

World's first 3GPP and IMT-2000 scanner now also "understands" LTE

The R&S®TSMW-K29 LTE scanner option expands the R&S®TSMW universal radio network analyzer to meet 3GPP LTE requirements. It is the only scanner capable of simultaneously measuring the parameters of six mobile radio standards for all three ITU regions worldwide in the frequency range from 30 MHz to 6 GHz.

Six mobile radio standards with one scanner

Owing to its new option, the R&S®TSMW can handle six mobile radio standards in parallel: LTE FDD and TD-LTE, WCDMA, GSM as well as CDMA2000®, 1xEV-DO and WiMAX™. This makes it ideal for setting up and optimizing 3GPP LTE networks, and in particular for integrating the new LTE standard into existing 3GPP and IMT-2000 networks. Especially during the initial network setup phase – long before handheld wireless devices or test mobile phones are available – the R&S®TSMW is the most important and reliable source for drive test data. This data is required to analyze both coverage and interference.

Network operators, regulatory authorities and base station manufacturers will profit from the scanner's high degree of automation, which simplifies the analysis of LTE mobile radio

networks. For example, the 3GPP LTE synchronization channels do not have to be entered manually, since signal scan and measurements run automatically. Featuring high sensitivity (up to -127 dBm), the radio network analyzer is capable of detecting even the weakest signals. Due to its signal-to-interference ratio from -20 dB to $+40$ dB, detection is even possible when the frequency channel experiences fading and interference. For LTE (both FDD and TDD) and CDMA2000®/1xEV-DO, as well as for GSM/WCDMA, the universal radio network analyzer also demodulates the system information in order to identify the source of interference within the networks – in the individual

An article on an LTE research project carried out at the Technical University of Dresden, Germany, shows the successful deployment of the R&S®TSMW and the R&S®ROMES drive test software in the initial LTE networks (PDF file **N200_TSMW_e** on the Internet, see page 4).

The R&S®TSMW universal radio network analyzer is a high-performance mobile radio scanner for optimizing all common mobile radio networks. It was specially developed for applications requiring fast measurement and analysis of digital base-band data. For more detailed information, see NEWS 197/08 (pp. 6–8).



RF performance

- LTE FDD und TD-LTE/WCDMA/GSM/CDMA2000® / CDMA2000® 1xEV-DO/WiMAX™
- No band limiting, fully covered frequency range from 30 MHz to 6 GHz
- Two independent receivers with preselection and an IF bandwidth up to 20 MHz
- Intermodulation-free dynamic range
- Signal-to-interference ratio with LTE from -20 dB to $+40$ dB

LTE performance

- High degree of automation with code power measurements
- Demodulation of system information (MIB)
- Measurement of the channel impulse response (CIR) up to the eight-fold guard interval (normal cyclic prefix)
- Adaptive measurement that combines high selectivity with high measurement speed
- Sensitivity up to -127 dBm, synchronization up to -125 dBm
- Up to 200 measurements per second (up to 80 km/h for Lee criterion)
- Channel measurements and fading analysis for Doppler frequencies up to ± 100 Hz

FIG 1 The map view provides an example of the signal-to-interference-plus-noise ratio (SINR) along the route and displays the base station with the highest received signal code power.

