

# R&S® CMW500 Wideband Radio Communication Tester

Wireless device  
production test:  
breakthrough in  
scalability and speed



**75** Years of  
Driving  
Innovation



# R&S®CMW500 Wideband Radio Communication Tester At a glance

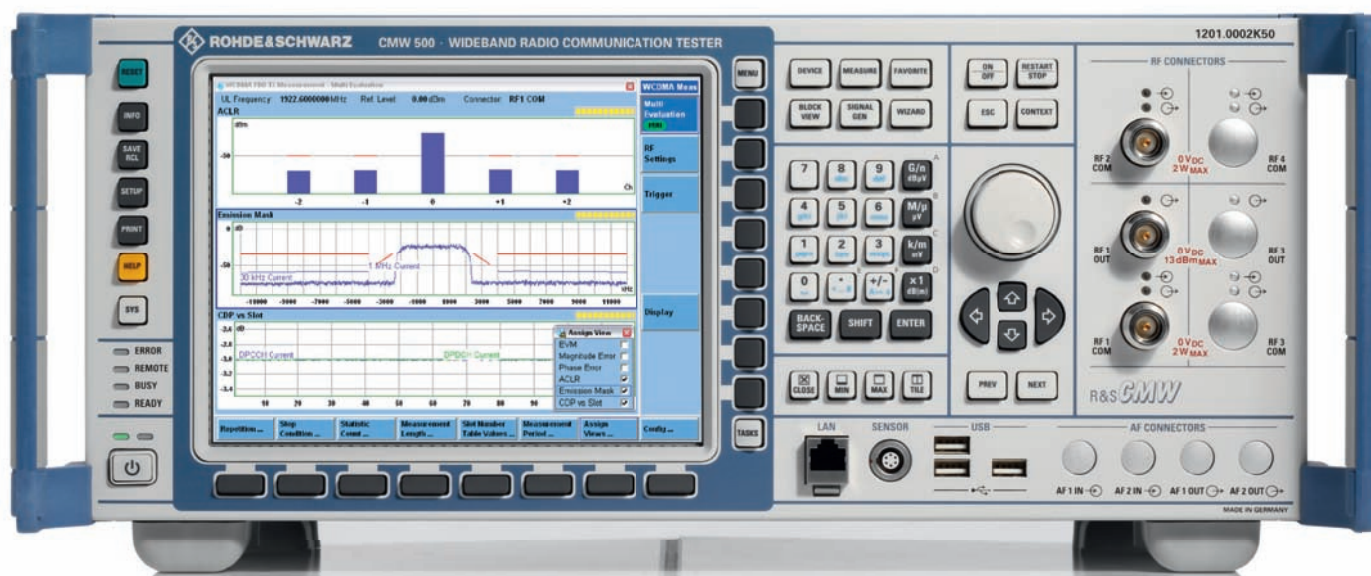
The R&S®CMW500 marks the entry of a new generation of test equipment from Rohde & Schwarz. It allows fast and precise production testing of current and future wireless devices from a basic mobile phone to the most sophisticated PDA.

The new tester includes the R&S®Smart Alignment<sup>1)</sup> high-speed test concept plus the all-in-one architecture with integrated vector signal generator and analyzer. These are the prerequisites for state-of-the-art non-signaling alignment approaches.

The extreme scalability, test speed, and measurement accuracy of the R&S®CMW500 translate into minimum test costs.

## Key facts

- Multitechnology solution: GSM/GPRS/EDGE/WCDMA/HSPA/Mobile WiMAX™/CDMA2000®<sup>2)</sup>/1xEV-DO/TD-SCDMA
- Base model: general-purpose RF power meter and CW generator with List modes for fast calibration<sup>1)</sup> of wireless devices
- Vector signal analyzer (VSA) for transmitter verification<sup>1)</sup>
- Vector signal generator (VSG) for expanded receiver testing: ARB mode<sup>1)</sup> for short setup times or online mode<sup>1)</sup> for complex signals with high data volume
- Reference RF power measurement enabled by direct connection of R&S®NRP-Zxx power sensors
- Easy connection to wireless devices with complex RF architecture by using the integrated RF interface
- State-of-the-art graphical user interface (GUI)
- SCPI remote control via LAN/GPIB interface
- Ready for LXI Class C
- Process controller with Windows® XP operating system for test routines and remote control via Windows® Remote Desktop



# R&S®CMW500

## Wideband Radio Communication Tester

### Benefits and key features

#### **Future-proof for all important technologies of today and tomorrow**

3.3/6 GHz frequency range and 40/70 MHz analyzer/generator IF bandwidth

▷ [page 4](#)

#### **User-specific selection of test strategy**

Powerful Rohde & Schwarz analyzer/generator modules for Rohde & Schwarz applications or user-specific evaluations/waveforms

▷ [page 5](#)

#### **Drastically reduced test costs; alignment up to ten times faster**

Innovative Rohde & Schwarz test concepts: R&S®Smart Alignment<sup>1)</sup> and R&S®Multi-Evaluation<sup>1)</sup>

▷ [page 6](#)

#### **Designed for high first pass yield**

High absolute accuracy plus repeatability and linearity

▷ [page 7](#)

#### **Optimized handling for production test systems**

All-in-one architecture<sup>1)</sup> with fully automatic RF path correction<sup>1)</sup> and Press & Go<sup>1)</sup> applications

▷ [page 8](#)

#### **Reduced operating costs due to 24-month calibration interval**

Optimized solution for every application: selectable calibration interval of 12 or 24 months for high absolute accuracy or reduced costs

▷ [page 10](#)

#### **From pre-sale to service. At your doorstep.**

Worldwide network of local Rohde & Schwarz experts in over 70 countries

▷ [page 11](#)

<sup>1)</sup> For explanations see glossary at end of brochure.

<sup>2)</sup> CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA -USA).

# Future-proof for all important technologies of today and tomorrow

## Minimum risk due to scalable 3.3 GHz or 6 GHz frequency range

The frequency range of the base model is 70 MHz to 3.3 GHz. Extension to 6 GHz by means of software update (R&S®CMW-KB036 option) and instrument calibration. Quick and easy adaptation to new technologies and bands.

## High measurement speed owing to 40 MHz IF bandwidth

Simple one-sweep broadband measurements can be performed. Technologies such as LTE/EUTRA with transmission bandwidths of up to 20 MHz can be handled.

## Simplified test system architecture through wide RF level range

- Output level range from  $-130$  dBm to  $+8$  dBm (CW, rms)
- Output level dynamic range of 128 dB
- Input level range from  $-84$  dBm to  $+34$  dBm (power meter, CW, rms)

The wide dynamic range makes additional external amplifiers or attenuators unnecessary. You can reduce test system costs without having to accept restrictions on reliability or accuracy.



Comprehensive RF frontend eliminates external hardware (front panel prepared for future extensions)

# User-specific selection of test strategy

The R&S®CMW500 contains a powerful measurement DSP module<sup>1)</sup> as standard and an optional flexible ARB + realtime<sup>1)</sup> baseband generator module. Users can implement either their own approaches or Rohde & Schwarz applications.

- User-specific evaluations and waveforms meet in-house requirements and provide fast response to new technologies
- Turnkey Rohde & Schwarz measurement algorithms and generator functions ensure immediate usability, high measurement speed, and optimum handling

## Analyzer

- Base model: flexible RF power meter with List mode for fast calibration of transmit power steps
- I/Q recorder function: recording of baseband signals for customer-specific evaluation
- Vector signal analyzer function for GSM/GPRS/EDGE/WCDMA/HSPA/iMAX/CDMA2000®/1xEV-DO/TD-SCDMA transmitter verification (R&S®CMW-KMxxx measurement personalities)

## Generator

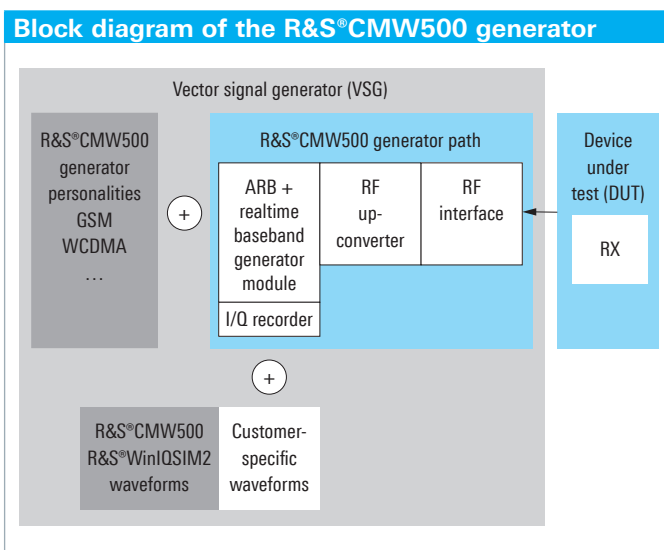
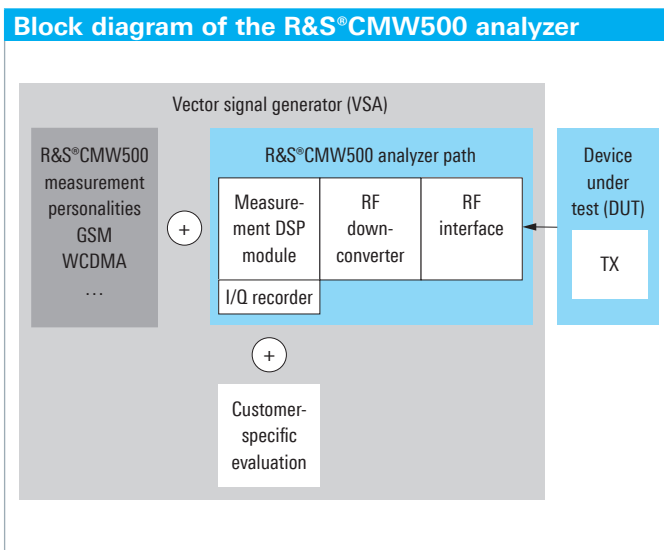
- Base model: CW generator with List mode for fast receiver calibration<sup>1)</sup>
- ARB + realtime<sup>1)</sup> baseband generator module for expanded receiver tests (R&S®CMW-B110A option)
- Flexible sample rate from 400 Hz to 100 MHz
- 1 Gbyte memory depth for long, multisegment waveforms
- Vector signal generator function via online or ARB mode
- Online mode: realtime coding of complex GSM/(E)GPRS/WCDMA signals with high data volume (R&S®CMW-KGxxx generator personalities)
- ARB mode: modulation via precalculated waveforms stored in the ARB memory
- R&S®WinIQSIM2 waveform creation tool supporting GSM/(E)GPRS/WCDMA/HSPA/Mobile WiMAX/CDMA2000®/1xEV-DO/TD-SCDMA (R&S®CMW-KWxxx options), alternatively user-specific waveforms
- Marker signals stored in the waveform file for fast switching of RF level and frequency

