection,<br>handover |
| **Cell reselection** | | MS/BS scan initiation, neighbor cell configuration for advertisement |
| **Handover test** | | MS/BS initiation, neighbor cell configuration |
| **Ranging control** | | initial ranging, periodic ranging |
| **Power control** | | open loop, closed loop |
| **Power boosting** | | preamble, pilots, FCH, DL map, UL map, data and management bursts |
| **Burst allocation mode** | data burst region | optimized,<br>normal |
| **Bandwidth allocation mode** | data burst region | dynamic,<br>fixed |
| **Dummy burst generator** | unused symbols filled with | pilots, dummy burst |
| **Sample frequency offset** | | −1000 Hz to +1000 Hz |
| **AWGN** | CN ratio | −6 dB to +40 dB, two channels |
| **Trigger output** | WiMAX™ signaling: frame trigger | adjustable offset (positive and negative),<br>adjustable pulse width,<br>slope |
| **Service flows** | | fragmentation control,<br>UL ACK channel configuration |

## WiMAX™ IP application enabler (prerequisite: R&S®CMW-KA700, R&S®CMW-B660, R&S®CMW-B661 options)

| | | |
|---|---|---|
| **Key features** | | throughput measurement and end-to-end application testing |
| **Interface** | rear panel | 1 GBaseT |
| **Convergence sublayer** | IP version | V4 |
| **Protocols** | | DHCP, RIP |
| **DHCP support** | | enable, disable (static IP) |
| **Network settings** | | WiMAX™ stack IP,<br>MS IP address (destination),<br>subnet mask,<br>gateway,<br>DNS server |
| **Interface to IP-based server/client applications** | | e.g. IPERF (throughput test),<br>e.g. web browsing,<br>e.g. FTP file transfer,<br>e.g. video streaming,<br>e.g. VoIP |
| **Data throughput** | end-to-end IP connection | |
| | DL: UDP, SISO | up to 17.2 Mbps |
| | DL: UDP, MIMO | up to 36.5 Mbps |
| | UL: UDP, SISO | up to 9.7 Mbps |

# TD-SCDMA specifications – mobile station (UE) test [51]

| | | |
|---|---|---|
| **Standard** | | TD-SCDMA CWTS |

## TD-SCDMA RF generator (prerequisite: R&S®CMW-B110A/R&S®CMW-B110D option)

| | | |
|---|---|---|
| **Frequency range** [52] | 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** | depending 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** [52] | 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,<br>BASE: external TRIG B,<br>GPRF: BB generator,<br>TD-SCDMA: free run,<br>TD-SCDMA: IF power |

[51] R&S®CMW500 and R&S®CMW290 only.

[52] 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 [53] |
| **Analysis modes** | TD-SCDMA uplink | QPSK, DPCH,<br>QPSK, DPCH + HSDPA,<br>16QAM, DPCH + HSUPA |
| **Measured parameters** | numeric results and standard deviation | error vector magnitude (EVM),<br>magnitude error (ME),<br>phase error (PE),<br>frequency error,<br>I/Q origin offset,<br>I/Q imbalance,<br>UE power |
| | graphical | EVM versus time,<br>ME versus time,<br>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,<br>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 [53] |
| **Analysis modes** | TD-SCDMA uplink | QPSK, DPCH,<br>QPSK, DPCH + HSDPA,<br>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 [53] |

[53] 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 [54] |
| Level uncertainty | | see general technical specifications |
| Measurement length | | 1 slot |

## TD-SCDMA signaling (prerequisite: R&S®CMW-KS750, R&S®CMW-B300A/R&S®CMW-B300B options)

| | | |
|---|---|---|
| **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, depending 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 |

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

# CDMA2000® 1xRTT specifications – mobile station test [55]

| | | |
|---|---|---|
| **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)

| | | |
|---|---|---|
| **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 |

### CDMA2000® GEN (R&S®CMW-KG800 option)

| | | |
|---|---|---|
| **Output level range** | depending 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** | depending 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 |

