The first comprehensive drive test solution for WiMAX™ wireless communications networks

The sophisticated R&S®ROMES coverage measurement software can handle all wireless communications standards and can measure, merge and evaluate measurement data from a wide range of different sensors and devices, e.g. radio network analyzers, test mobile phones, data cards and GPS receivers. In conjunction with the R&S®TSMW universal radio network analyzer, it represents the first comprehensive test solution on the market for the WiMAX™ standard.

The versatile R&S®ROMES software platform

Using appropriate sensors, e.g. WiMAX™ trace data cards, the R&S®ROMES measurement software can display, store and evaluate network parameters. It provides insight into the PHY layer with important information such as RSSI, CINR and transmit power. Measurement data from up to eight neighboring cells can also be compared. The user can thus check whether the base station with the best reception quality is really always used. The layer 3 decoder in the software also assists in solving problems with cell handovers, which can result in the disconnection of calls, by providing insight into the MAC and IP layers. The integrated filter helps to find specific protocol messages or suppress irrelevant messages, for example. In conjunction with the coupled focus function in R&S®ROMES, any desired points of a test drive can thus be selected, and all results with an identical time stamp visualized. The map view allows the convenient identification and selection of measurement areas with low coverage, for example. The map presents all parameters measured at the different layers. The user can thus easily compare the (limited) view from the perspective of a mobile phone or data card with the (comprehensive) view of the scanner, and thus draw conclusions with respect to user problems in the network.

QoS is what counts

In addition to physical parameters, R&S®ROMES can also measure network quality and performance. The data quality analyzer (DQA) option uses a job list to generate data traffic (FTP, HTTP, PING, UDP, e-mail) and measures parameters such as effective data transfer rate, round trip time (RTT) or connection setup time. These parameters are combined in key performance indicators (KPI), which present the essential performance aspects in concise form. The DQA also measures the effective data throughput at the application level, which if lower than expected indicates a potential need for optimization. Possible causes can, for example, be a poor CINR, a low-order modulation format (QPSK instead of 64QAM, despite a high CINR), or a configuration problem in the relevant base station. The numerous views of the R&S®ROMES measurement software allow optimal checking of all of these possibilities.

	R&S®TSML-x	R&S®TSMU	R&S®TSMQ	R&S®TSMW
Frequency range	80 MHz to 3 GHz 80 MHz to 6 GHz (R&S®TSML-CW)	80 MHz to 3 GHz	80 MHz to 3 GHz	30 MHz to 6 GHz
Standard	GSM, WCDMA, CDMA2000®, EV-DO, CW, spectrum	GSM, WCDMA, CDMA2000®, EV-DO, CW, spectrum	GSM, WCDMA, CDMA2000®, EV-DO, CW, spectrum	WiMAX™, digital I/Q data interface
Features	Supplied with one standard in each case	All standards can be installed simultaneously; one standard can be measured at a time	All standards can be installed and measured simultaneously (except for CW)	All standards can be installed and measured simultaneously

**Overview of radio network analyzers available from Rohde & Schwarz**

Detecting what mobile phones can't "see"

The R&S®ROMES measurement software and the R&S®TSMW universal radio network analyzer (see also page 6) together form a particularly powerful duo for WiMAX™ measurements. The R&S®TSMW-K28 WiMAX™ scanner option enables a detailed analysis of what actually takes place on the air interface. A mobile phone normally only receives neighborhood information from the broadcast channels of the active base station; the analyzer, however, is not restricted in this respect, and detects each and every available WiMAX™ signal with a sensitivity significantly below the noise level. It can therefore not only check neighborhood information, but can also identify interference signals from remote base stations.

The 20 MHz bandwidth offered by both frontends in the R&S®TSMW enables operation with all established WiMAX™ bandwidths.

The scanner not only detects basic parameters such as FFT size, length of cyclic prefix and frame rate, but also the preamble ID and the cell ID as well as the segments used in the WiMAX™ signal. At the same time, it calculates the RSSI and the CINR based on the preamble. This provides the user with an overview of the actual situation on the air interface. Incorrect configurations in the network such as preamble IDs used more than once on the same center frequency in neighboring cells, different cycle prefix lengths or unexpectedly poor CINR values despite high RSSIs can thus be detected immediately.

