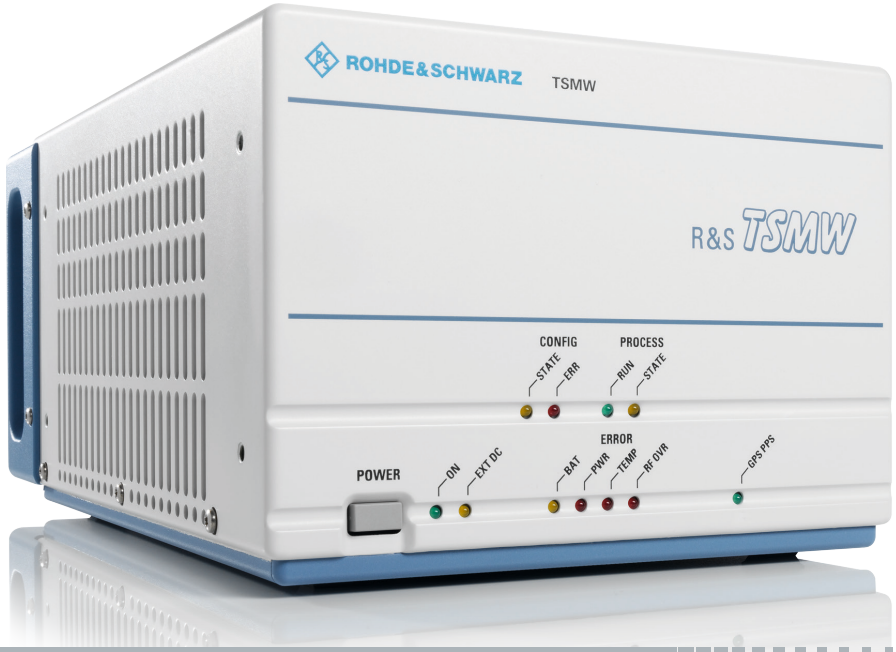
R&S®TSMW Universal Radio Network Analyzer

Scanner for drive tests and I/Q streaming



ROHDE&SCHWARZ
Mobile Network Testing

Product Brochure | Version 22.00

R&S®TSMW Universal Radio Network Analyzer

At a glance

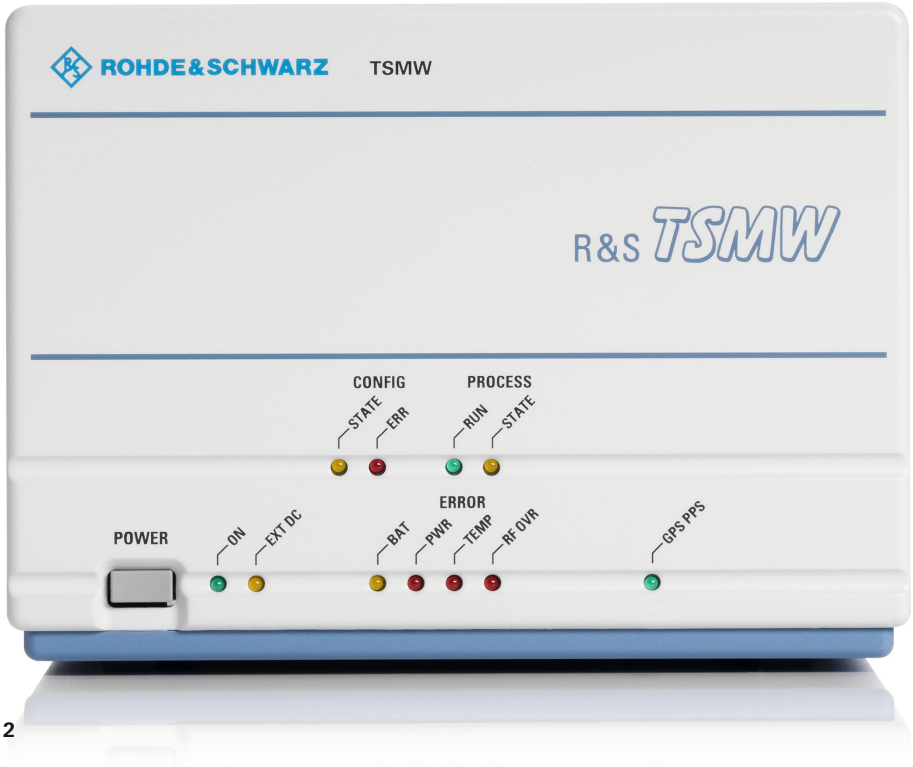
The R&S®TSMW universal radio network analyzer is a platform for optimizing all conventional wireless communications networks. Two frontends for any input frequency from 30 MHz to 6 GHz, preselection and software defined architecture offer unsurpassed performance while providing maximum flexibility. In addition to functioning as a scanner for wireless communications networks, the R&S®TSMW is also an ideal digital I/Q baseband receiver.

Owing to its hardware platform, the R&S®TSMW universal radio network analyzer offers maximum flexibility. For example, the R&S®TSMW comes in handy as an LTE scanner, and it can be utilized together with the R&S®ROMES4 drive test software to roll out and optimize 3GPP EUTRA networks. In addition to LTE, other wireless communications technologies such as GSM, WCDMA, CDMA2000® 1xEV-DO, TETRA and WiMAX™, NB-IoT/Cat NB1 and LTE-M are supported simultaneously.

Moreover, the R&S®TSMW can be used as a realtime scanner for I/Q baseband data. The R&S®TSMW-K1 option offers a MATLAB® and a C++ interface via which I/Q measurement data can be captured and evaluated.