[55] 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 |

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

| | | |
|---|---|---|
| **Trigger** | | |
| Trigger sources | | BASE: external TRIG A,<br>BASE: external TRIG B,<br>GPRF: BB generator,<br>C2K: free run,<br>CDMA2000® signaling: superframe (80 ms) |

## Modulation analysis

| | | |
|---|---|---|
| **Filter** | | 1.23 MHz, RRC, α = 0.22, CDMA filter |
| **Level range** | | –28 dBm to +42 dBm [56] |
| **Analysis modes** | | OQPSK, HPSK |
| **Measured parameters** | numeric results and standard deviation | error vector magnitude (EVM),<br>magnitude error (ME),<br>phase error (PE),<br>frequency error,<br>rho,<br>carrier feedthrough,<br>I/Q imbalance,<br>power,<br>wideband power (8 MHz),<br>narrowband power (1.23 MHz) |
| | graphical | EVM versus time,<br>ME versus time,<br>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 |
| Measurement length | | 0.5 ms |

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

| **Frequency error** | | |
|---|---|---|
| Measurement range | | ±3 kHz |
| Frequency measurement uncertainty | | < 20 Hz + drift of timebase,<br>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 [57] |
| **Measured parameters** | numeric values of current, average, max. and min. values | code domain power (CDP),<br>code domain error (CDE) |
| | graphical | code domain power versus code,<br>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,<br>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 [57] |
| 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 [57] |
| Level uncertainty | | see general technical specifications |
| Measurement length | | 616 chip (0.5 ms) |

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

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

| **Frequency range** | | |
|---|---|---|
| Band class 0 to band class 19 | DL | see CDMA2000® 1xRTT RF generator specifications |
| | UL | see CDMA2000® 1xRTT RF analyzer specifications |

| | | |
|---|---|---|
| **Output level range** | depending on PAR | see general technical specifications |
| **Output level uncertainty** | | see general technical specifications |
| **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),<br>8k enhanced or EVRC-A (SO 3),<br>13k or QCELP (SO 17),<br>EVRC-B (SO 68),<br>EVRC-WB (SO 70),<br>EVRC-NW (SO 73) |

# CDMA2000® 1xEV-DO specifications – access terminal test [58]

| | | |
|---|---|---|
| **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)

| | | |
|---|---|---|
| **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 |

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

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

| | | |
|---|---|---|
| **Output level range** | depending 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 |
| | 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 |

[58] R&S®CMW500 and R&S®CMW290 only.

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

| **Trigger** | | |
|---|---|---|
| Trigger sources | | BASE: external TRIG A,<br>BASE: external TRIG B,<br>GPRF: BB generator,<br>1xEV-DO: free run,<br>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 [59] |
| **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),<br>magnitude error (ME),<br>phase error (PE),<br>frequency error,<br>rho,<br>carrier feedthrough,<br>I/Q imbalance,<br>power,<br>wideband power (8 MHz for single carrier or 16 MHz for multicarrier),<br>narrowband power (1.23 MHz) |
| | graphical | EVM versus time,<br>ME versus time,<br>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,<br>see general technical specifications |

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

| **I/Q imbalance** | | |
|---|---|---|
| Inherent I/Q imbalance | | < –50 dB |

[59] 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 [60] |
| **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 [60] |
| 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 [60] |
| 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, R&S®CMW-B230A options)

| | | |
|---|---|---|
| **Frequency range** | | |
| Band class 0 to band class 19 | DL | see CDMA2000® 1xEV-DO RF generator specifications |
| | UL | see CDMA2000® 1xEV-DO RF analyzer specifications |

| | | |
|---|---|---|
| **Output level range** | depending 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 | |

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

# Data application unit (R&S®CMW-B450D option)

The R&S®CMW-B450D option provides data test capabilities and makes a Gigabit Ethernet connector available 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 |

