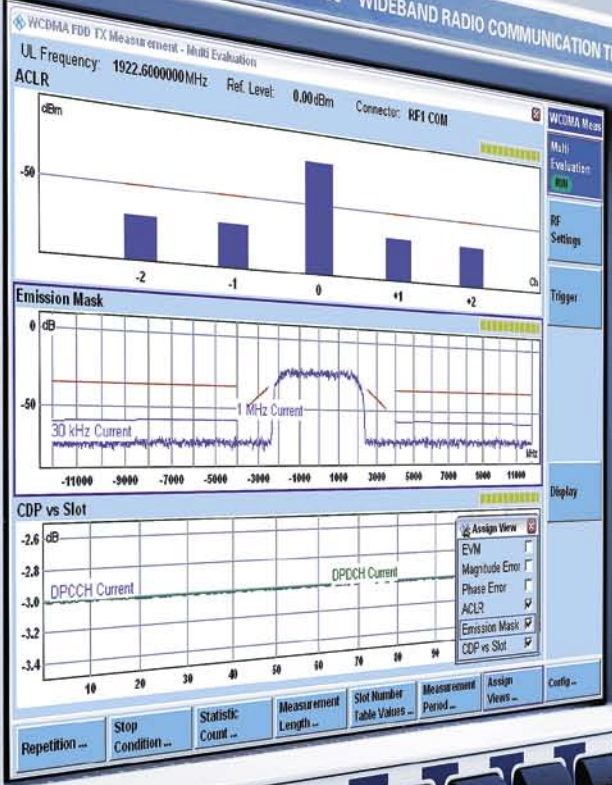




**ROHDE & SCHWARZ**  
CMW 500 · WIDEBAND RADIO COMMUNICATION TESTER



# Breakthrough in scalability and speed in production

State-of-the-art wireless devices are increasingly evolving into multistandard platforms. This trend and the overall cost pressures are forcing manufacturers to make their production processes more efficient and cost-effective. Rohde & Schwarz has therefore joined hands with mobile radio manufacturers and chipset developers to find solutions. The new R&S®CMW500 wideband radio communication tester from Rohde & Schwarz now stands available as the impressive result of these efforts

(FIG 1).

◀ FIG 1  
The R&S®CMW500 non-signaling tester is a fast, precise, and highly scalable tool in production. Featuring a frequency range up to 6 GHz and an IF bandwidth of 40 MHz/70 MHz (analyzer/generator), the production tester is optimally prepared to handle future technological developments.

For TD-SCDMA tests by means of the R&S®CMW500, refer to the article on page 10.

## Future-proof and scalable

While the achievements of the 3G standard are being implemented step by step in mobile wireless devices, new standards (3.9G, LTE) are being developed as quickly as possible. Mobile radio manufacturers of course do not want to purchase new test equipment for every new standard. Future-proof test equipment is therefore required, i.e. equipment that is also ready to handle tomorrow's requirements. The R&S®CMW500 meets this criterion. Its hardware is designed to operate in a frequency range up to 6 GHz. The instrument is calibrated up to 3.3 GHz as standard and up to 6 GHz with the R&S®CMW-KB 036 option. You can enable the extended frequency range when required and thus pay only for what you really need.

Large transmission bandwidths are an integral aspect of future mobile radio standards. Standards such as LTE/EUTRA stipulate bandwidths up to 20 MHz, which the R&S®CMW500 even exceeds – offering reception bandwidth of 40 MHz and transmission bandwidth of 70 MHz. Featuring digital IF and baseband processing, the tester provides extremely high accuracy.

The task of aligning mobile wireless devices often calls for very wide RF level ranges. If the tester does not offer the required dynamic range, external amplifiers or attenuators have to be provided, which will impair reliability and accuracy. With its very wide input and output level range, the R&S®CMW500 eliminates the need for such external equipment. Moreover, the tester's flexible RF frontend (FIG 2) makes external switching matrices superfluous in many cases.