Key facts

- User-definable input frequency range from 30 MHz to 6 GHz
- Two independent RF and signal processing paths, each with a bandwidth of up to 20 MHz
- Integrated preselection for high intermodulation suppression while dynamic range is high
- Support of LTE-FDD/TD-LTE and eMBMS
- Support of TD-SCDMA
- Parallel measurements in GSM, WCDMA, LTE (FDD, TDD, LTE-M), TD-SCDMA, CDMA2000®, 1xEV-DO, TETRA, WiMAX™, NB-IoT/Cat NB1 networks and power scan with the R&S®ROMES4 drive test software
- Support of NB-IoT/Cat NB1 and LTE-M
- Spectrum measurements with the RF power scan option
- I/Q baseband streaming and capturing
- Integrated GPS



R&S®TSMW Universal Radio Network Analyzer

Benefits and key features

LTE and MIMO network rollout and network optimization

- Automatic detection and measurement of all available cells
- MIMO-specific measurements show MIMO gain
- Intersymbol interference analysis with multipath measurements
- Narrowband and wideband measurements
- Support of LTE-FDD and TD-LTE
- Support of LTE-A
- LTE uplink and downlink allocation analyzer
- LTE eMBMS measurements
- NB-IoT/Cat NB1 measurements
- LTE-M measurements
- Automatic channel detection

▷ page 4

All-in-one drive test solution with R&S®ROMES4

- Network optimization with scanner and test terminal
- Improvement of QoS

▷ page 10

Parallel support of multiple wireless communications technologies

- Simultaneous measurements in all supported technologies
- Simple scanner setup
- Flexible assignment of the two receivers for maximum measurement speed
- Everything in one instrument

▷ page 11

Maximum flexibility when evaluating I/Q data

- Seamless streaming of I/Q data in realtime
- I/Q streaming via LAN (1)
- I/Q streaming via Rohde&Schwarz I/Q interface (2)
- Data access via MATLAB® or C++ interface
- Fast integration due to included example application based on MATLAB®

▷ page 12

Unsurpassed hardware platform performance and flexibility

- Broadband with 20 MHz bandwidth and maximum frequency range from 30 MHz to 6 GHz
- Maximum configuration flexibility
- Top dynamic range and measurement accuracy due to adaptive preselection
- Update of hardware platform via software
- Integrated SuperSense GPS with PPS

▷ page 14

Supported by many drive test tools

- Open interfaces for integration into individual software solutions
- Flexibility in choice of drive test software

▷ page 16

LTE and MIMO network rollout and network optimization

Using the R&S®TSMW together with the R&S®ROMES4 drive test software opens the door to numerous measurement and analysis capabilities for LTE field tests.

Automatic detection and measurement of all available cells

All that the R&S®ROMES4 software needs to "know" is the center frequency of an LTE signal. The R&S®TSMW can find all further information that is required, e.g. the bandwidth used, the physical cell ID, the eNodeB cell ID, the cyclic prefix length and the synchronization channels (P-SCH and S-SCH) and RSRP/RSRQ/RS-SINR values. This is particularly relevant when a wireless communications network is growing in size and complexity. The user does not require any detailed knowledge about the LTE network and its structure when carrying out measurements.

Immediately after the measurement is started, the power values of the physical cell IDs are displayed in a Top N chart.

In addition to these values, the RSRP, RSRQ and the narrowband and wideband signal to interference plus noise ratio (SINR) are output. These values indicate whether interference is present on a signal. The sync-signal measurement results can be output at a maximum rate of 200 measurements/s.

MIMO-specific measurements show MIMO gain

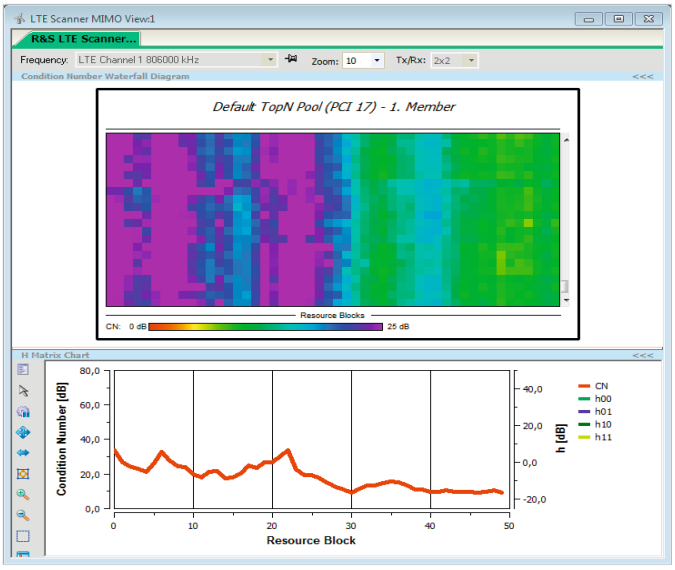
A special MIMO measurement using the two internal R&S®TSMW receivers measures the true MIMO gain under real-world conditions. Two antennas simultaneously measure the LTE signal, making it possible to determine the degree of correlation of the MIMO channel. This indicates whether MIMO can profitably be used in the measured area and whether investments to expand the infrastructure will pay off.

The MIMO measurement function can be used for 4x2 and 2x2 systems. All measurements are based on the channel matrix H with the complex amplitude and phase values. The matrix is output for each measured cell and resource block. The condition number calculated from the matrices obtained gives a good idea of the degree of correlation of a MIMO channel. A value in the range of 0 dB to 15 dB, for example, indicates good conditions for LTE MIMO.

R&S®ROMES4 allows the measurement data to be output to a text file for further processing. MIMO-specific measurements are useful for the following applications:

- Determining in what areas MIMO can profitably be used
- Determining whether additional investments for MIMO will pay off
- Optimizing MIMO performance
- Reproducing LTE signal channels in the lab under real-world conditions

Condition number per resource block



Intersymbol interference analysis with multipath measurements

By means of the channel impulse response measurement, the R&S®TSMW can measure multipath propagation and reflections and then display the results by using the R&S®ROMES4 software. Reflections can be measured in a time frame of –6 µs to +34 µs. This means that the eightfold length of a normal cyclic prefix can be measured. As a result, users can detect violations of the guard interval (intersymbol interference, ISI).