## R&S®WinIQSIM2 waveform creation tool

- Extremely easy generation of complex, digitally modulated baseband signals on a PC
- Transfer of precalculated waveforms to the R&S®CMW500 ARB<sup>1)</sup> memory

For more information visit:

[www.rohde-schwarz.com](http://www.rohde-schwarz.com), search term: WinIQSIM2





# Drastically reduced test costs; alignment up to ten times faster

Ongoing technological innovation and the ever-rising number of bands that must be supported increase the complexity of state-of-the-art wireless devices. The test effort multiplies, and the production costs rise. For these reasons, finding new, time-saving alignment approaches is essential. Rohde&Schwarz offers a significant reduction of test times compared to conventional methods by means of its R&S®Smart Alignment<sup>1)</sup> concept and R&S®Multi-Evaluation<sup>1)</sup> TX measurements. The R&S®CMW500 all-in-one architecture<sup>1)</sup> with built-in analyzer and generator provides the fastest possible transmit-receive interaction and is the optimum solution for time-critical tests in production.

## R&S®Smart Alignment concept

- Fully automatic frequency and level switching with general-purpose RF generator and power meter in List mode
- Simultaneous transmitter and receiver alignment, if supported by the DUT<sup>1)</sup>
- Extensive trigger functions for analyzer/generator
- Statistical evaluation included

Preconfigured identical test sequences in the DUT<sup>1)</sup> and the tester minimize the volume of communications inside the test system, which is the bottleneck of conventional approaches. Flexible R&S®CMW500 parameterization facilitates adaptation to the test philosophy of the wireless device under test and speeds up transfer to mass production.

## R&S®Multi-Evaluation transmitter measurements

- Different evaluations (power, time mask, modulation quality, spectrum, code domain) can use an identical sampling data set
- Time-overlapped data capturing and evaluation
- Enhanced speed by switching off evaluations that are not required
- Overview screen for simultaneous graphical display of all measurement results with zoom function

This approach not only increases the test speed in comparison with purely sequential data capturing and evaluation but also ensures greater test depth. This results in a more detailed overview of the transmitter functions, since all measured parameters are correlated.

R&S®Multi-Evaluation: GSM TX measurement



# Designed for high first pass yield

The R&S®CMW500 has been specially designed for production applications: Top priority was placed on accuracy, repeatability, and linearity. These parameters have a direct influence on the production yield. The higher the accuracy of these parameters, the lower the number of DUTs that are classified as faulty although they comply with specifications. Internal temperature sensors automatically adapt the measurement accuracy to the ambient conditions. It is not necessary to perform a calibration when temperatures vary or when the instrument is switched on.

Its high absolute accuracy plus repeatability and linearity enable the R&S®CMW500 to be used flexibly no matter which RF path correction test concept is applied to the individual production test station.

## Relevant R&S®CMW500 RF power meter parameters

| Parameter   | Conditions                   |
|---|------------------------------|
| Level uncertainty:<br><0.50 dB<br>typ. <0.30 dB                             |                              |
| Level repeatability:<br>typ. <0.01 dB                                       | input level $\geq -40$ dBm   |
| Level linearity with fixed expected nominal power setting:<br>typ. <0.15 dB | level range 0 dB to $-40$ dB |

## Relevant R&S®CMW500 generator parameters

| Parameter  | Conditions  |
|--|---|
| Output level uncertainty:<br><0.60 dB<br>typ. <0.36 dB                           | output level $> -120$ dBm   |
| Output level repeatability:<br>typ. <0.05 dB                                     | output level $< -80$ dBm  |
| Output level linearity with fixed RF output attenuator setting:<br>typ. <0.15 dB | output level range $-130$ dBm to $-5$ dBm, GPRF generator List mode, level range 0 dB to $-30$ dB |

# Optimized handling for production test systems

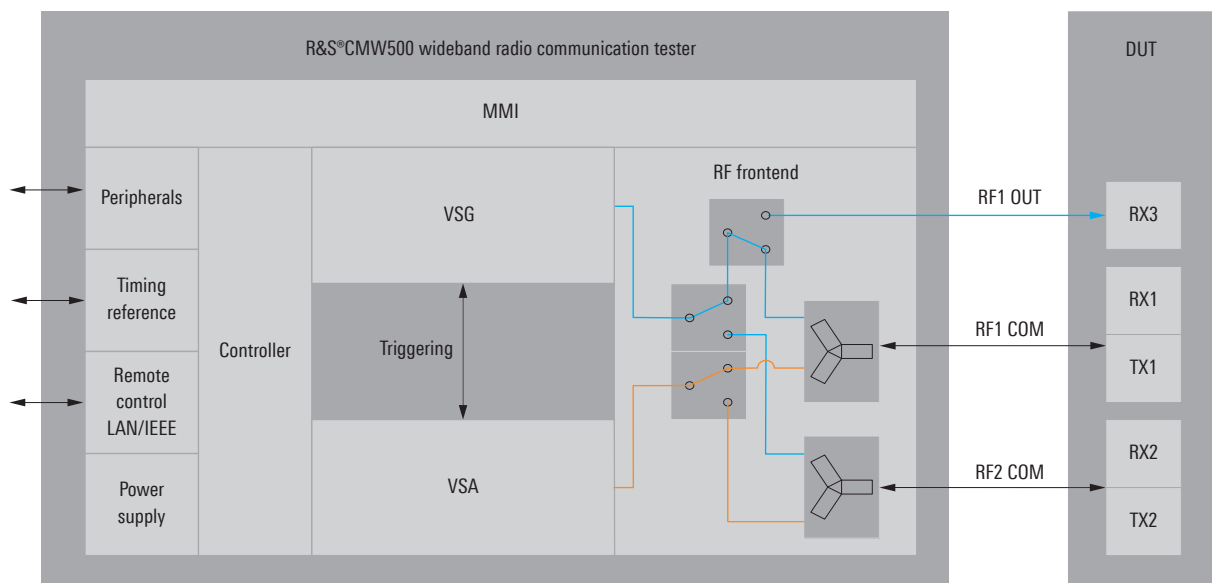
The R&S®CMW500 is a turnkey solution that can start testing immediately after delivery. The fully integrated tester with calibrated RF paths and Press&Go<sup>1)</sup> applications simplifies generating and updating test sequences and production test systems. The all-in-one architecture<sup>1)</sup> ensures maximum test performance plus minimum footprint and optimum power consumption. This concept for minimizing test costs comes from a company that has been successfully supplying solutions for the production of wireless devices for more than 30 years: Rohde&Schwarz.

## Minimum user risk owing to all-in-one architecture

- Built-in vector signal analyzer and generator
- SCPI remote control via LAN or GPIB interface
- Windows® XP operating system
- Remote control via Windows® Remote Desktop
- Connectors for mouse, keyboard, and external monitor
- Internal TCXO or OCXO timebase and 10 MHz reference frequency output
- External reference frequency (alternative)
- Fully automatic RF path correction concept<sup>1)</sup> of frequency, temperature, and level in realtime
- Completely calibrated solution
- Completely standard-conforming EMC<sup>1)</sup> characteristics
- Matched power supply

The turnkey solution provides assured measurement accuracy without the user's constant attention. Time- and cost-intensive repetitive self-alignment procedures can be omitted.

Block diagram of the R&S®CMW500





### Comprehensive RF frontend eliminating external hardware

- ▮ Flexible RF interface for direct connection of wireless devices with complex RF architecture
- ▮ Alternative: simultaneous connection of two wireless devices with one antenna each (connectors RF1 COM and RF2 COM)
- ▮ Entirely integrated into R&S®CMW500 path correction concept<sup>1)</sup>
- ▮ Flexible path configuration via GUI<sup>1)</sup>
- ▮ Optimized for mass tests in production
- ▮ Snap-N female connector RF1 OUT: RF output
- ▮ Snap-N female connector RF1 COM: combined RF input/output
- ▮ Snap-N female connector RF2 COM: combined RF input/output

The handling time for sequential testing of two wireless devices is reduced. The test system costs decrease while reliability and accuracy increase, since additional RF components are not required.

### Optimum handling through Press & Go applications

- ▮ Highly automated measurements at the press of a button
- ▮ Preconfigured in line with specifications of the selected technology
- ▮ Extensive statistical evaluations of measurement results already implemented

Technology-specific measurement results are output; no need to bother with time-consuming details such as calculation, limits, or statistics.

