



FIG 1 The R&S®TSMx radio network analyzer family offers the suitable unit for any task and any budget.

# Radio network analyzers for all tasks and any budget

Five new instruments expand the radio network analyzer portfolio: The tried and tested R&S®TSMU radio network analyzer is supplemented by the R&S®TSMQ and the R&S®TSML-x quartet. The R&S®TSML-x has a particularly attractive price and – depending on the model – can be used for GSM network scan and PN scan for CDMA2000® or WCDMA, as well as for power measurements and handover analysis. The R&S®TSMQ all-purpose instrument is equipped with comprehensive functions and can analyze several different networks at the same time.

The article on page 9 shows how conveniently the R&S®TSMx radio network analyzers perform neighborhood analysis in 2G and 3G networks.

## T&M equipment for all needs

Maintaining, expanding, and optimizing mobile radio networks are some of the never-ending tasks network operators have to perform. Highly specialized T&M equipment can facilitate such complex tasks. With the expanded R&S®TSMx family, Rohde & Schwarz thus offers radio network analyzers to meet any requirement (FIG 1). The analyzers offer many solid advantages and are not subject to the drawbacks of a test mobile phone. The box on page 6 describes how network operators can profit from the Rohde & Schwarz radio network analyzers; for the major differences between the various product lines, see FIG 2.

## Cost-efficient specialists: R&S®TSML-x

The new R&S®TSML-x radio network analyzers offers attractive solutions for applications within a particular mobile radio standard. If a test system is to be expanded at a later time to meet additional standards, the FireWire interface (IEEE 1394) and the modular structure of the R&S®ROMES coverage measure-

ment software make it possible to integrate several analyzers without modifying the system.

The ViCOM interface – a special feature of all the R&S®TSML-x analyzers – allows you to access raw measurement data using customer-specific software. A detailed description, example programs, and a preconfigured source code facilitate implementation and offer utmost flexibility.

All the instruments of the R&S®TSML-x family are very compact and weigh only 1.5 kg. They can also be integrated into 19" racks. Owing to their low power consumption of only 8 W, they are ideal for mobile use. Measured data can quickly be transferred to a PC via the FireWire interface.

The **R&S®TSML-CW power measurement receiver** is perfect for performing radio-network-independent CW measurements and RF power level measurements of modulated and unmodulated carriers. Triggering is by time or by distance. The instrument's large frequency range of 80 MHz to 6 GHz and settable resolution bandwidths between 12.5 kHz

FIG 2 The R&S®TSMx product line at a glance

	<b>new</b> Four models: R&S®TSML-x	R&S®TSMU	<b>new</b> R&S®TSMQ
<b>Mobile radio standards (GSM, CDMA, WCDMA) or CW</b>	defined standard	user-defined standard	several standards in parallel (CW separately)
<b>ViCOM interface for user-specific software</b>	yes	no	no
<b>Measurement speed</b>			
<b>WCDMA</b>	10 measurements/s	20 measurements/s	50 measurements/s
<b>CDMA2000®</b>	5 measurements/s	10 measurements/s	10 measurements/s
<b>GSM</b>	40 channels/s	80 channels/s	100 channels/s

▶ and 4 MHz make it highly versatile. No matter if it is used for broadband reception, TV bands, WiMAX, TETRA, GSM (all bands) or WCDMA (bands I to IX) – it can do virtually everything. WiMAX measurements can be performed not only in line with the IEEE 802.16-2004 stationary standard but also in line with the IEEE 802.16e-2005 standard for mobile applications, allowing coverage gaps to be detected at an early roll-out stage. Also its measurement speed is convincing: 20 channels per second (GSM) with a resolution of 10 cm at a speed of 180 km/h (GSM-R).

The **R&S®TSML-G GSM network scanner** decodes system information such as CI, MNC, LAC, MCC, and BSIC for all GSM bands. At 40 channels per second including demodulation and decoding, its measurement speed is extremely high and thus ideal for the fast optimization of GSM, GPRS, and EDGE networks. Problems during roaming or interference caused by carriers from other networks can be easily detected.