A further interference factor may be excessively high base station phase noise. The low inherent phase noise of the R&S®TSMW allows users to also detect problems in the base station.

Narrowband and wideband measurements

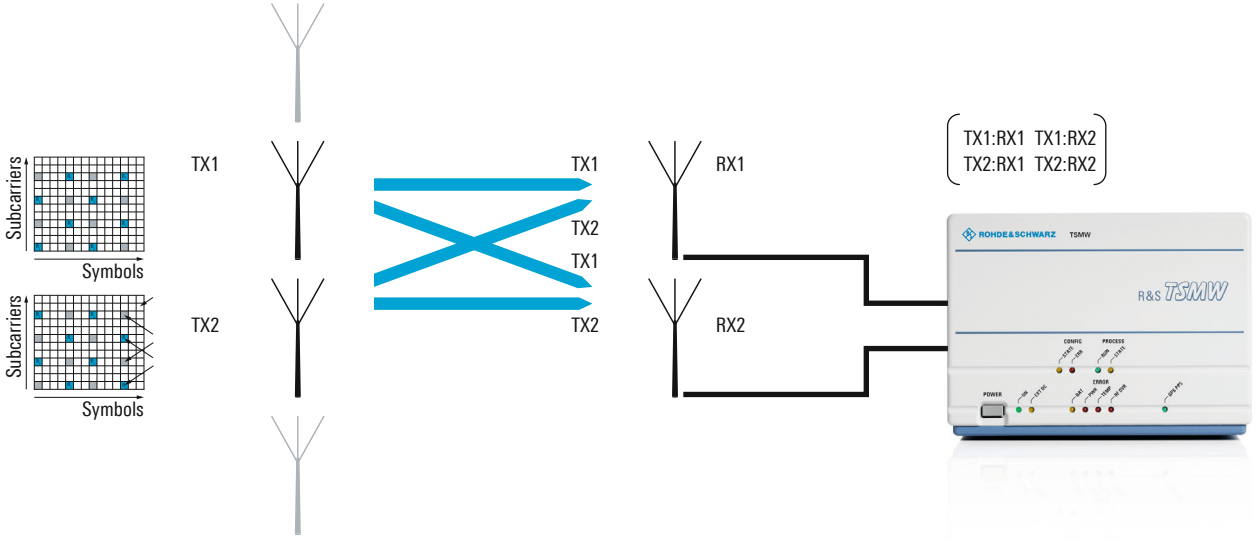
The R&S®TSMW automatically recognizes the bandwidth of the LTE signal. Based on this information, both narrowband measurements and wideband measurements are output simultaneously. Wideband measurements are especially important to detect any interference caused by external sources such as TV transmitters, repeaters, jammers and narrowband interferers.

Of particular interest is the SINR of the reference signal (RS-SINR), which is measured for each resource block, cell and antenna. This measurement shows interference and its spectral position, making it possible to quickly trace the causes of interference. The figure to the right shows the paths of a 2x2 or 4x2 LTE system as a waterfall diagram, making changes over time visible. A marker allows the user to quickly find the resource block and frequency from which interference originates, as well as the associated RS-SINR and timestamp.

	Narrowband	Wideband
Received power	**Power**	**RSRP**
	based on SCH (62 SC [1])	based on full RS [2] bandwidth
Quality	**RSRQ**	**RSRQ**
	based on PBCH (72 SC)	based on full RS bandwidth
SNR	**SINR**	**RS-SINR**
	based on SCH (62 SC)	based on full RS bandwidth
Total power	**P_{total}**	**RSSI**
	based on SCH (62 SC)	based on full RS bandwidth

[1] SC: synchronization channel.
[2] RS: reference signal.

MIMO configuration



Support of LTE-FDD and TD-LTE

The R&S®TSMW can also perform FDD and TDD measurements. Measurements can be carried out in parallel in the TDD frequency bands 33 to 44 and the FDD frequency bands 1 to 31.

There are no additional costs for TD-LTE and other frequency bands, making the R&S®TSMW an investment for the future – with maximum flexibility.

Support of LTE-A

In an LTE-Advanced network with carrier aggregation (CA) the network schedules data for a terminal on several carriers at the same time. As the component carriers utilize different frequencies, it is vital to validate the coverage of the carriers. The R&S®TSMW is ideal for this task since it supports the simultaneous measurement of any combination of LTE carriers. Even MIMO measurements are possible on all component carriers.

LTE uplink and downlink allocation analyzer

The R&S®TSMW offers a unique feature that allows analysis of the UL and DL allocations (up to Rel. 12) of the strongest eNodeBs during measurement. The information includes the following: the number of RNTIs (UEs) that have been scheduled data by the eNodeB, the MCS and throughput for each detected UE, and the occupation of the cell. Information is provided per TTI and per resource block. The data can be statistically evaluated to assess the overall load of the cell in terms of throughput and number of users. This information is important during network optimization and troubleshooting because it helps users acquire network data without accessing O&M network information such as base station counters. Uplink and downlink allocation analysis can be run simultaneously; the balance between uplink and downlink allocation can be analyzed. LTE allocation analysis requires the R&S®TSMW-K31 option for downlink analysis and the R&S®TSMW-K33 option for uplink analysis.