### Minimum operating costs due to state-of-the-art selftest concept

- ▮ Extensive selftests at the system and module level ensure that the communications between internal modules are not interrupted and that hardware modules work properly
- ▮ Selftests primarily intended for service purposes and not needed during normal operation
- ▮ Examples: voltage diagnostic test, memory test, address line test, download test, EEPROM test

The user can determine the status of the R&S®CMW500 without having to disassemble the test system. The possibility of directly locating error spots in the case of increased DUT<sup>1)</sup> failure rates reduces the downtime of the production system.

### Precise reference measurements by connecting R&S®NRP-Zxx power sensors

Highly accurate RF power measurements at any point in the test setup make it possible to optimize test procedures in production. It is possible to connect an R&S®NRP-Zxx power sensor directly to the R&S®CMW500 for reference measurements.

Test setup for reference measurements with an R&S®NRP-Zxx power sensor and an R&S®NGMO2 power supply



# Reduced operating costs due to 24-month calibration interval

Selectable calibration interval of either 12 or 24 months. Users can optimize costs to achieve high absolute accuracy or minimum test and measurement operating costs.

## Relevant R&S®CMW500 RF level uncertainty

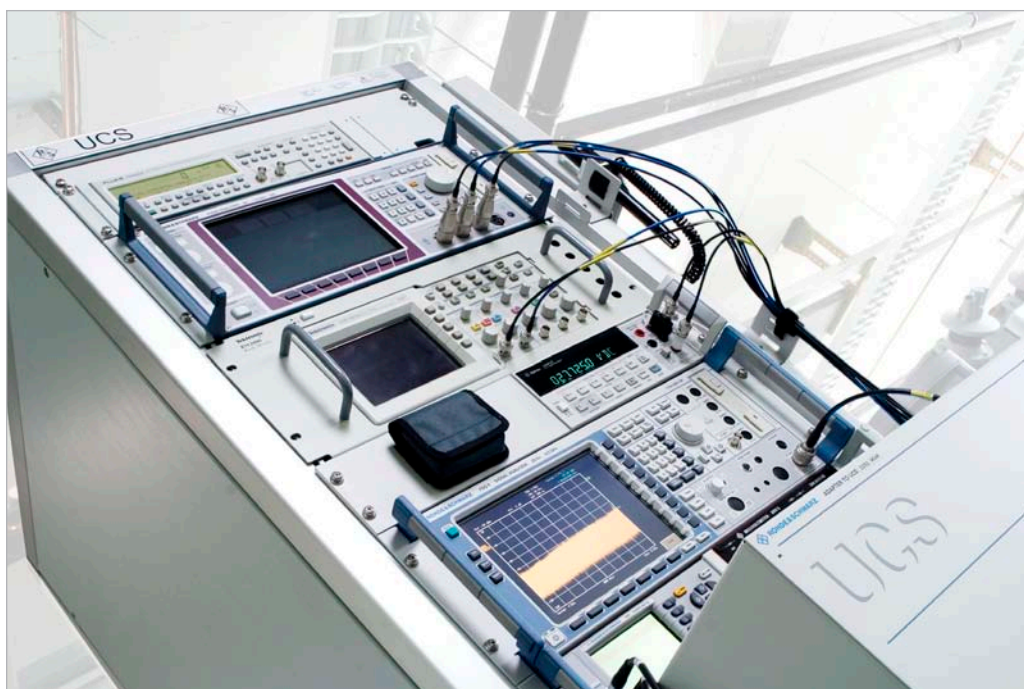
### 12-month calibration interval:

- Analyzer <0.50 dB
- Generator <0.60 dB

### 24-month calibration interval:

- Analyzer <0.70 dB
- Generator <0.80 dB

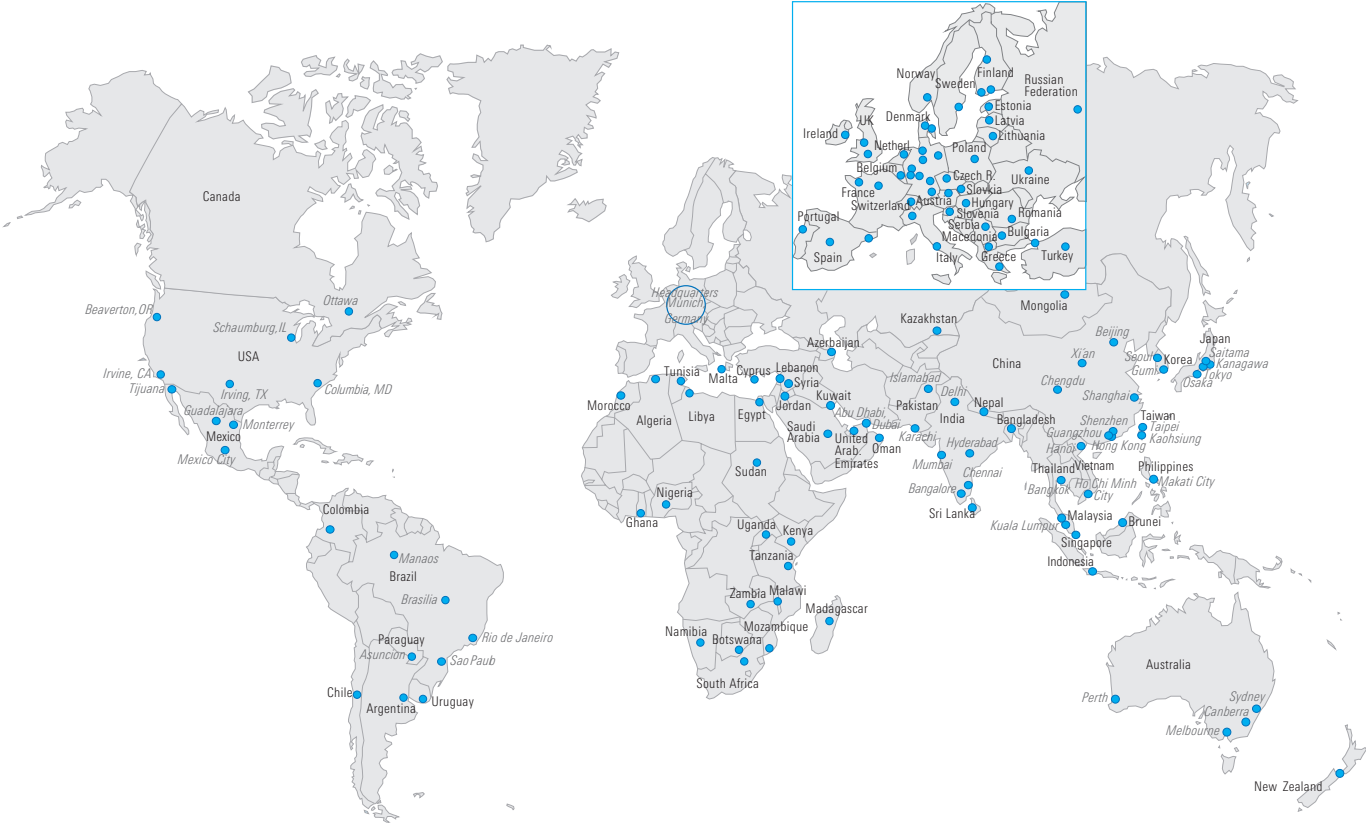
R&S®UCS calibration system



# From pre-sale to service. At your doorstep.

The Rohde & Schwarz network in over 70 countries ensures optimum on-site support by highly qualified experts. The user risks are reduced to a minimum at all stages of the project:

- Solution finding/purchase
- Technical start-up/application development/integration
- Training
- Operation/calibration/repair



# Application

## Production test on wireless devices with the R&S® CMW500

Economically produced RF chips exhibit variations in frequency and level characteristics. The following test procedure must be applied:

Step 1: Calibration. Deviations from the ideal values for transmitter and receiver must be measured, interpolated, and stored in correction tables.

Step 2: Verification of the most important transmit and receive parameters.

This is the only way to ensure that the specifications of the relevant technology standard will be complied with later during operation in the network and that the wireless device will operate reliably.

### Calibration of receiver signal strength indication (RSSI)<sup>1)</sup>

The R&S®CMW500 enables the following calibration scenarios to be implemented as a function of the specific chipset requirements.

The GPRF<sup>1)</sup> generator in List mode can be operated with preconfigured levels and frequencies. The precalculated baseband signal, which is stored in the ARB<sup>1)</sup> memory, can be provided with markers that stepwise switch the list of the GPRF<sup>1)</sup> generator.