For example, to perform a sequential test of two mobile wireless devices, you can measure the first device on one RF connector even as you are connecting the second device to the other RF connector on the tester. When measurements on the first device are completed, the RF connection is switched over to measure the second device. The R&S®CMW500 thus reduces the number of extra RF components that have to be used in a test system. This, in turn, cuts down on costs without any loss in reliability and accuracy.

In production test systems, highly accurate reference measurements are often required at specific points in the test setup. The R&S®CMW500 optimally supports this requirement, allowing you to add an R&S®NRP-Z power sensor to its measurement process. All you have to do is connect the appropriate power sensor to the R&S®CMW500; the tester will handle everything else. The R&S®NRP-Z power sensors meet a variety of test requirements over a wide power range (up to a frequency as high as 40 GHz, depending on the model).

Instruments in production test systems are in most cases remote-controlled from a central controller and thus need no display. The R&S®CMW500 therefore comes in two models – with and without a display.

While test systems used to be controlled mainly via GPIB, there is a clear trend today toward remote control via LAN. The R&S®CMW500 is equipped as standard with a SCPI-based LAN and optionally with a GPIB interface (R&S®CMU-KB612A). Moreover, it can be software-updated to handle LXI Class C. ▶

- ▶ The tester is even optimally prepared to handle requirements yet to be defined. Its digital IF processing and a versatile internal wiring and slot system mean that future requirements can be met by simply plugging in the appropriate expansion modules.

### Multistandard solution

Modern mobile wireless devices support numerous mobile radio standards plus Bluetooth® and WLAN. The use of classic, standard-specific alignment procedures would result in test and alignment times that far exceed acceptable limits. State-of-the-art concepts, therefore, are aimed at performing transmitter and receiver alignment using general-purpose measurements as far as possible. To this effect, the R&S®CMW500 includes as standard an RF power meter with versatile configuration capabilities and a CW/dual-tone generator. The power meter offers various filters with different characteristics and bandwidths for evaluation and provides comprehensive statistical analysis functions.

### Ideal also for complex signals and measurements

To generate complex signals, the tester can be expanded with an arbitrary waveform (ARB) generator (R&S®CMW-B110A option). The ARB generator features a variable clock rate of 400 Hz to 100 MHz and a memory depth of 1 Gbyte, and delivers arbitrary, user-specific modulation signals. The R&S®WinIQSIM2 waveform creation tool is available to help you generate waveform files. With the R&S®CMW-KG200 and R&S®CMW-KG400 options, the ARB generator can produce GSM, GPRS, EDGE and WCDMA signals directly without requiring any waveform files.

The R&S®CMW500 contains as standard an I/Q recorder for the analysis of complex signals. The signal to be measured is recorded over a defined period of time, and the I and Q values are transferred to an external PC for analysis.

This can be done more conveniently and rapidly using various R&S®CMW500 measurement options. These options determine, for example, all relevant parameters of a GSM or WCDMA signal in a minimum of time. Measurement options are currently available for GSM/GPRS/EDGE, WCDMA, CDMA2000®, TD-SCDMA and mobile WiMAX – each of them designed for maximum performance. This means, for example, that measurement data is analyzed right where it is collected. A high-speed digital signal processing (DSP) system with specially designed hardware support analyzes recorded measurement data in virtually no time. It thus reduces the data to be transferred to an acceptable minimum. You therefore do not need to manipulate sample rates and bus transfer times in order to optimize processing times, as would be necessary with test systems that have to transfer all measurement data to the controller for signal processing. An independent DSP system allows you to perform numerous measurements in realtime because it is not loaded with any parallel processes such as the processing of data for displaying traces on screen. Moreover, the DSP system is supported by an intelligent sample logic, allowing signal analysis even as the signal is being recorded. This enables, for example, seamless measurements of indefinite length, if the time required for the applied measurement algorithm is shorter than the corresponding signal segment.