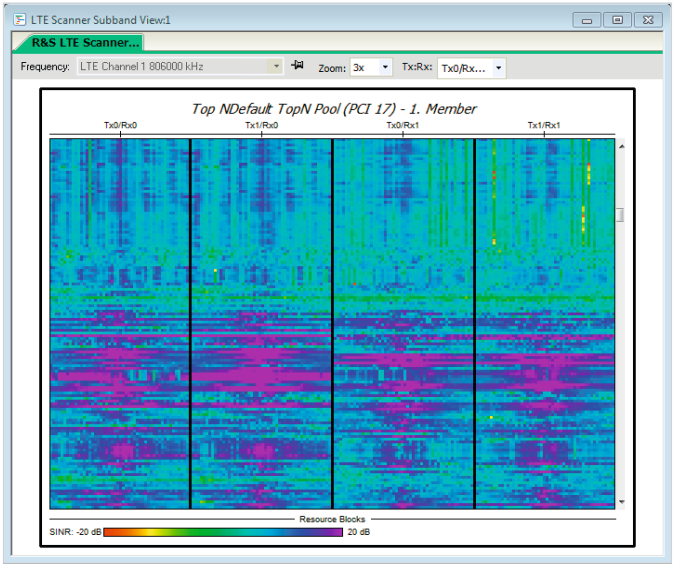
Typical configuration of an LTE drive test system consisting of an R&S®TSMW and the R&S®ROMES4 software

LTE uplink and downlink allocation analysis results can explain a limited UE throughput if the scanner shows that the cell load is already high and therefore not enough resources are available for the test UE. In a benchmarking environment, the feature provides deep insight into networks, allowing comparison of traffic and available capacity between different operators. The tool can also be used as a network probe to measure the cell load in a stationary situation, for example when a site owner wants to know the importance of a site before renewing the lease with the network operator.

LTE eMBMS measurements

The LTE evolved multimedia broadcast multicast service (eMBMS) uses several base stations to broadcast the same content at the same time to all users. This poses new challenges for RAN engineers, such as base station synchronization and managing the coverage and quality of the multimedia single frequency network. eMBMS scanner measurements provide the needed insight to the SFN's RF performance, such as eMBMS reference signal power, quality and SINR.

Wideband RS-SINR per resource block and per antenna



Equipment required for LTE drive tests

- R&S®TSMW universal radio network analyzer
- R&S®TSMW-K29 LTE scanner option
- R&S®TSMW-K30 LTE MIMO scanner option
- R&S®TSMW-Z1 power supply
- R&S®ROMES4 drive test software
- R&S®ROMES4T1W R&S®TSMW all-technology driver for R&S®ROMES
- R&S®ROMES4LTS LTE Samsung driver
- R&S®ROMES4LTQ LTE Qualcomm driver

The channel impulse response provided by the scanner allows detection of intersymbol interference as well as the interfering base station. The complete MBSFN configuration is decoded from SIB messages 2 and 13 from the broadcast channel. eMBMS measurements are enabled by the R&S®TSMW-K32 option.

NB-IoT/Cat NB1 measurements

The R&S®TSMW-K34 option makes it possible for the R&S®TSMW to measure in NB-IoT/Cat NB1 networks. NB-IoT/Cat NB1 is a 3GPP standard for connecting a huge number of devices, such as smart meters, to the internet (IoT). While traditional LTE standards mainly enhance throughput and network capacity, the focus of NB-IoT/Cat NB1 is on low power consumption for IoT devices and highest availability of the connection, especially indoors.

Indoor measurements require lightweight and ultra-compact scanners with low power consumption. For coverage validation, troubleshooting and optimization, the R&S®TSMW measures signal power, quality and power to interference and noise ratio on each available physical cell ID based on synchronization and reference signals. During NB-IoT/Cat NB1 measurements, it is possible to demodulate the layer 3 broadcast information to check the network configuration.

The standard allows three operating modes to integrate the NB-IoT carrier efficiently into the available spectrum. The R&S®TSMW supports all three modes. The most spectrum-efficient mode is the LTE in-band operating mode where the NB-IoT carrier uses the spectrum of one LTE PRB.

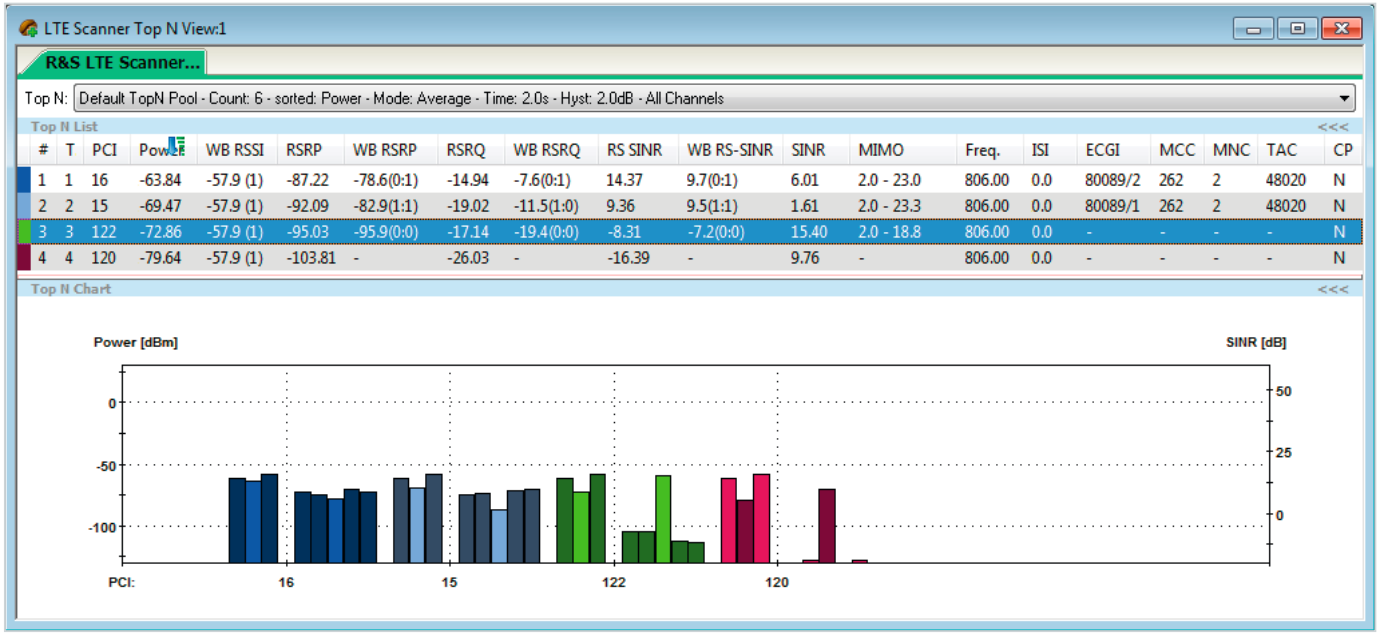
The guard band and standalone operating modes allow NB-IoT deployments independently of the LTE spectrum.