Multisegment waveforms and marker-triggered GPRF<sup>1)</sup> generator lists are prerequisites for minimum ARB<sup>1)</sup> setup times and fast RSSI<sup>1)</sup> calibration scenarios.

| Chipset requirements  | R&S®CMW500 solution   |
|---|---|
| Narrowband RF signal (CW), variable level and frequency                                     | Basic functionality, GPRF <sup>1)</sup> generator   |
| Broadband RF signal, variable level and frequency   | GPRF <sup>1)</sup> generator combined with ARB + realtime <sup>1)</sup> baseband generator module (R&S®CMW-B110A option) in ARB mode <sup>1)</sup> ; broadband modulated waveforms  |
| Complex modulated RF signal with technology-specific channels, variable level and frequency | GPRF <sup>1)</sup> generator combined with ARB + realtime <sup>1)</sup> baseband generator module (R&S®CMW-B110A option) in ARB mode <sup>1)</sup> ; technology-specific waveforms precalculated by means of R&S®WinIQSIM2 (R&S®CMW-KWxxx option) |

The screenshot shows the 'General Purpose RF Generator - Generator' software interface. The main window is titled 'List Mode' and displays various configuration options. On the left, a tree view shows the configuration hierarchy: List Mode, Baseband Mode, Baseband Configuration (Dual Tone, ARB), Trigger, List Configuration, and List. The 'List Configuration' section is expanded, showing 'List Mode' set to 'On', 'Start Index: 0', 'Stop Index: 19', and 'Result Count: 20'. Below this, a table lists the list items with their respective parameters.

| Frequency      | Level (RMS) | Digital Gain | Dwell Time   | Mod. On/Off              |
|----------------|-------------|--------------|--------------|--------------------------|
| 903.000000 MHz | -40.00 dBm  | 0.00 dB      | 500.00000 ms | <input type="checkbox"/> |
| 903.000000 MHz | -50.00 dBm  | 0.00 dB      | 500.00000 ms | <input type="checkbox"/> |
| 903.000000 MHz | -60.00 dBm  | 0.00 dB      | 500.00000 ms | <input type="checkbox"/> |
| 903.000000 MHz | -70.00 dBm  | 0.00 dB      | 500.00000 ms | <input type="checkbox"/> |

At the bottom of the window, there are several buttons: 'List Mode Off', 'Start- / Stop Index...', 'Current Index...', 'List Submode...', 'Execute Single', and 'Fill List...'. On the right side, there is a vertical toolbar with buttons for 'GPRF Gen', 'ARB', 'List Config.', and 'GPRF Generator ON'.

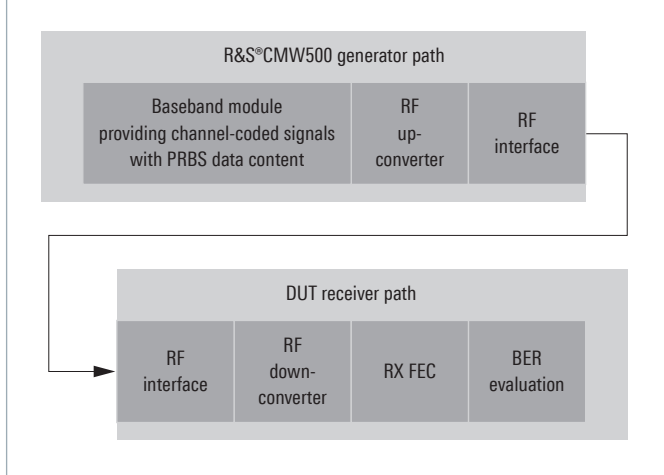
General-purpose RF generator configuration menu

## Transmit power step alignment

The R&S®CMW500 GPRF<sup>1)</sup> power measurement evaluates a list of power steps at different levels and frequencies and performs statistical evaluation. A wide range of IF filters is available:

- ▮ Gaussian filters, selectable bandwidths between 1 kHz and 10 MHz
- ▮ Bandpass root raised-cosine (RRC) filters, selectable bandwidths between 1 kHz and 40 MHz, roll-off 0.1
- ▮ WCDMA RRC filter (3GPP TS 34.121 specification), 3.84 MHz bandwidth, roll-off = 0.22
- ▮ CDMA filter (TIA/EIA/IS-2000.2-A specification), 1.4 MHz bandwidth

## Single-ended BER test approach



## Receiver verification

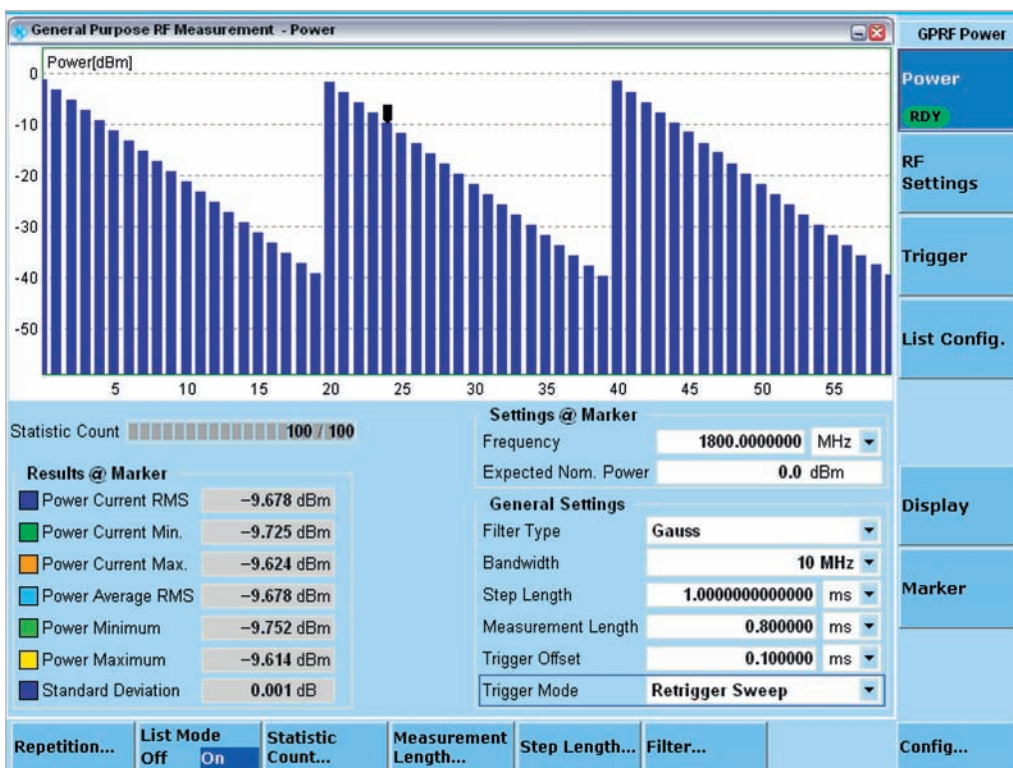
The receiver is checked for technology-specific absolute sensitivity and maximum input level.

This verification is based on a single-ended BER test<sup>1)</sup> approach with the R&S®CMW500 being used as the signal source. The ARB + realtime<sup>1)</sup> baseband generator module (R&S®CMW-B110A option) makes available technology-specific signals with pilot and data channels. Depending on the applicable test requirements, the following solutions are offered:

- ▮ ARB mode<sup>1)</sup> based on precalculated R&S®WinIQSIM2 waveforms (R&S®CMW-KWxxx options) or customer-specific waveforms
- ▮ Online mode<sup>1)</sup> for pilot channels and PRBS user data channels with high data volume (R&S®CMW-KGxxx options)

## Transmitter verification

The R&S®CMW500 can perform technology-specific TX measurements.



General-purpose RF power measurement menu



R&S®CMW-KM200 measurement personality

## Power

- ▮ Transmit power
- ▮ Time mask

## Modulation quality (GMSK modulation scheme)

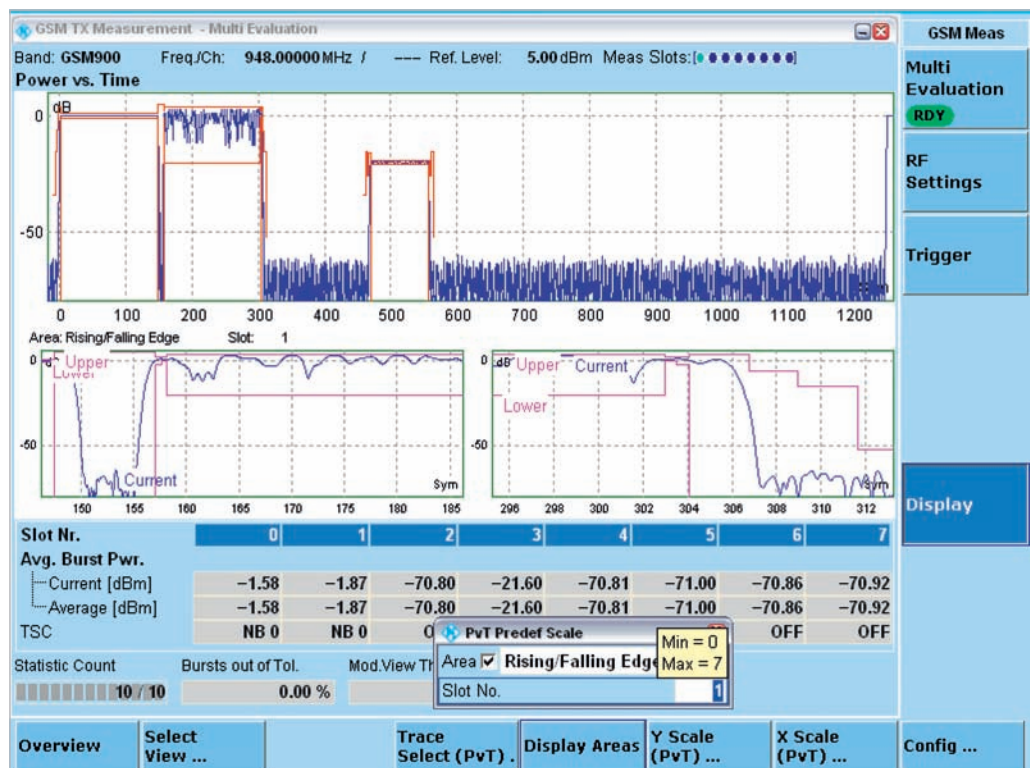
- ▮ Phase error
- ▮ Frequency error

## Modulation quality (8PSK modulation scheme)

- ▮ Error vector magnitude
- ▮ Magnitude error
- ▮ Phase error
- ▮ I/Q errors

## Spectral measurement

- ▮ Output RF spectrum modulation
- ▮ Output RF spectrum switching



Time mask screen:  
 GSM/GPRS/EDGE TX measurement – R&S®Multi-Evaluation

# WCDMA

R&S®CMW-KM400 measurement personality

## Power

- ▮ OFF power
- ▮ Max. power
- ▮ Min. power
- ▮ UE power versus slot

## Modulation quality

- ▮ Error vector magnitude (versus slot and versus chip)
- ▮ Magnitude error (versus slot and versus chip)
- ▮ I/Q origin offset/imbalance versus slot
- ▮ Frequency error versus slot
- ▮ Phase discontinuity