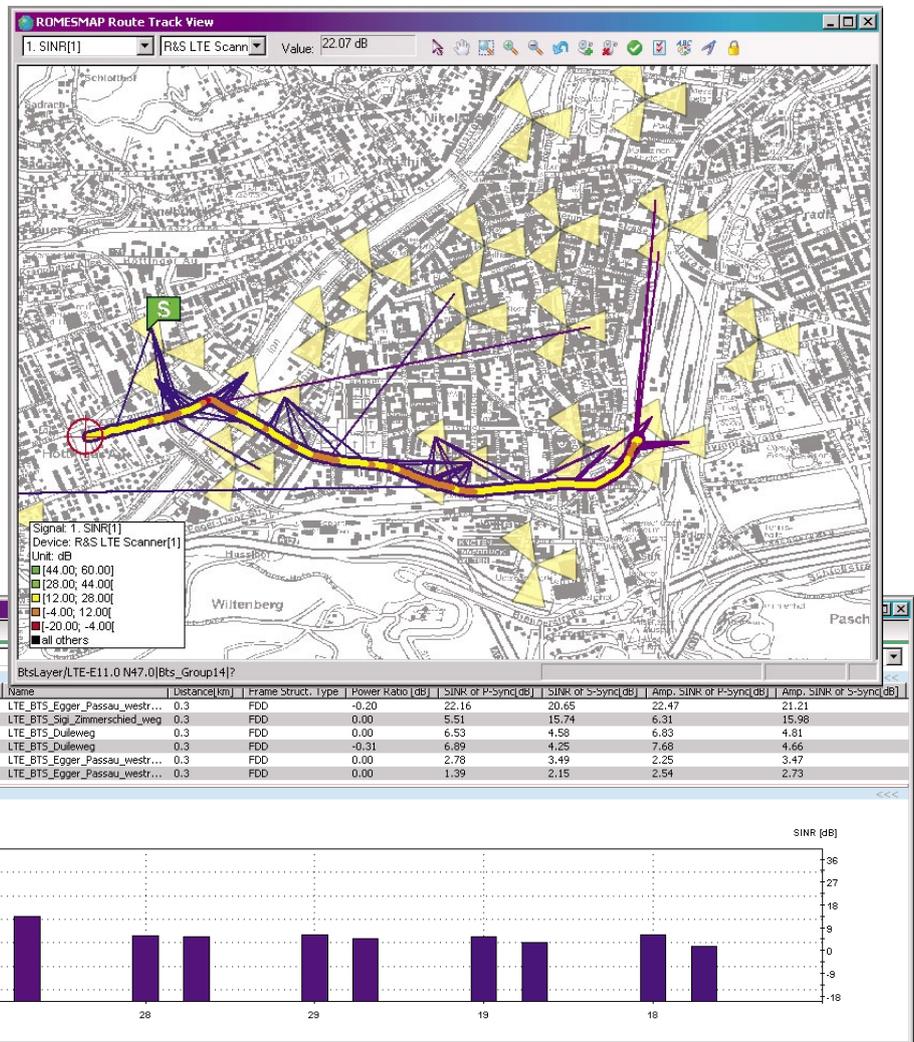


FIG 2 The LTE Top N view displays the N-strongest signals with code power and SINR.

network but also across borders. Together with the integrated spectrum measurement, the R&S[®]TSMW thus enables a comprehensive analysis of the air interface regarding to coverage and LTE network issues (FIGS 1 and 2). Offering a measurement speed of up to 200 measurements per second, complete network coverage testing can be carried out even if driving at high speed.

A key factor for setting up LTE networks is the measurement of the channel impulse response up to 35 μs duration (8-fold guard interval) (FIG 3). In the OFDM modulation mode, which is used with LTE, the guard interval serves as protection against reflections (intersymbol interference) that might occur on buildings or mountains, for example. If the guard interval is impacted as a result of longer delay reflections, data throughput can be considerably impaired, a problem that neither test mobile phones nor conventional scanners can detect (FIG 4).

In addition to a GPS receiver, the R&S[®]TSMW also has two built-in independent receivers with separate antenna inputs, allowing users to flexibly combine and simultaneously measure signals of different standards or frequency bands. Despite the wide frequency range and the high measurement bandwidth of up to 20 MHz, the R&S[®]TSMW is fully protected against interference and intermodulation. This is due to an adaptive preselection that filters out all disturbing influences outside the wanted frequency bands.

Two measurement modes were developed for LTE measurements:

- **Streaming mode**, in which the two RF frontends are able to pick up one or two RF channels simultaneously. This fast measurement mode with up to 200 measurement results per second is available only for LTE and cannot be combined with other measurements