NB-IoT measurements can be run simultaneously with measurements on other technologies such as GSM, LTE, (W)CDMA (with the appropriate R&S®TSMW option). For optimization or in case of troubleshooting, the impact of NB-IoT spectrum on adjacent GSM/LTE/(W)CDMA spectrum and vice versa can be validated.

LTE-M measurements

LTE-M is another 3GPP standard for connecting things to the internet. LTE-M addresses different use cases than NB-IoT, for instance voice (VoLTE) and mobility. It also provides higher data rates. LTE-M is based on legacy LTE and reuses some of the cell-specific signals. Like NB-IoT, LTE-M uses smart mechanisms to enlarge the link budget. One of those mechanisms is frequency hopping to overcome fading and areas of bad SINR (resulting from LTE traffic and other interference) across the LTE spectrum. This is achieved by dividing the LTE carrier into several LTE-M narrowbands that are allowed to handle LTE-M traffic depending on the RF environment. The R&S®TSMW supports LTE-M measurements that deliver RF parameters (SINR, RSRP, RSRQ and RSSI) on each of those LTE-M narrowbands per PCI to identify, for example, the best narrowband for LTE-M data transmission. In R&S®ROMES4, it is also possible to compare all narrowbands at a glance to evaluate the RF environment in the surrounding narrowbands. With fading and interference from LTE traffic and other pilot signals, the RF parameter differences between the narrowbands can be quite remarkable. It is also possible to compare scanner based and module based results to verify if the LTE-M module uses the best narrowband for data transmission.

Top N with narrowband, wideband and MIMO values



Automatic channel detection

In combination with the R&S®ROMES4ACD automatic channel detection feature, the R&S®TSMW detects active channels in a specified band. LTE, LTE-M, NB-IoT, UMTS and CDMA2000®/1xEV-DO networks are supported. This feature can be optionally enhanced by a spectrum scan that significantly speeds up the detection process. In this mode, channel lists no longer have to be set up before a measurement campaign. The measurement system dynamically identifies new channels and adds them to the workspace during the drive. This is particularly relevant in LTE networks that are deployed in a shared spectrum with other cellular standards where frequent channel frequency and channel bandwidth changes can occur. Without R&S®ROMES4ACD, automatic channel detection is provided by the R&S®TSMW-K40 option via the ViCom interface.

EUTRA operating band	Uplink (UL) operating band BS: receive UE: transmit	Downlink (DL) operating band BS: transmit UE: receive	Duplex mode
1	1920 MHz to 1980 MHz	2110 MHz to 2170 MHz	FDD
2	1850 MHz to 1910 MHz	1930 MHz to 1990 MHz	FDD
3	1710 MHz to 1785 MHz	1805 MHz to 1880 MHz	FDD
4	1710 MHz to 1755 MHz	2110 MHz to 2155 MHz	FDD
5	824 MHz to 849 MHz	869 MHz to 894 MHz	FDD
6	830 MHz to 840 MHz	875 MHz to 885 MHz	FDD
7	2500 MHz to 2570 MHz	2620 MHz to 2690 MHz	FDD
8	880 MHz to 915 MHz	925 MHz to 960 MHz	FDD
9	1749.9 MHz to 1784.9 MHz	1844.9 MHz to 1879.9 MHz	FDD
10	1710 MHz to 1770 MHz	2110 MHz to 2170 MHz	FDD
11	1427.9 MHz to 1447.9 MHz	1475.9 MHz to 1495.9 MHz	FDD
12	699 MHz to 716 MHz	729 MHz to 746 MHz	FDD
13	777 MHz to 787 MHz	746 MHz to 756 MHz	FDD
14	788 MHz to 798 MHz	758 MHz to 768 MHz	FDD
15	Reserved	Reserved	FDD
16	Reserved	Reserved	FDD
17	704 MHz to 716 MHz	734 MHz to 746 MHz	FDD
18	815 MHz to 830 MHz	860 MHz to 875 MHz	FDD
19	830 MHz to 845 MHz	875 MHz to 890 MHz	FDD
20	832 MHz to 862 MHz	791 MHz to 821 MHz	FDD
21	1447.9 MHz to 1462.9 MHz	1495.9 MHz to 1510.9 MHz	FDD
22	3410 MHz to 3490 MHz	3510 MHz to 3590 MHz	FDD
23	2000 MHz to 2020 MHz	2180 MHz to 2200 MHz	FDD
24	1626.5 MHz to 1660.5 MHz	1525 MHz to 1559 MHz	FDD
25	1850 MHz to 1915 MHz	1930 MHz to 1995 MHz	FDD
26	814 MHz to 849 MHz	859 MHz to 894 MHz	FDD
27	807 MHz to 824 MHz	852 MHz to 869 MHz	FDD
28	703 MHz to 748 MHz	758 MHz to 803 MHz	FDD
29	–	717 MHz to 728 MHz	FDD (CA only)
30	2305 MHzto 2315 MHz	2350 MHz to 2360 MHz	FDD
31	452.5 MHz to 457.5 MHz	462.5 MHz to 467.5 MHz	FDD
32		1452 MHz to 1496 MHz	FDD (CA only)
33	1900 MHz to 1920 MHz	1900 MHz to 1920 MHz	TDD
34	2010 MHz to 2025 MHz	2010 MHz to 2025 MHz	TDD