## Spectral measurement

- ▮ Adjacent channel leakage ratio
- ▮ Spectrum emission mask
- ▮ Occupied bandwidth

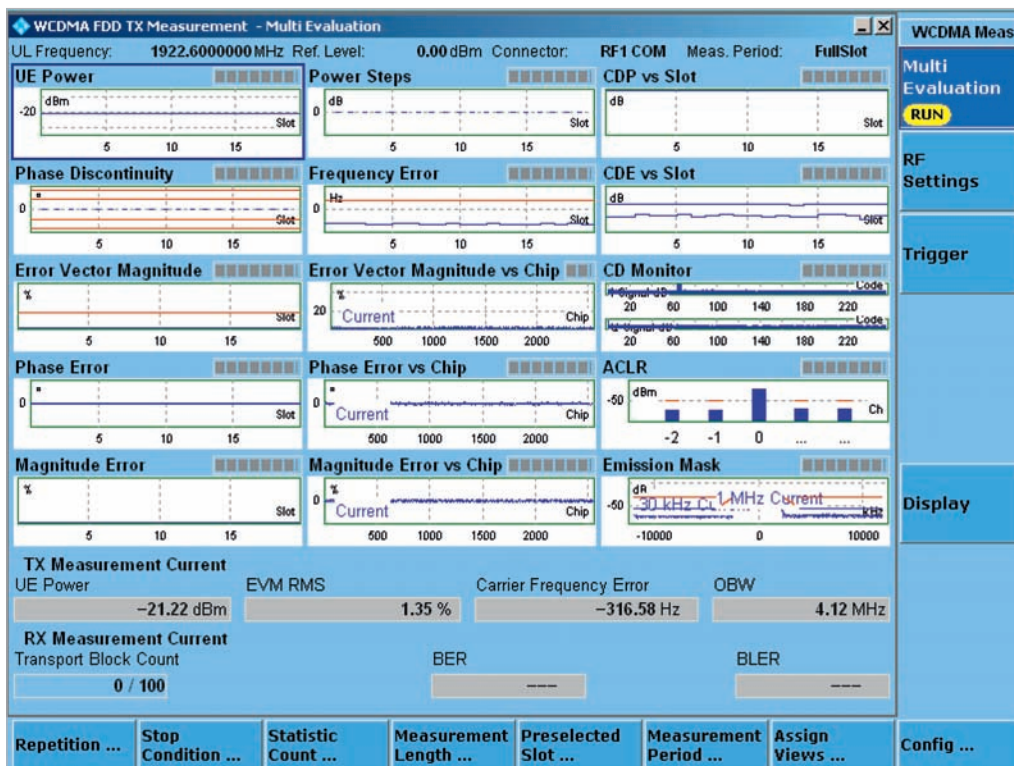
## Code domain

- ▮ Code domain power versus slot
- ▮ Peak code domain error
- ▮ Code domain error versus slot
- ▮ Code domain power monitor
- ▮ Code domain error monitor

# HSPA extensions

R&S®CMW-KM401 measurement personality

- ▮ Half-slot measurements
- ▮ Modulation analysis of HSPA channels
- ▮ Code domain power measurement of HSPA channels
- ▮ Code domain error versus slot measurement of HSPA channels
- ▮ HS-DPCCH power control
- ▮ Phase discontinuity



Overview screen:  
TD-SCDMA TX measurement –  
R&S®Multi-Evaluation

# CDMA2000® 1xRTT

R&S®CMW-KM800 measurement personality

## Power

- MS power

## Modulation quality (OQPSK and HPSK modulation schemes)

- Error vector magnitude
- Magnitude error
- Phase error
- Frequency error
- Carrier feedthrough
- I/Q imbalance
- Waveform quality

## Spectral measurement

- Adjacent channel power

## Code domain

- Code domain power
- Code domain error power



Overview screen:  
CDMA2000® 1xRTT  
TX measurement –  
R&S®Multi-Evaluation

# CDMA2000<sup>®</sup> 1xEV-DO

R&S<sup>®</sup>CMW-KM880 measurement personality

## Power

- MS power

## Modulation quality (dual BPSK modulation scheme)

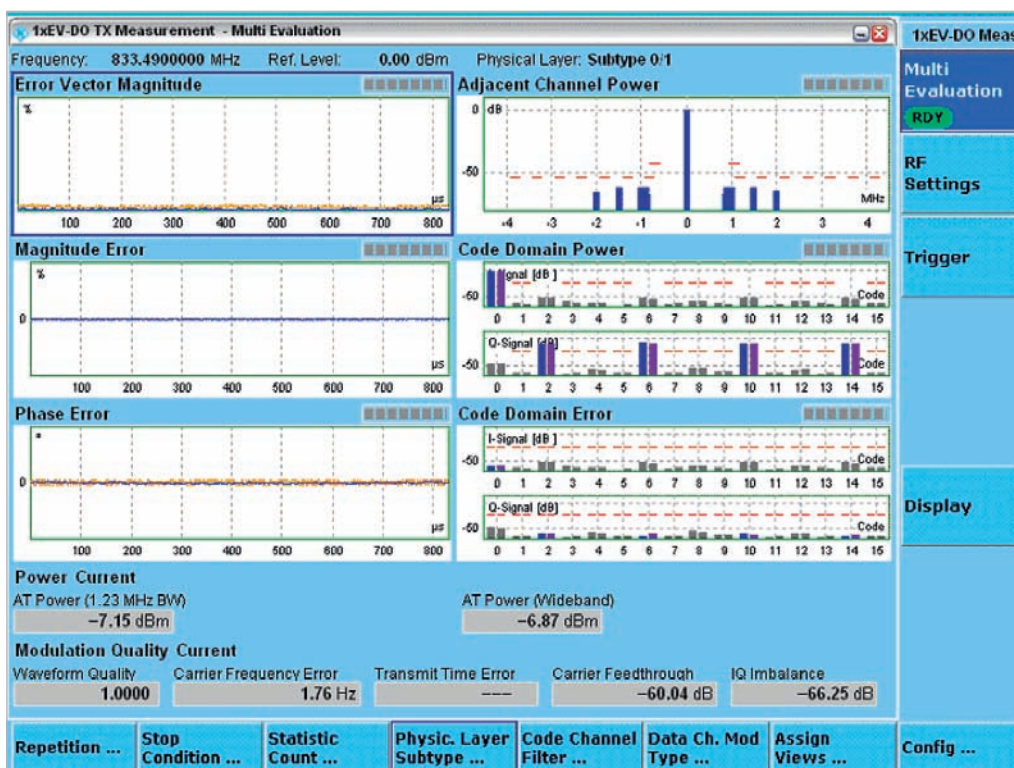
- Error vector magnitude
- Magnitude error
- Phase error
- Frequency error
- Carrier feedthrough
- I/Q imbalance
- Waveform quality

## Spectral measurement

- Adjacent channel power

## Code domain

- Code domain power
- Code domain error power



Overview screen:  
CDMA2000<sup>®</sup> 1xEV-DO  
TX measurement –  
R&S<sup>®</sup>Multi-Evaluation



# Mobile WiMAX

R&S®CMW-KM700 measurement personality

## Power

- Burst power
- Crest factor

## Modulation quality

- Error vector magnitude
- I/Q errors
- Center frequency error

## Spectral measurement

- Adjacent channel power
- Spectrum emission mask
- Spectrum flatness
- Occupied bandwidth

| WIMAX - Multi Evaluation  |             |            |             |        |
|---|-------------|------------|-------------|--------|
| Frequency: 2300000000.0 Hz Modulation: QPSK Zone Length: 18 FFT: 1024 Bandwidth: 10 MHz |             |            |             |        |
| Preamble Power [dBm]  | ---         | ---        | ---         | ---    |
| Subframe Power [dBm]  | ---         | ---        | ---         | ---    |
| Crest Factor [dB]   | 9.58        | 9.61       | 9.53        | 9.67   |
| RSSI [dB]   | ---         | ---        | ---         | ---    |
| CINR [dB]   | ---         | ---        | ---         | ---    |
| Occupied Bandwidth [MHz]  | 9.11        | 9.11       | 9.11        | 9.11   |
| <b>Spectral Flatness</b>  |             |            |             |        |
| Outer Upper [dB]  | -0.39       | -0.38      | -0.40       | -0.37  |
| Inner Upper [dB]  | 0.37        | 0.38       | 0.37        | 0.39   |
| Outer Lower [dB]  | -0.24       | -0.25      | -0.25       | -0.24  |
| Inner Lower [dB]  | 0.21        | 0.21       | 0.21        | 0.22   |
| Neighbor [dB]   | 0.04        | 0.04       | 0.04        | 0.05   |
| <b>Adjacent Channel</b>   |             |            |             |        |
| Left Absolute [dBm]   | -65.54      | -65.53     | -65.57      | -65.47 |
| Right Absolute [dBm]  | -64.90      | -64.81     | -64.90      | -64.76 |
| Left Relative [dB]  | -50.00      | -50.00     | -50.00      | -50.00 |
| Right Relative [dB]   | -49.93      | -49.84     | -49.93      | -49.79 |
| <b>Spectral Emission Mask</b>   |             |            |             |        |
|   | Start [MHz] | Stop [MHz] | Margin [dB] |        |
| Left Interval 04  | -20.0       | -14.8      | 5.91        |        |
| Left Interval 03  | -14.8       | -9.75      | -5.02       |        |
| Left Interval 02  | -9.75       | -5.45      | -20.82      |        |
| Left Interval 01  | -5.45       | -4.75      | -26.39      |        |
| Right Interval 01   | 4.75        | 5.45       | -27.10      |        |
| Right Interval 02   | 5.45        | 9.75       | -20.56      |        |
| Right Interval 03   | 9.75        | 14.8       | -3.81       |        |
| Right Interval 04   | 14.8        | 20.0       | -2.60       |        |