FIG 1 Evaluation of WiMAX™ data cards using the R&S®ROMES coverage measurement software. At the top right MAC and IP messages, at the bottom right an overview of the WiMAX™ parameters, and at the bottom left WiMAX™ scanner data. The recording of the route is used for correlating measured values.
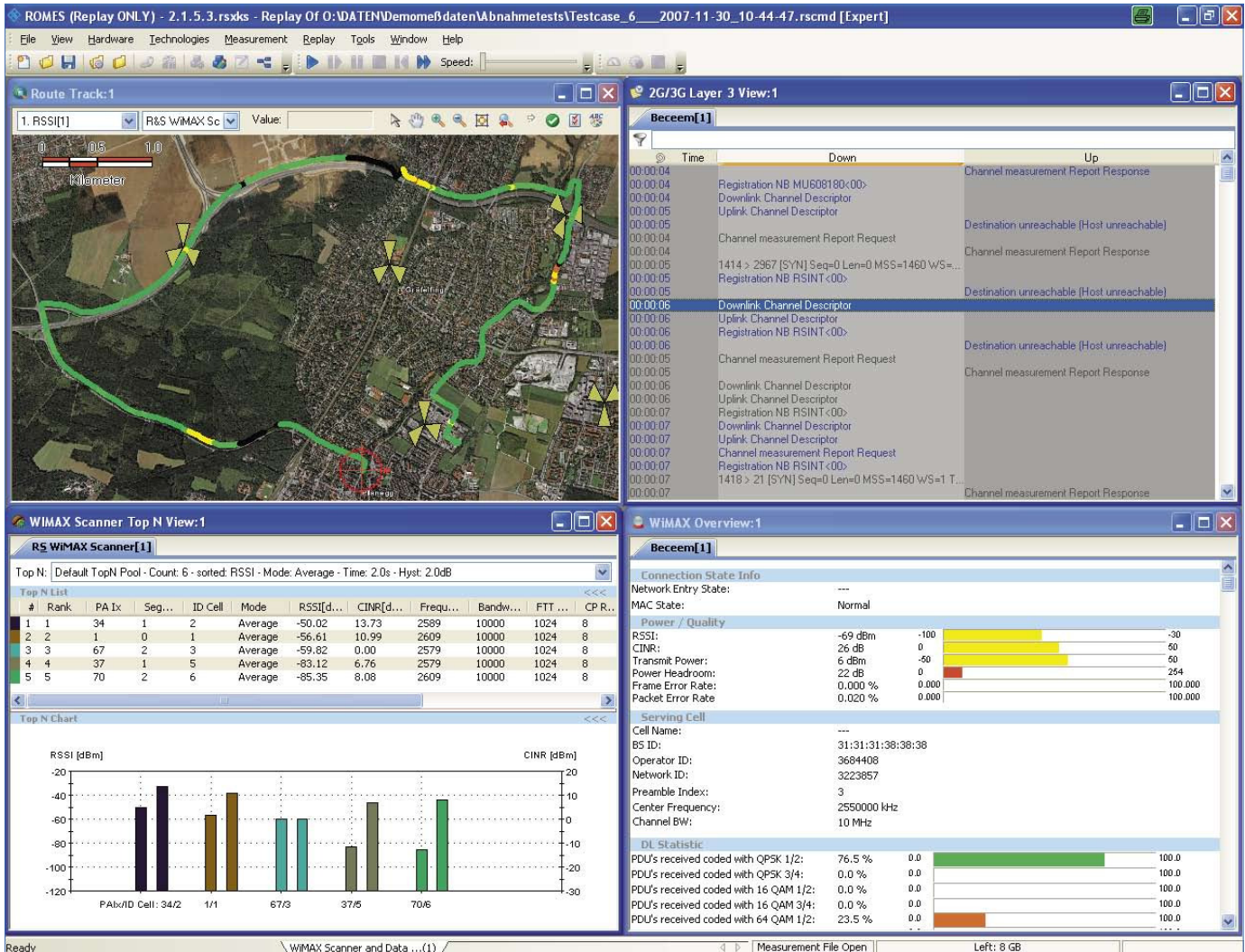
High sensitivity paired with high immunity to interference

Sensitivity, dynamic range and scanning speed are the key parameters of a radio network analyzer, fields in which the R&S®TSMW offers outstanding performance. A noise figure of typically 7 dB at 3.5 GHz, for example, ensures high sensitivity. This by no means compromises immunity to interference. The integrated preselection sufficiently attenuates interference signals outside the reception band and protects against undesired intermodulation products.

In order to achieve a high scanning speed, the R&S®TSMW has been equipped with two powerful frontends. This enables simultaneous scanning and demodulation on different center frequencies. The short switchover time of <5 ms between different center frequencies even enables the quasi-parallel reception on any number of carrier frequencies across the entire frequency range from 30 MHz to 6 GHz. The very good phase noise figure of the R&S®TSMW frontends, in conjunction with the sophisticated signal processing, ensures unparalleled measurement performance.

A platform for all technologies

The R&S®TSMW-K28 WiMAX™ scanner option provides the first wireless communications standard for the R&S®TSMW. The R&S®TSMW universal radio network analyzer is prepared to handle all established standards, and can support all of these with a bandwidth of up to 20 MHz. This requires no hardware reconfiguration. Based on a software-defined architecture (SDR), the R&S®TSMW can easily be expanded to include current and future standards such as LTE by adding the appropriate software options. This makes it a future-oriented investment. The multiplex capability of the R&S®TSMW also enables the parallel measurement of two or more standards without any significant loss in performance. A further powerful advantage is provided by the integrated GPS receiver which can be used for synchronization via PPS and for determining the positions of base stations.

With its R&S®TSMW universal radio network analyzer and the R&S®ROMES universal software platform for drive tests, Rohde&Schwarz is the first manufacturer to offer a comprehensive, seamless solution for the WiMAX™ standard.

Dr. Markus Herdin; Stefan Schindler

Rear panel of the R&S®TSMW universal radio network analyzer.

Abbreviations

CINR	Carrier-to-interference-plus-noise ratio
MAC	Medium access control
RSSI	Receiver signal strength indicator
QoS	Quality of service
UDP	User datagram protocol
SDR	Software defined radio

When is a test mobile phone used?

❚ When access to measurement data via the trace interface is sufficient
❚ For link-related measurements:
  – Data throughput
  – Link quality
  – Soft and hard handover
  – Speech quality
  – Video quality
  – Detection of call interruptions
  – IP protocol analysis
❚ For end-to end tests from the customer's perspective

Advantages offered by a radio network analyzer

❚ Higher measurement speed
❚ High dynamic range and sensitivity
❚ Operates independently of wireless communications network
❚ Is capable of detecting missing or incorrect neighborhood information
❚ Can be used for multiple applications and multiple wireless communications networks
❚ Can be used as a measurement reference due to independence from chipsets
❚ Future-oriented investment due to upgradability via software options
❚ Requires no network resources
❚ No operating costs, since a SIM card is not necessary