The **R&S®TSML-C and R&S®TSML-W PN scanners** demodulate RF parameters of CDMA2000® networks (R&S®TSML-C) or WCDMA networks (R&S®TSML-W). Network operators can thus automatically analyze all PN codes of the corresponding signals with respect to RF power, timing, and quality parameters. With its frequency range, the R&S®TSML-C covers all CDMA2000® bands and performs five measurements per second. The RF receiver of the R&S®TSML-W covers all WCDMA frequency bands (I to IX) and can perform ten measurements per second. Both instruments have rake receivers with 512 fingers and measure up to six carriers at the same time. This makes them ideal for benchmark applications.

### The universal R&S®TSMU radio network analyzer

The established modular R&S®TSMU radio network analyzer [1, 2] can be specially configured for the desired application. It can perform WCDMA, CDMA2000®, GSM, and CW measurements. The required options can be quickly and easily integrated – a classic example of versatility and cost efficiency.

The receivers of the instrument family are not based on a chipset but are equipped with a broadband RF input section. This is a huge advantage, since standards and frequencies may be completely different and since the R&S®TSMU offers utmost flexibility for measuring frequencies between 80 MHz and 3 GHz.

An integrated distance triggering was for the first time implemented in the R&S®TSMU. Wheel-generated pulses provide a fixed distance irrespective of the driving speed. The advantage of this is that the spatial distribution of measurement points is always the same. Thus, power measurements in line with the Lee criterion are no problem. Even measurement distances of 15 cm at a speed of up to 200 km/h are no difficulty for the R&S®TSMU.

### Fully equipped: the R&S®TSMQ

The new R&S®TSMQ radio network analyzer (FIG 4) offers the highest performance in the family. It not only supports networks of all standards (WCDMA, GSM, CDMA2000®) but can also simultaneously perform measurements in all standards. No additional options are required; everything is integrated in the analyzer. It thus offers new applications ▶

## Unbeatable:

Radio network analyzers from Rohde & Schwarz are an indispensable tool in all cycles of a mobile radio network (FIG 3), and they provide measurement results far more quickly and more accurately than test mobile phones. Their broadband RF input section and the easy and modular optioning offer utmost flexibility for network operators, service providers, regulatory authorities, and hardware manufacturers.

Test drives with radio network analyzers are performed to check whether mobile radio networks allow complete and interference-free radio coverage. But network coverage also has to be ensured in areas inaccessible by car, e.g. public buildings such as exhibition halls, train stations, or airports. The radio network analyzers from Rohde & Schwarz are ideal for these tasks: They are small, light in weight, and can be operated for quite a long time without an external power supply.

The numerous radio cells in large cities and many small cells in public buildings increase the complexity of mobile radio networks. They call for coverage measurements with a high spatial resolution. This is also important for measurements to be carried out on railway lines, since mobile radio customers want to be as accessible in increasingly fast trains as in their homes. The frequent cell handovers caused by the high speed as well as large Doppler shifts place extremely high demands on the T&M equipment: It has to provide quick and meaningful results. No problem for the R&S®TSMU: Even at distances of 15 cm and speeds of 200 km/h, it can provide accurate measurement results.

The radio network analyzers from Rohde & Schwarz are far superior to conventional test mobile phones in terms of accuracy and speed. In contrast to conventional test mobile phones, they also synchronize to signals with far less received power – either by pulses from a GPS receiver or by network-

# radio network analyzers from Rohde & Schwarz in practice

internal, highly accurate synchronization sequences. You can also measure signals that are too weak for data transmission but able to impair existing links. Mobile phones in WCDMA networks, for example, tolerate erroneous codes by simply discarding them during demodulation. For handover procedures, however, this can be very annoying. The R&S®TSMx radio network analyzers, on the contrary, evaluate several signal sections to achieve a far higher correlation gain.

In addition, the radio network analyzers can also detect interference originating from external sources, e.g. broadband signals. Owing to their analog spectrum monitor, they measure signals over a wide frequency range. 2D waterfall diagrams help to clearly display external interference and to detect it over a long period of time.