EUTRA operating band	Uplink (UL) operating band BS: receive UE: transmit	Downlink (DL) operating band BS: transmit UE: receive	Duplex mode
35	1850 MHz to 1910 MHz	1850 MHz to 1910 MHz	TDD
36	1930 MHz to 1990 MHz	1930 MHz to 1990 MHz	TDD
37	1910 MHz to 1930 MHz	1910 MHz to 1930 MHz	TDD
38	2570 MHz to 2620 MHz	2570 MHz to 2620 MHz	TDD
39	1880 MHz to 1920 MHz	1880 MHz to 1920 MHz	TDD
40	2300 MHz to 2400 MHz	2300 MHz to 2400 MHz	TDD
41	2496 MHz to 2690 MHz	2496 MHz to 2690 MHz	TDD
42	3400 MHz to 3600 MHz	3400 MHz to 3600 MHz	TDD
43	3600 MHz to 3800 MHz	3600 MHz to 3800 MHz	TDD
44	703 MHz to 803 MHz	703 MHz to 803 MHz	TDD
45	1447 MHz to 1467 MHz	1447 MHz to 1467 MHz	TDD
46	5150 MHz to 5925 MHz	5150 MHz to 5925 MHz	TDD
47	5855 MHz to 5925 MHz	5855 MHz to 5925 MHz	TDD
65	1920 MHz to 2010 MHz	2110 MHz to 2200 MHz	FDD
66	1710 MHz to 1780 MHz	2110 MHz to 2200 MHz	FDD
67	–	738 MHz to 758 MHz	FDD (CA only)
68	698 MHz to 728 MHz	753 MHz to 783 MHz	FDD
69	–	2570 MHz to 2620 MHz	FDD (CA only)
70	1695 MHz to 1710 MHz	1995 MHz to 2020 MHz	FDD
71	663 MHz to 698 MHz	617 MHz to 652 MHz	FDD
72	451 MHz to 456 MHz	461 MHz to 466 MHz	FDD
73	450 MHz to 456 MHz	460 MHz to 465 MHz	FDD
74	1427 MHz to 1470 MHz	1475 MHz to 1518 MHz	FDD
75	–	1432 MHz to 1517 MHz	FDD (CA only)
76	–	1427 MHz to 1432 MHz	FDD (CA only)

All-in-one drive test solution with R&S®ROMES4

When used together with the R&S®TSMW, the R&S®ROMES4 drive test software also supports test terminals. The R&S®TSMW can be used to detect and eliminate wireless communications network errors indicated by a terminal.

Network optimization with scanner and test terminal

The R&S®ROMES4 drive test software not only evaluates measurement data from Rohde&Schwarz scanners, it also covers test terminals. These terminals establish either a voice or a data link. For example, a voice connection enables the user to measure speech quality or to generate a statistical evaluation about dropped calls. In the case of data links, the maximum possible transmission rate must be achieved. This is verified by means of data services such as an FTP download.

Improvement of QoS

Example: LTE

During an FTP download, a test terminal displays the maximum current data transmission rate. If this rate is too low for the wireless communications technology being used, the channel quality indicator (CQI) measured by the test terminal can be used to trace the cause of the problem.

If the CQI is too low, either the received signal may be too weak or the measured SINR may be very low. In this case, the test terminal will not be able to use any higher-order modulation types such as 64QAM. The R&S®TSMW can detect and identify such trouble spots independently of the terminal. If the received signals are too weak, this may indicate that the test terminal did not find a neighbor cell. The R&S®TSMW is network-independent because it does not rely on neighbor lists. Unknown neighbor cells can therefore be detected without any problem. Even automatic neighbor relation (ANR) algorithms that are used by self-organizing networks (SON) can be verified.

When combined with R&S®ROMES4, the R&S®TSMW can be used with the technologies listed in the table

Technology	Option
3GPP LTE MIMO	R&S®TSMW-K30
3GPP LTE	R&S®TSMW-K29
WiMAX™ IEEE 802.16e	R&S®TSMW-K28
GSM/WCDMA	R&S®TSMW-K21
CDMA2000®, 1xEV-DO Rev. B	R&S®TSMW-K22
CW channel power RSSI scan	R&S®TSMW-K25
TETRA	R&S®TSMW-K26
TETRA Rel. 2 (TEDS)	R&S®TSMW-K26Q
TETRA DMO	R&S®TSMW-K26D
RF power scan	R&S®TSMW-K27
NB-IoT/Cat NB1	R&S®TSMW-K34
LTE-M	R&S®TSMW-K35

Typical drive test configuration

Parallel support of multiple wireless communications technologies

The R&S®TSMW can be adapted to the customer's application by using various options. Together with the R&S®ROMES4 software, more than ten different technologies can be measured and displayed at the same time, while the hardware resources can be scaled as needed.

Simultaneous measurements in all supported technologies

Multiple wireless communications technologies are often used simultaneously. Particularly during the rollout of technologies such as 3GPP LTE or WiMAX™ IEEE 802.16e, wireless communications networks such as NB-IoT, LTE-M, 3GPP, GSM/WCDMA, CDMA2000®, 1xEV-DO or TETRA are already present. To keep the T&M effort and the related costs low, an all-in-one solution should be used. Rohde&Schwarz offers the perfect solution with its R&S®TSMW and the R&S®ROMES4 software.

Simple scanner setup

The user generally does not require expert knowledge about the wireless communications network to be tested. The R&S®TSMW detects all important information automatically. For example, the user only has to enter the following parameters: the UARFCN number in a WCDMA network, the band in a GSM network, the center frequency in a WiMAX™, LTE, LTE-M or NB-IoT network, and the channel number in a CDMA2000®, 1xEV-DO network. The R&S®TSMW then automatically detects and measures all detectable scrambling codes, channels, preamble indices and physical cell IDs. The measurement speed is not affected by the quantity of measured signals. Similarly for TETRA, all active channels in a 15 MHz downlink band are detected and decoded automatically.

Flexible assignment of the two receivers for maximum measurement speed

Technologies to be measured can be flexibly distributed to two RF and signal paths. Measuring two technologies in parallel does not cause any reduction in measurement speed. If further technologies are added, they are time-distributed to the hardware resources. This feature enables the R&S®TSMW to offer maximum performance in multiple-technology measurements. Up to seven wireless communications technologies can be measured at the same time.