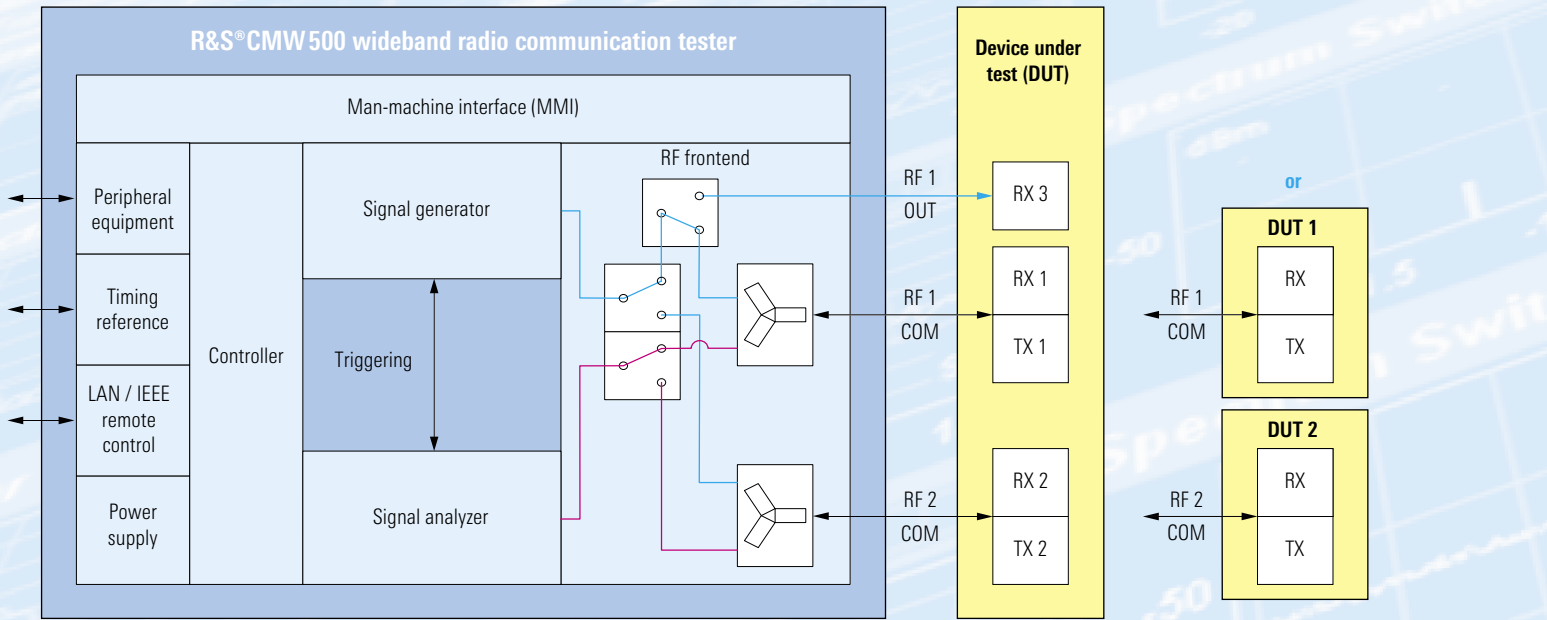
### Speed advantage through multi-evaluation measurements

In the past, it was often difficult to identify the cause of an error. For example, when out-of-tolerance values were detected during GSM modulation analysis, it would have been useful to see the power characteristic for the signal segment being measured. This was rarely possible because signal recording was restarted with each measurement. The R&S®CMW500 has overcome this obstacle; it can simultaneously perform numerous measurements on a given signal segment (multi-evaluation measurements). If an error is detected, all measurements carried out on that segment can be used to trace the cause of the error (FIG 3). The real advantage of parallel measurements, however, is the reduction of measurement time: The R&S®CMW500 carries out a large number of measurements in no more time than for a single measurement. In conjunction with the intelligent sample logic mentioned above, this reduces measurement time to a minimum.