The R&S®TSMx radio network analyzers support you in finding suitable sites for base stations or provide information on required antenna modifications. When optimizing and maintaining radio networks, new base stations have to be checked for network integration. Interference measurements are necessary to check whether additional interference is created by the new transmitters. This would be a draw-

back, since interference reduces the valuable network capacity and transmission quality. Owing to their sophisticated technical features, the radio network analyzers from Rohde & Schwarz together with the R&S®ROMES coverage measurement software [3] are able to detect and accurately localize such interference.

They also help to avoid interference, e.g. when parameters in the network are incorrectly set. Handover hystereses, target block error ratios, or errors in neighbor lists may cause additional problems. With test mobile phones, the analyzers can, for instance, evaluate target block error ratios (BLER) that are set too high by means of the perceptual evaluation of speech quality (PESQ) algorithm. This end-to-end measurement method measures from the customer's point of view and easily provides mean opinion score (MOS) values reflecting the speech quality of the network.

Handover and neighborhood analysis carried out in the past by time-consuming data post-processing can now be performed already during the test drive using the R&S®ROMES coverage measurement software (see box on page 9).

## The most important advantages

- ◆ Convenient and time-saving coverage measurements and network optimization
- ◆ Patented measurement methods from Rohde & Schwarz, irrespective of a test mobile phone
- ◆ Future-proof due to flexible hardware and software expansion
- ◆ Compact and handy design for indoor and outdoor use
- ◆ Versatile frequency-band-independent use owing to broadband RF input module
- ◆ Conclusive spectrum monitor of air interface for uplink and downlink
- ◆ Decoding of broadcast information in 2G and 3G networks without SIM card authorization

FIG 3 The radio network analyzers from Rohde & Schwarz help in all cycles of mobile radio networks.

Network setup	Network maintenance	Network optimization	Network regulation
Power level measurements Selection of base station sites – Network coverage – Calibration of planning tools – Verification of network planning – Adjustment of antennas CW measurements	Interference measurements Avoiding pilot pollution Functional tests of base stations Interference analysis	Increasing capacity Increasing quality – Handover – Neighborhoods – Quality of service (QoS) Benchmark tests Handover analyses Neighborhood analyses Voice and video quality Key performance indicator (KPI) Data rates and network quality	Interference measurement Network coverage QoS Spectrum Interference measurement Voice and video quality Data rates Spectrum display

► and provides unique ways to reduce costs. During a test drive, for example, it performs measurements in additional networks, such as another network of a network operator with a different mobile radio standard.

Due to its high performance, the instrument can also run benchmark tests – offering cost advantages and saving a considerable amount of time. Another application is neighborhood analysis: The R&S®ROMES coverage measurement software can decode base station information from the measured values in 2G and 3G networks simultane-

ously. This data is compared with a base station list and thus quickly provides missing neighborhood relationships or detects potential interference. Moreover, the R&S®TSMQ can also perform analog CW measurements.

Owing to its compact size, light weight, and low current consumption, the instrument can be easily accommodated in a backpack and is suitable for mobile use by means of a battery pack. Areas that are only accessible on foot can thus be fully measured and optimized at a high measurement speed.

Stefan Schindler

More information and data sheets at  
[www.rohde-schwarz.com](http://www.rohde-schwarz.com)  
 (search term: type designation)

#### REFERENCES

- [1] Radio Network Analyzers R&S®TSMU: Performance giant in compact format sets new standards. News from Rohde & Schwarz (2003) No. 180, pp. 4–7
- [2] Radio Network Analyzer R&S®TSMU: Automatic detection of interferences in GSM networks. News from Rohde & Schwarz (2006) No. 190, pp. 4–9
- [3] Coverage Measurement Software R&S®ROMES3: Acquisition, analysis and visualization of data in coverage measurements. News from Rohde & Schwarz (2000) No. 166, pp. 29–32