Everything in one instrument

Wireless communications scanners such as the R&S®TSMW are primarily used when measurements must be performed independently of a test terminal. The R&S®ROMES4 software offers a Top N evaluation of all available signals for each technology. The user receives an overview of the strongest signals and can sort them by provider. Especially in CDMA2000® and WCDMA networks, this evaluation plays a crucial role in reducing pilot pollution.

Furthermore, neighbor cells that may not be found by a test terminal can be detected. Missing neighbor cells can be detected independently of the technology. This enables the user to identify coverage gaps or interference. The capability to demodulate the broadcast information of the broadcast channel (BCH) offers insight into the network configuration. Applications such as automatic neighborhood analysis or automatic interference detection can easily be carried out by applying this functionality.

The RF spectrum scan running in parallel additionally supports finding external interferences. Moreover, this function is very useful in spectrum clearing, in refarming and in using the digital dividend.

The R&S®TSMW can also be used for benchmark purposes. Multiple technologies and multiple providers can be scanned simultaneously. Even when a new technology is being rolled out, networks already present can be monitored as well.

Technology support at a glance

	Technologies supported	MIB, SIB decoding
GSM	•	•
WCDMA	•	•
CDMA2000®	•	•
1xEV-DO (Rel. 0/Rev. A/Rev. B)	•	•
WiMAX™ IEEE 802.16e	•	•
TD-LTE	•	•
LTE FDD	•	•
LTE-M	•	•
NB-IoT/Cat NB1	•	•
TETRA, TETRA 2, TETRA DMO	•	•
TD-SCDMA	•	•
RF power scan	•	–
CW channel power RSSI scan	•	–

Maximum flexibility when evaluating I/Q data

Seamless streaming of I/Q data in realtime

A special asset of the R&S®TSMW is its R&S®TSMW-K1 digital I/Q data interface. Users of this option can, for example, perform technology-independent channel measurements. These measurements can be used to simulate realistic fading scenarios in a lab environment. The recorded I/Q data can either be replayed in the lab using a Rohde&Schwarz signal generator or analyzed using the MATLAB®/C++ interface. I/Q data can be recorded in two ways. One, the R&S®TSMW can be connected with a PC via a LAN interface. Two, the data can be recorded with the R&S®IQR via the Rohde&Schwarz I/Q interface. The higher data rate of the Rohde&Schwarz I/Q interface makes it possible to record both frontends of the R&S®TSMW with up to 2 × 20 MHz instead of using a 20 MHz I/Q measurement bandwidth.

To facilitate I/Q data analysis, the GPS data is saved together with the I/Q data. The R&S®TSMW offers a truly mobile solution for recording all types of RF signals.

I/Q streaming via LAN (1)

For this application, the R&S®TSMW and a high-performance PC are connected via Gigabit Ethernet. This interface allows a maximum streaming bandwidth of 20 MHz with 8/12/16 or 20-bit data compression. The measured data is stored on a fast hard disk. It can be replayed as a waveform on a Rohde&Schwarz signal generator or analyzed via MATLAB®. In addition to offering a MATLAB® based GUI for controlling the recording, the R&S®TSMW-K1 option also includes a MATLAB® and a C++ interface. These interfaces permit simple access to the I/Q data after the measurement or in realtime. The recording time is limited only by the size of the hard disk. A hard disk with a write speed of at least 80 Mbyte/s is recommended to avoid any problems.

I/Q streaming via Rohde&Schwarz I/Q interface (2)

Due to its higher transmission bandwidth, the Rohde&Schwarz I/Q interface enables I/Q streaming with 2 × 20 MHz bandwidth. The R&S®TSMW is directly connected with the R&S®IQR and is operated via the R&S®IQR touchscreen.

The I/Q data stored on the removable hard disks of the R&S®IQR can be output to a host PC via Gigabit Ethernet for offline analysis. All Rohde&Schwarz instruments with a Rohde&Schwarz I/Q interface, e.g. a signal generator, can be connected via the digital I/Q interface.

The R&S®IQR enables a recording time of one to three hours depending on the digital word length (8/12/16/20 bit).

The automatic gain control feature can be used to prevent RF level overdrives and maintain good signal quality in case of low signal strength. It is described in the R&S®IQR manual. The R&S®IQR-K104 option is required to use this feature.

Application examples

- Navigation: recording of GPS/GLONASS/Galileo/Compass (BeiDou) signals in different regions. Recorded signals can be replayed under controlled conditions in the lab. This results in faster time-to-market for GPS receivers and mobile phones
- Broadcasting: recording of TV/FM signals during a drive test. Recorded signals can be replayed under lab conditions to test TV/FM receivers
- LTE MIMO and LTE-Advanced: channel measurements for 4x2 MIMO scenarios and subsequent analysis, e.g. using MATLAB®

Equipment required for I/Q recording (1)