### R&S®Smart Alignment minimizes alignment times

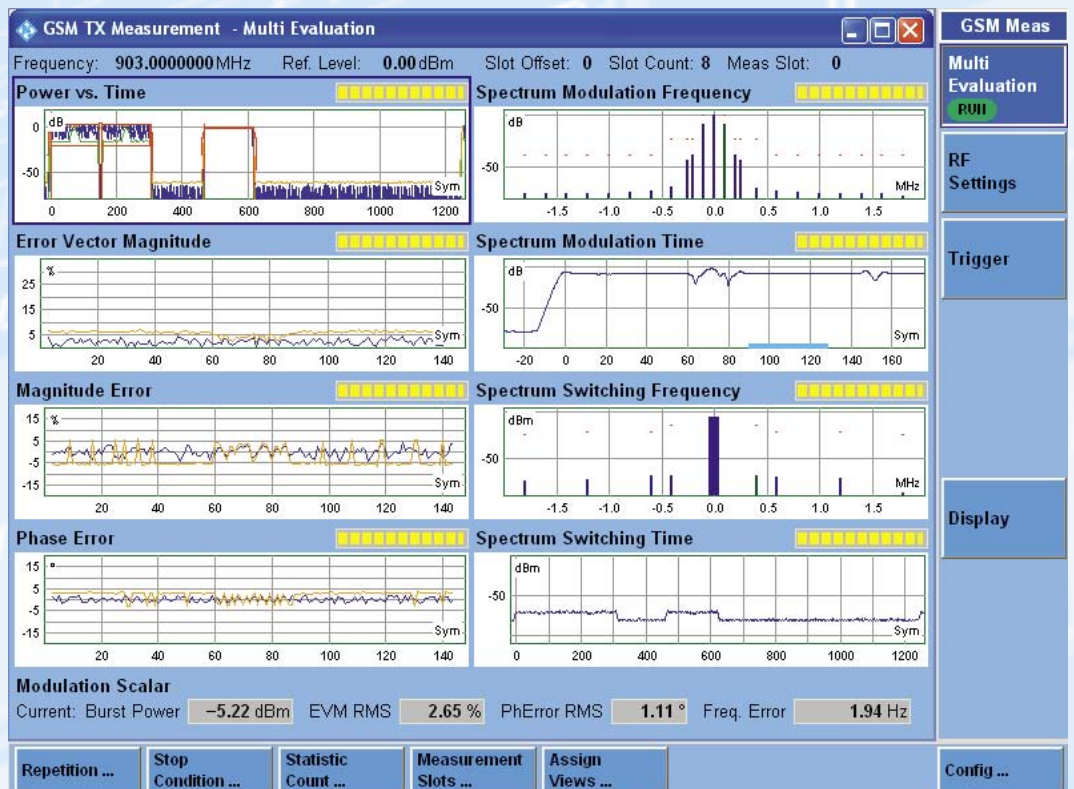
Alignment using general-purpose measurements that are not specific to any standard is only the first step toward reducing measurement time. An analysis of the process times required for alignment reveals that the critical factor is not measurement times but handling times. Coordinating the test sequence takes up most of the time. In the conventional approach, the controller sets the required frequency first on the tester and then on the mobile wireless device. Next, it sets the first power control level on the wireless device and starts the measurement. The result is transferred to the controller. Then the next power level is set and the next measurement performed. After all power control levels

**FIG 2** Block diagram of the R&S®CMW500. With all test components integrated in a single box, the R&S®CMW500 offers outstanding measurement accuracy without any effort required on the part of the user. There is no need for costly and time-consuming repetitive self-alignment procedures. The flexible RF frontend can in many cases replace an external switching matrix (e.g. when testing a mobile wireless device with multiple receive and transmit paths, or when testing and aligning two mobile wireless devices in parallel).



**FIG 3**

The R&S®CMW-KM200 option (TX measurement, GSM/GPRS/EDGE, uplink) offers a variety of measurements and statistical evaluations from which you may select as needed. The selected measurements are performed in parallel on a specific signal segment (multi-evaluation measurement). All results can be displayed in an overview window. For detailed analysis, you can enlarge each partial measurement to full-screen size. Multi-evaluation measurements are available as options for all important mobile radio standards.



- ▶ at the first frequency have been measured, the controller advances to the next frequency, and the test sequence is repeated.