Overview screen:  
Mobile WiMAX TX measurement –  
R&S®Multi-Evaluation



# TD-SCDMA

R&S®CMW-KM750 measurement personality

## Power

- ▮ UE power
- ▮ Transmit on/off time mask

## Modulation quality

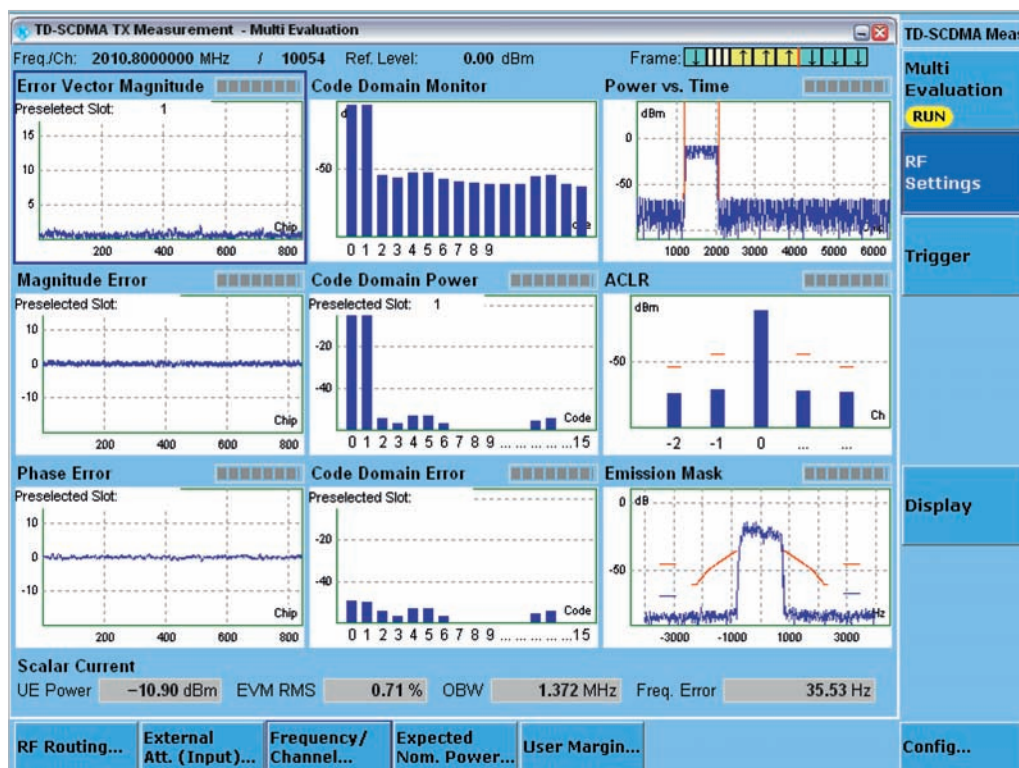
- ▮ Error vector magnitude
- ▮ Magnitude error
- ▮ Phase error
- ▮ Frequency error
- ▮ I/Q origin offset
- ▮ I/Q imbalance
- ▮ Waveform quality

## Spectral measurement

- ▮ Adjacent channel leakage ratio
- ▮ Spectrum emission mask
- ▮ Occupied bandwidth

## Code domain

- ▮ Code domain power
- ▮ Code domain error power
- ▮ Code domain monitor



Overview screen:  
TD-SCDMA TX measurement –  
R&S®Multi-Evaluation

# Recommended extra R&S®CMWrun sequencer software tool

The R&S®CMWrun sequencer software tool meets all needs for executing test sequences to remote-control the R&S®CMW500 in R&D, quality assurance, and in the production of current and future wireless equipment.

The software engine is based on the execution of test DLLs (plug-in assemblies). This architecture not only allows easy and straightforward configuration of test sequences without knowledge of specific remote programming of the instrument but also provides full flexibility in configuring parameters and limits of the test items provided in the R&S®CMWrun package options for the different standards.

## Highlights

- Multitechnology solution:
  - R&S®CMWrun general-purpose software package for non-signaling applications (R&S®CMW-KT051 option)
  - R&S®CMWrun WiMAX software package for Mobile WiMAX in non-signaling and signaling applications (R&S®CMW-KT057 option)
  - Further technologies to be supported in the future
- Ready-to-use solution, containing predefined Rohde&Schwarz applications for the technologies supported by the R&S®CMW500
- Application programming interface (API)-based engine for easy and flexible integration of new applications
- Ease of use due to dedicated interfaces for operation, for editing sequences, for measurement reports and for debugging test sequences
- Application for SCPI remote control via LAN or GPIB interface



## Key features

### Ready-to-use solution for configuring a test sequence with just a few mouse clicks

The straightforward graphical interface makes it easy to program test sequences. The user can define customized test sequences for any of the supported mobile communications standards in the R&S®CMW500 with just a few mouse clicks. Programming knowledge is not required.

### Test sequence editor for high flexibility, from regression testing to simple test sequences

The R&S®CMWrun sequencer software lets the user integrate basic programming commands such as “if”, “while” or “loop” to control the test sequence, allowing test sequences to be executed interactively. Such control features are integrated into the test sequence in a separate “edit test sequence menu” view to protect the configuration in the standard test sequence view.

### Control of all parameters in one view

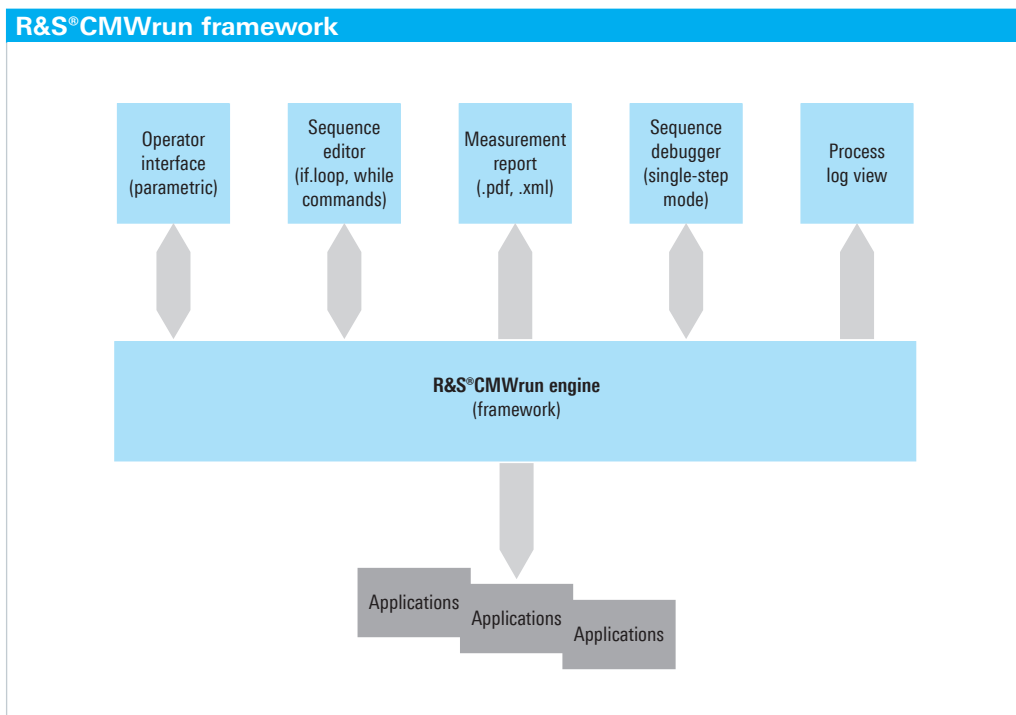
Input fields are available for configuring all essential RF parameters; tolerances for the individual measurements can be changed. If no special requirements for tolerances exist, the software uses the tolerances defined in the specification. A customer-specific testing scenario can thus be configured very easily.

### Automated report options for secure quality management in linr with international quality standards

Measurement reports are generated online during test execution or after the end of the test, if priority is placed on measurement speed. In addition, different export formats are available as a global setting or for a specific test sequence. Test reports can be stored automatically after every test routine and automatically exported to a defined report format. This feature allows a high level of automation in production lines, e.g. by providing the interfaces for standard statistical tools.

### Flexible optioning concept for instrument- or PC-based licensing

The R&S®CMWrun sequencer software can be installed either on an external PC (Microsoft Windows XP PC) or directly on an R&S®CMW500. A smart card is required for licensing if the external PC is used for R&S®CMWrun licensing. This allows full flexibility with different instruments. For best performance, the PC installation is recommended.