## Enabling of IP data interface for IPV4 (R&S®CMW-KA100 option)

## Enabling of IP data interface for IPV6 (R&S®CMW-KA150 option)

## IP multimedia subsystem server (R&S®CMW-KAA20 option)

| | | |
|---|---|---|
| **IMS server**<br>**VoIMS application, SMS application** | | IMS registration,<br>voice over IMS,<br>SMS over IMS |

## Data application measurements (R&S®CMW-KM050 option)

| | | |
|---|---|---|
| **Measured parameters** | | ping,<br>IPerf,<br>IP throughput,<br>DNS requests,<br>IP logging |
| **IP impairments** | | up to 7 filter rules,<br>delay,<br>jitter,<br>packet loss,<br>packet corruption |

## IP analysis (R&S®CMW-KM051 option)

| | | |
|---|---|---|
| **Measured parameters** | | TCP analysis,<br>IP connectivity,<br>data amount per destination/protocol,<br>trigger per IP flow,<br>throughput per IP flow |

## LAN DAU interface

| | | |
|---|---|---|
| **LAN DAU** | | Ethernet RJ-45 connector, 1000 Mbps |

# Digital I/Q 1 to 4 (R&S®CMW-B510F option) and digital I/Q 5 to 8 (R&S®CMW-B520F option) [61]

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 for connecting 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 [62] | 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 for connecting 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 |

[61] R&S®CMW500 and R&S®CMW270 only.

[62] 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, 100 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:<br>• EN 61326-1 (industrial environment)<br>• EN 61326-2-1<br>• 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:<br>• UL 61010-1<br>• 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.,<br>55 Hz to 150 Hz, 0.5 g const.,<br>in line with EN 60068-2-6 |
| Vibration | random | 10 Hz to 300 Hz, acceleration 1.2 g RMS,<br>in line with EN 60068-2-64 |
| Shock | | 40 g shock spectrum,<br>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 | | max. 850 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<br>(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<br>(18.31 in × 7.77 in × 20.35 in) |
|---|---|---|
| | for rackmounting | 19" 1/1, 4 HU, 450 |
| **Weight** | single tester, nonsignaling | approx. 14 kg<br>(approx. 31 lb) |
| | with typical options | approx. 18 kg<br>(approx. 40 lb) |

| **Calibration interval** | 12 months | recommended for highest accuracy,<br>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**<br>Base unit with following accessories:<br>power cord, operating manual (quick start guide), comprehensive documentation on CD-ROM | R&S®CMW500 | 1201.0002K50 |
| **Wireless Connectivity Tester**<br>Base unit with following accessories:<br>power cord, operating manual (quick start guide), comprehensive documentation on CD-ROM | R&S®CMW270 | 1201.0002K75 |
| **Functional Radio Communication Tester**<br>Base unit with following accessories:<br>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 5213.9211.12) or ask your local Rohde & Schwarz expert to find the solution that is optimally suited to 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;<br>additional cable for R&S®CMW-B510F used with<br>e.g. R&S®AMU200A, R&S®EX-IQ-Box | R&S®SMU-Z6 [63] | 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 a term of one to four years (WE1 to WE4)**
Repairs carried out during the contract term are free of charge [64]. Necessary calibration and adjustments carried out during repairs are also covered. Simply contact the forwarding agent we name; your product will be picked up free of charge and returned to you in top condition a couple of days later.

**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 [64] and calibration at the recommended intervals as well as any calibration carried out during repairs or option upgrades.

**For product brochure, see PD 5213.9211.12 and www.rohde-schwarz.com**

[63] R&S®CMW500 and R&S®CMW270 only.

[64] 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

### About Rohde&Schwarz

The Rohde&Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, radiomonitoring and radiolocation. Founded more than 80 years ago, this independent company has an extensive sales and service network and is present in more than 70 countries. The electronics group is among the world market leaders in its established business fields. The company is headquartered in Munich, Germany. It also has regional headquarters in Singapore and Columbia, Maryland, USA, to manage its operations in these regions.

### 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


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