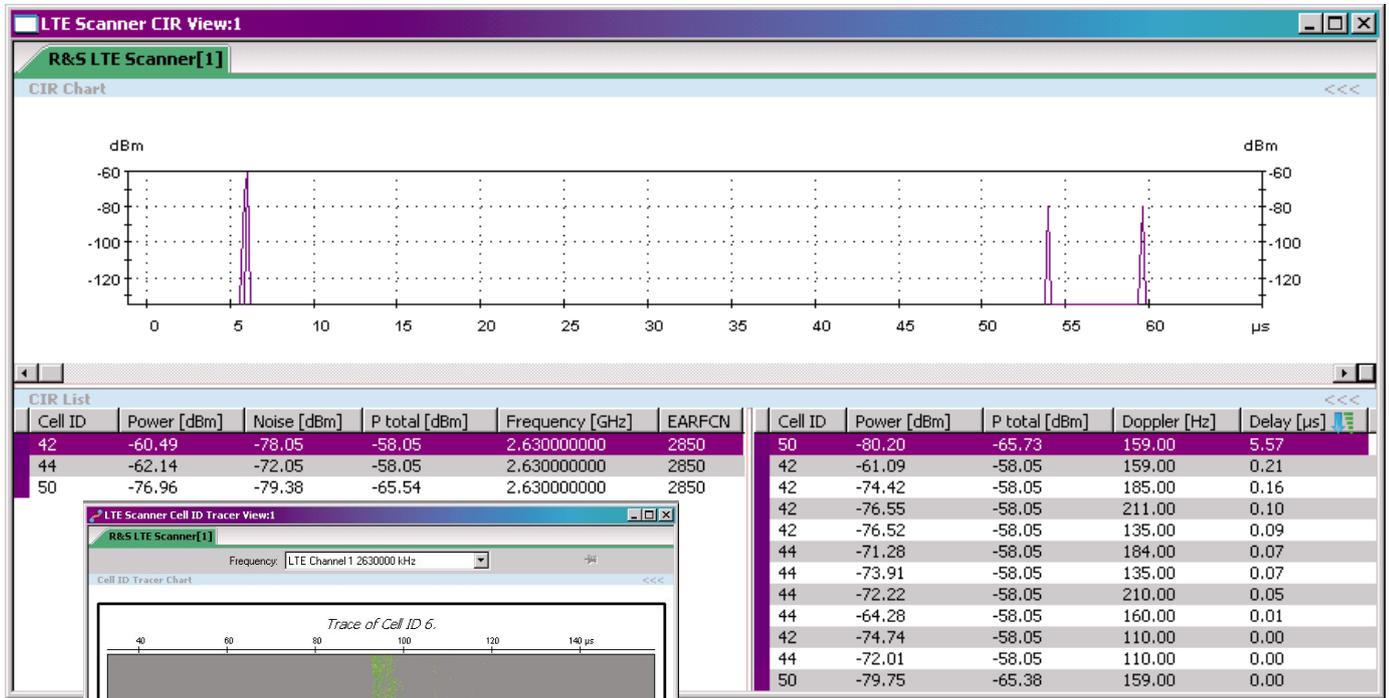


FIG 3 The channel impulse responses of all LTE signals with the corresponding tabs in the CIR view.

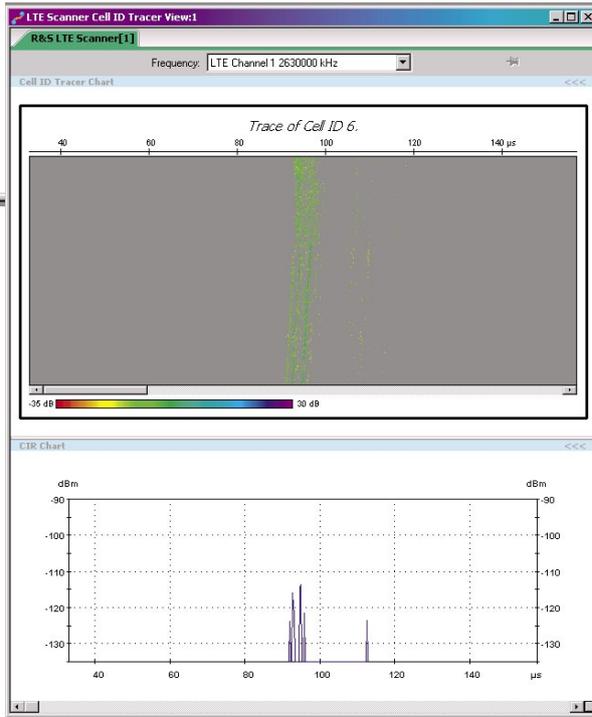


FIG 4 The trace view displays reflections that are continuously distributed across the guard interval, where definite propagation paths are no longer visible. The benefits of OFDM are obvious. Reflections outside the guard interval are shown on the right.

■ **Block mode**, in which up to 64 RF channels can be picked up using the multiplex method (also with up to 200 measurement results per second). In this mode, all other measurements for CDMA2000®/CDMA2000® 1xEV-DO as well as for GSM/WCDMA or WiMAX™ can be added in parallel, reducing the measurement rate for each standard correspondingly.

Moreover, the high measurement speed allows pilot power measurements (measured separately for each base station) in accordance with the Lee criterion (50 measurement results per 40-wavelength distance) up to a speed of 80 km/h. In the case of GSM, for example, this could previously be achieved only by using high-quality test receivers that performed analog power measurements without any reference to the base stations.

The R&S®TSMW is controlled by the R&S®ROMES4 drive test software, which supports all of the scanner functions. An option has been developed for the R&S®ROMES network problem analyzer software (R&S®ROMES4NPA) for conducting postprocessing and problem-spot analysis in LTE coverage measurements.

The R&S®TSMW is a future-oriented and scalable multi-standard platform that fully covers the frequency range from 30 MHz to 6 GHz. Rohde&Schwarz will continue to enhance the new R&S®TSMW-K29 LTE scanner option because it is an important element in the coverage measurement portfolio that will help keep pace with future requirements.

Wolf Seidl