# Specifications in brief

| RF generator                    |   |                    |
|---------------------------------|---|--------------------|
| <b>Frequency range</b>          | base model  | 70 MHz to 3300 MHz |
|                                 | with R&S®CMW-KB036 option                           | 70 MHz to 6000 MHz |
| <b>Output level range</b>       |   |                    |
| RF1 COM, RF2 COM                | 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        |
| RF1 OUT                         | 100 MHz to 3300 MHz                                 |                    |
|                                 | continuous wave (CW)                                | -120 dBm to +8 dBm |
|                                 | peak envelope power (PEP)                           | up to +8 dBm       |
|                                 | overranging (PEP)                                   | up to +13 dBm      |
| <b>Output level uncertainty</b> |   |                    |
|                                 | in temperature range +20°C to +35°C, no overranging |                    |
| RF1 COM, RF2 COM                | output level >-120 dBm                              |                    |
|                                 | 100 MHz to 3300 MHz                                 | <0.6 dB            |
| RF1 OUT                         | output level >-110 dBm                              |                    |
|                                 | 100 MHz to 3300 MHz                                 | <0.8 dB            |

| Modulation source: arbitrary waveform generator (ARB) (R&S®CMW-B110A option) |                   |                      |
|--|-------------------|----------------------|
| <b>Memory size</b>   |                   | 1024 Gbyte           |
| <b>Word length</b>   | I                 | 16 bit               |
|  | Q                 | 16 bit               |
|  | marker            | 4 bit to 16 bit      |
| <b>Sample length</b>   | with 4-bit marker | up to 227.55 Msample |
| <b>Sample rate</b>   | minimum           | 400 Hz               |
|  | maximum           | 100 MHz              |

| RF power meter                              |                           |                    |
|---|---------------------------|--------------------|
| <b>Frequency range</b>                      | base model                | 70 MHz to 3300 MHz |
|   | with R&S®CMW-KB036 option | 70 MHz to 6000 MHz |
| <b>Expected nominal power setting range</b> |                           |                    |
| RF1 COM, RF2 COM                            | 100 MHz to 3300 MHz       | -47 dBm to +34 dBm |
| <b>Level uncertainty</b>                    |                           |                    |
| RF1 COM, RF2 COM                            | 100 MHz to 3300 MHz       | <0.5 dB            |

| General data         |                      |  |
|----------------------|----------------------|--|
| Dimensions           | W × H × D            | 465.1 mm × 197.3 mm × 517.0 mm<br>18.31 in × 7.77 in × 20.35 in<br>(19" 1/1, 4 HU, 450)              |
| Weight               | with typical options | approx. 18 kg<br>approx. 39.68 lb  |
| Calibration interval | 12 months            | recommended for highest accuracy,<br>see specified RF generator and RF analyzer level<br>uncertainty |
|                      | 24 months            | add 0.2 dB to specified RF generator and RF<br>analyzer level uncertainty                            |

# Glossary

| Term                                     | Explanation   |
|--|---|
| ACLR                                     | Adjacent channel leakage ratio  |
| ACP                                      | Adjacent channel power  |
| Alignment                                | Wireless device production cycle consisting of calibration and verification   |
| All-in-one architecture                  | Complete, highly integrated compact solution with assured measurement accuracy and optimum handling   |
| ARB                                      | Generally used abbreviation for arbitrary waveform generator functionality  |
| ARB generator mode                       | Baseband generator mode where the modulation is implemented by means of precalculated waveforms stored in the ARB memory  |
| ARB + realtime baseband generator module | Generator module that supports not only the classic ARB mode but also the generation of complex modulated signals in realtime   |
| BB                                       | Baseband  |
| BER                                      | Bit error ratio   |
| Calibration                              | Wireless device production stage during which the transmit power steps and the RSSI steps are measured and compared to reference values. The correction factors obtained are stored in the wireless device. Other common designations: phasing, tuning, alignment |
| CW                                       | Continuous wave   |
| DSP                                      | Digital signal processor  |
| DUT                                      | Device under test   |
| DVI                                      | Digital video interface   |
| EMC                                      | Electromagnetic compatibility   |
| EVM                                      | Error vector magnitude  |
| GPRF                                     | General-purpose radio frequency   |
| GPRF List mode                           | Lists containing predefined levels and frequencies for GPRF generator/power meter test sequences  |
| GUI                                      | Graphical user interface  |
| HW                                       | Hardware  |
| ME                                       | Magnitude error   |
| MMI                                      | Man machine interface   |
| OBW                                      | Occupied bandwidth  |
| Online generator mode                    | Baseband generator mode where complex modulated signals are generated in realtime; maximal operation is performed via MMI   |
| Path correction                          | Method for increasing the measurement accuracy by taking into account the influence of frequency, temperature, and level on the RF attenuation of the measurement path  |
| PE                                       | Phase error   |
| PRBS                                     | Pseudo random bit sequence  |
| Press & Go                               | Turnkey, highly automated test functionality that is available at the press of a button   |
| RF                                       | Radio frequency   |
| R&S®Smart Alignment                      | Alignment concept where predefined identical test sequences in the DUT and in the tester reduce the data volume in the test system and significantly shorten the test time  |
| R&S®Multi-Evaluation                     | Transmitter measurement concept where different measurement parameters use identical raw data   |
| RSSI                                     | Receiver signal strength indication   |
| RX                                       | Receiver  |
| RX FEC                                   | Receiver forward error correction, contains decoding chain  |
| SEM                                      | Spectrum emission mask  |
| Single-ended BER test                    | Modern approach to receiver verification where the stimulating signal is provided by the measuring instrument and the BER is calculated in the DUT  |
| SW                                       | Software  |
| Verification                             | Wireless device production stage during which the most important transmit and receive parameters are checked after calibration  |
| VSA                                      | Vector signal analyzer  |
| VSG                                      | Vector signal generator   |