With a state-of-the-art approach like the R&S®Smart Alignment concept, predefined frequency/power sequences are started synchronously on the mobile wireless device and on the tester. They are processed in parallel, i.e. without any time loss, and all results are transferred to the controller. This approach drastically reduces alignment times. The R&S®CMW500 can both generate and analyze R&S®Smart Alignment frequency/level sequences by means of its power meter (FIG 4) and its CW/dual-tone generator (FIG 5). The step width can of course be adapted to the characteristics of the device under test. In addition, the ARB generator enables you to control the processing of a frequency/level sequence as required by using markers stored in the waveform file.

### Bit error ratio (BER)

The BER is used to assess the quality of the receiver of a mobile wireless device. The classic approach determines the BER by means of a measurement loop. The tester transmits a standard-compliant signal with PRBS-modulated data content (PRBS = pseudo random binary sequence) to the mobile wireless device, which receives and decodes the signal. The mobile wireless device re-encodes the decoded signal in line with the standard and returns it to the tester. The tester analyzes the signal and compares its data content with that of the original signal. This approach has two disadvantages. First, this measurement requires a fully functional mobile wireless device capable of transmitting and receiving standard-compliant signals. In the case of a GSM phone that can serve one timeslot only, the measurement takes

eight times the minimum theoretical time because data exchange takes place only in one of the eight timeslots. Second, standard-compliant coding of the PRBS data means that not all data bits are available for determining the BER, as numerous bits are required for the header and for error correction. Plus, the standard error correction mechanisms impede the objective quality assessment of the receiver.

State-of-the-art approaches for measuring the BER use a method referred to as single-ended BER. The tester transmits a defined PRBS-modulated signal, and the receiver in the mobile wireless device determines the BER by comparing the received signal with the expected signal. Since neither a standard-compliant signal nor a loop is used, all bits of the signal are available for measuring the BER, which dramatically cuts down on test times.

### Summary

But, there are drawbacks to everything. This also applies to state-of-the-art measurement approaches in production. The classic approaches permitted you to measure every standard-compliant mobile wireless device: All that was required was conventional signaling or a simple test interface on the wireless device in order to make all required test settings. Test sequences could easily be adapted to changing requirements.

State-of-the-art measurement approaches, by contrast, demand that even chipset manufacturers give careful consideration to subsequent alignment and test procedures in production. This is because the predefined frequency/level sequences are not defined by any standard, and subsequent modifications to such sequences are difficult to make with a finished chip. These drawbacks have so far kept manufacturers from

switching to modern alignment methods. In the meantime, however, cost and time pressures in production have grown to such an extent that an increasing number of manufacturers are adopting new concepts.

Rohde & Schwarz is also an experienced partner for wireless device manufacturers when it comes to state-of-the-art alignment and test methods. Furthermore, the company supports manufacturers in the implementation of the new concepts. The R&S®CMW500 wideband radio communication tester is tailored to meet the requirements of modern alignment and test concepts. Owing to its high flexibility and extremely short measurement times, the R&S®CMW500 marks a breakthrough in scalability and speed in production.

Rudolf Schindlmeier

More information and product brochure at  
[www.rohde-schwarz.com](http://www.rohde-schwarz.com)  
 (search term: CMW500)



FIG 4

The universal power meter of the R&S®CMW500 can track the frequency/level sequences returned by the mobile wireless device when using state-of-the-art alignment concepts, and analyze the power of the individual frequency/level steps of a sequence. The tester can perform various statistical analyses (e.g. minimum/maximum power or standard deviation), depending on requirements. The number of frequency/level steps of a sequence is selectable between 1 and 500.



FIG 5

The CW/dual-tone generator of the R&S®CMW500 can deliver sequences of up to 2000 frequency/level steps. Two separate functions are available for level setting – “Level (RMS)” and “Digital Gain”. You can thus control the R&S®CMW500 gain and attenuation paths exactly as needed. Adjusting the digital gain will not cause any change to the tester’s gain and attenuation paths. You can thus implement extremely linear level characteristics, avoiding any effects on the device under test that might distort results.