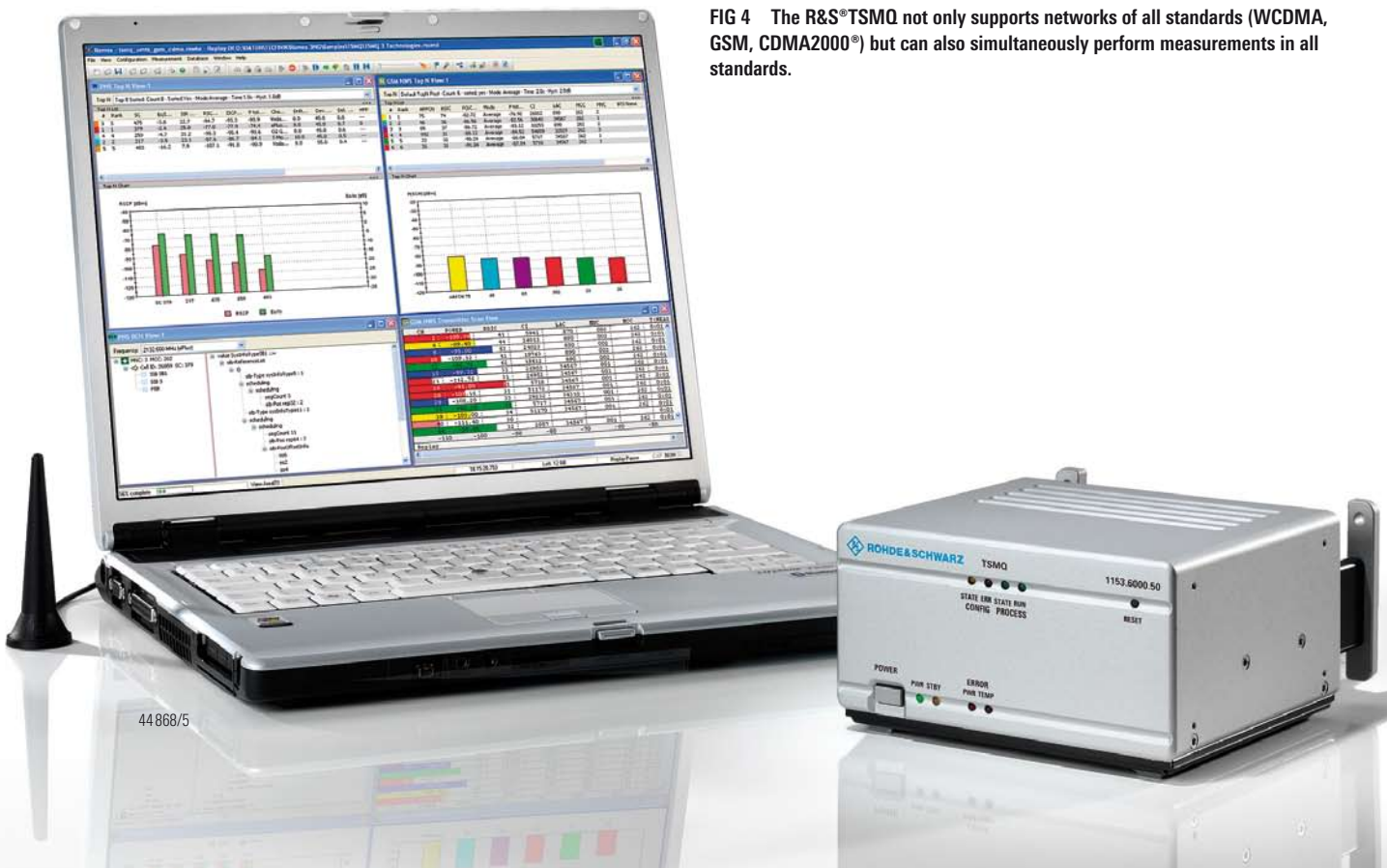


FIG 4 The R&S®TSMQ not only supports networks of all standards (WCDMA, GSM, CDMA2000®) but can also simultaneously perform measurements in all standards.

44868/5