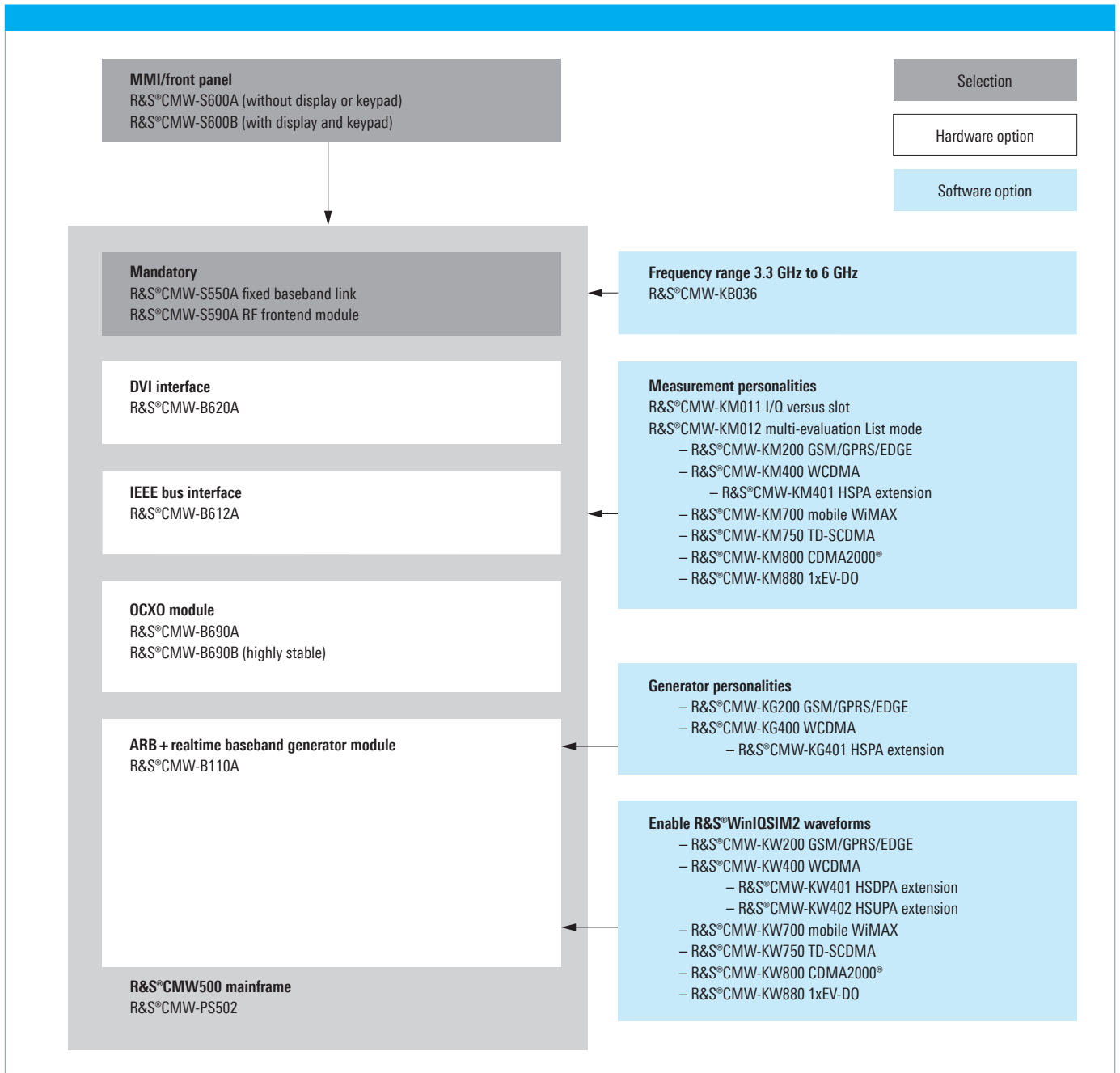


# Ordering information

| Designation  | Type          | Order No.    |
|--|---------------|--------------|
| <b>R&amp;S®CMW500 Wideband Radio Communication Tester</b>                                    | R&S®CMW500    | 1201.0002K50 |
| <b>Mainframe configuration, mandatory</b> <input checked="" type="checkbox"/>                |               |              |
| R&S®CMW500 Wideband Radio Communication Tester, Mainframe, Frequency Range 70 MHz to 3.3 GHz | R&S®CMW-PS502 | 1202.5408.02 |
| Baseband Interconnection Board (fixed link)  | R&S®CMW-S550A | 1202.4801.02 |
| RF Frontend Module   | R&S®CMW-S590A | 1202.5108.02 |
| Selection: Front Panel Without Display/Keypad (contains DVI interface)                       | R&S®CMW-S600A | 1201.0102.02 |
| Selection: Front Panel With Display/Keypad   | R&S®CMW-S600B | 1201.0102.03 |
| <b>Mainframe configuration, optional</b> <input type="checkbox"/>                            |               |              |
| ARB + Realtime Baseband Generator Module   | R&S®CMW-B110A | 1202.5508.02 |
| IEEE Bus Interface Module  | R&S®CMW-B612A | 1202.5608.02 |
| Digital Video Interface (DVI) Module (only required for units with display/keypad)           | R&S®CMW-B620A | 1202.5808.02 |
| OCXO Module  | R&S®CMW-B690A | 1202.5908.02 |
| OCXO Module (highly stable)  | R&S®CMW-B690B | 1202.6004.02 |
| Frequency Range 3.3 GHz to 6 GHz   | R&S®CMW-KB036 | 1203.0851.02 |
| <b>Measurement personalities, optional</b> <input type="checkbox"/>                          |               |              |
| TX Measurement, I/Q versus Slot  | R&S®CMW-KM011 | 1203.0800.02 |
| TX Measurement, Multi-Evaluation List Mode   | R&S®CMW-KM012 | 1203.4457.02 |
| TX Measurement, GSM/GPRS/EDGE, Uplink  | R&S®CMW-KM200 | 1203.0551.02 |
| TX Measurement, WCDMA, Uplink  | R&S®CMW-KM400 | 1203.0700.02 |
| TX Measurement, WCDMA HSPA Extension, Uplink   | R&S®CMW-KM401 | 1203.2954.02 |
| TX Measurement, Mobile WiMAX (IEEE 802.16e)  | R&S®CMW-KM700 | 1202.6604.02 |
| TX Measurement, TD-SCDMA, Uplink   | R&S®CMW-KM750 | 1203.2554.02 |
| TX Measurement, CDMA2000® 1xRTT, Reverse Link  | R&S®CMW-KM800 | 1203.2602.02 |
| TX Measurement, 1xEV-DO, Reverse Link  | R&S®CMW-KM880 | 1203.2854.02 |
| <b>Generator personalities, optional</b> <input type="checkbox"/>                            |               |              |
| Generator, GSM/GPRS/EDGE, Downlink   | R&S®CMW-KG200 | 1203.0500.02 |
| Generator, WCDMA, Downlink   | R&S®CMW-KG400 | 1203.0651.02 |
| Generator, WCDMA HSPA Extension, Downlink  | R&S®CMW-KG401 | 1203.2902.02 |
| <b>Enable R&amp;S®WinIQSIM2 waveforms, optional</b> <input type="checkbox"/>                 |               |              |
| Enable R&S®WinIQSIM2 Waveforms, GSM/EDGE   | R&S®CMW-KW200 | 1203.0951.02 |
| Enable R&S®WinIQSIM2 Waveforms, WCDMA  | R&S®CMW-KW400 | 1203.1006.02 |
| Enable R&S®WinIQSIM2 Waveforms, WCDMA HSDPA Extension  | R&S®CMW-KW401 | 1203.1058.02 |
| Enable R&S®WinIQSIM2 Waveforms, WCDMA HSUPA Extension  | R&S®CMW-KW402 | 1203.1106.02 |
| Enable R&S®WinIQSIM2 Waveforms, WiMAX (IEEE 802.16)  | R&S®CMW-KW700 | 1203.1358.02 |
| Enable R&S®WinIQSIM2 Waveforms, TD-SCDMA   | R&S®CMW-KW750 | 1203.1406.02 |
| Enable R&S®WinIQSIM2 Waveforms, CDMA2000®  | R&S®CMW-KW800 | 1203.1506.02 |
| Enable R&S®WinIQSIM2 Waveforms, 1xEV-DO  | R&S®CMW-KW880 | 1203.1558.02 |

|                                     |                 |
|-------------------------------------|-----------------|
| <input checked="" type="checkbox"/> | Selection       |
| <input type="checkbox"/>            | Hardware option |
| <input type="checkbox"/>            | Software option |

# Configuration guide



Your local Rohde & Schwarz expert will help you to find the solution that is optimally suited to your requirements and will be glad to prepare a custom offer for you.

To find your nearest Rohde & Schwarz representative, visit:  
[www.sales.rohde-schwarz.com](http://www.sales.rohde-schwarz.com)

# Recommended extras and power sensors

| Designation  | Type          | Order No.    |
|--|---------------|--------------|
| <b>Recommended extras and power sensors</b> <input type="checkbox"/>         |               |              |
| R&S®CMWrun Sequencer Software Tool, General Purpose                          | R&S®CMW-KT051 | 1203.4157.02 |
| R&S®CMWrun Sequencer Software Tool, WiMAX                                    | R&S®CMW-KT057 | 1203.4205.02 |
| LCD TFT Display, 17", 1280 × 1024, DVI-D and Analog Interface                | R&S®PMC3      | 1082.6004.12 |
| Keyboard with USB Interface (US character set)                               | R&S®PSL-Z2    | 1157.6870.04 |
| Mouse with USB Interface (optical, with wheel)                               | R&S®PSL-Z10   | 1157.7060.04 |
| 19" adapter, 4 HU, 1/1 for BW2000 Cabinets                                   | R&S®ZZA-411   | 1096.3283.00 |
| Average Power Sensor for Universal Use<br>10 MHz to 18 GHz, 200 pW to 200 mW | R&S®NRP-Z21   | 1137.6000.02 |
| Power Sensor Module DC to 18 GHz   | R&S®NRP-Z27   | 1169.4102.02 |
| Level Control Sensor 10 MHz to 18 GHz for Signal Generators                  | R&S®NRP-Z28   | 1170.8008.02 |
| Documentation of Calibration Values  | R&S®DCV-2     | 0240.2193.08 |

# PC-based R&S®CMW500 applications

| Designation   | Type          | Order No.    |
|---|---------------|--------------|
| <b>PC-based R&amp;S®CMW applications</b>            | R&S®CMWPC     | 1201.0002K90 |
| <b>Mandatory</b> <input type="checkbox"/>           |               |              |
| USB Smartcard for PC-based R&S®CMW Applications     | R&S®CMW-S089A | 1202.7900.02 |
| <b>Optional</b> <input type="checkbox"/>            |               |              |
| R&S®CMWrun Sequencer Software Tool, General Purpose | R&S®CMW-KT051 | 1203.4157.02 |
| R&S®CMWrun Sequencer Software Tool, WiMAX           | R&S®CMW-KT057 | 1203.4205.02 |

| System requirements |  |
|---------------------|--|
| Processor           | 1300 MHz (x86) minimum                       |
| Memory              | 256 MB minimum                               |
| HDD space           | 80 MB minimum                                |
| Operating system    | Microsoft Windows XP, Service Pack 2, 32 bit |
| Software            | Microsoft .net framework 2.0 or later        |

Note:  
Before ordering, the application has to be defined: For instrument-based licensing, the serial number of the R&S®CMW500 is required. For PC-based licensing, the serial number of the R&S®CMWPC smart card is required.

|                                     |                 |
|-------------------------------------|-----------------|
| <input checked="" type="checkbox"/> | Selection       |
| <input type="checkbox"/>            | Hardware option |
| <input type="checkbox"/>            | Software option |

# Typical configuration for GSM/EDGE/WCDMA

| Designation  | Type          | Order No.    |
|--|---------------|--------------|
| <b>R&amp;S®CMW500 Wideband Radio Communication Tester</b>                                    | R&S®CMW500    | 1201.0002K50 |
| R&S®CMW500 Wideband Radio Communication Tester, Mainframe, Frequency Range 70 MHz to 3.3 GHz | R&S®CMW-PS502 | 1202.5408.02 |
| Baseband Interconnection Board (fixed link)  | R&S®CMW-S550A | 1202.4801.02 |
| RF Frontend Module   | R&S®CMW-S590A | 1202.5108.02 |
| Selection: Front Panel Without Display/Keypad (contains DVI interface)                       | R&S®CMW-S600A | 1201.0102.02 |
| ARB + Realtime Baseband Generator Module   | R&S®CMW-B110A | 1202.5508.02 |
| TX Measurement, GSM/GPRS/EDGE, Uplink  | R&S®CMW-KM200 | 1203.0551.02 |
| TX Measurement, WCDMA, Uplink  | R&S®CMW-KM400 | 1203.0700.02 |
| Enable R&S®WinIQSIM2 Waveforms, GSM/EDGE   | R&S®CMW-KW200 | 1203.0951.02 |
| Enable R&S®WinIQSIM2 Waveforms, WCDMA  | R&S®CMW-KW400 | 1203.1006.02 |

## Service you can rely on

- | In 70 countries
- | Person-to-person
- | Customized and flexible
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- | No hidden terms

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Rohde & Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established 75 years ago, Rohde & Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

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For data sheet, see  
PD 5213.9211.22  
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