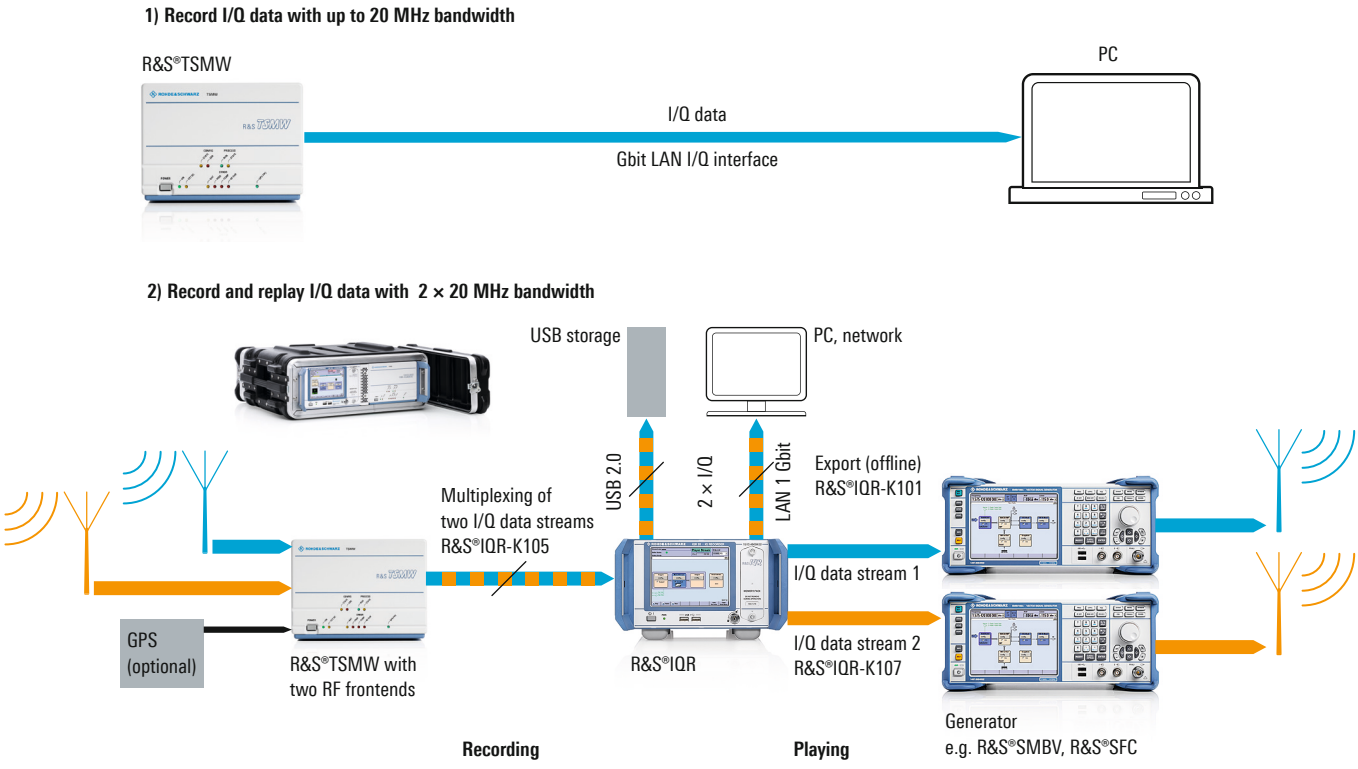
- R&S®TSMW universal radio network analyzer
- R&S®TSMW-K1 digital I/Q software option
- R&S®TSMW-Z1 AC power supply
- PC with Gigabit LAN interface and support of jumbo frames
- Hard disk with SATA interface and min. data write rate of 80 Mbyte/s

Equipment required for I/Q recording (2)

- R&S®TSMW universal radio network analyzer
- R&S®TSMW-K1 digital I/Q software option
- R&S®TSMW-B1 Rohde&Schwarz I/Q interface
- R&S®TSMW-Z1 AC power supply
- R&S®IQR100 I/Q data recorder
- R&S®IQR-B119F memory pack
- R&S®IQR-K1 software to configure R&S®TSMW

For additional options, see R&S®IQR product brochure and data sheet (PD 5214.4394.12 and PD 5214.4394.22)

Two ways to record I/Q data: I/Q data can be analyzed on a PC or replayed on a signal generator



Unsurpassed hardware platform performance and flexibility

Broadband with 20 MHz bandwidth and maximum frequency range from 30 MHz to 6 GHz

The R&S®TSMW universal radio network analyzer offers a hardware platform with maximum flexibility. The two integrated broadband receivers (30 MHz to 6 GHz) with a bandwidth of 20 MHz each and a separate preselection open the door to a variety of applications.

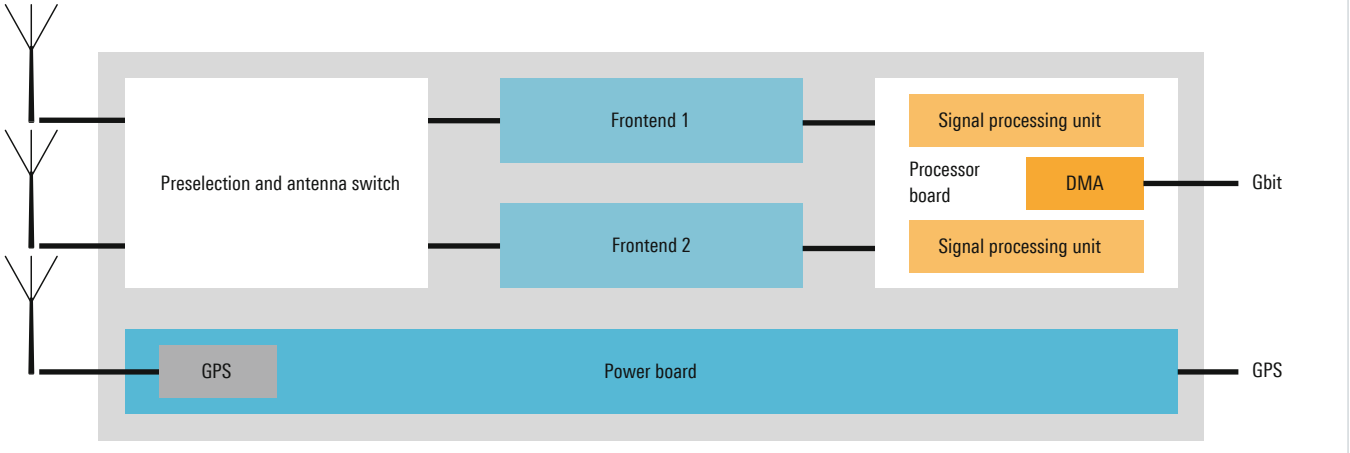
These features allow the R&S®TSMW to cover all existing and future frequency bands without any additional upgrade costs.

Maximum configuration flexibility

The R&S®TSMW contains two independent receivers with a bandwidth of 20 MHz each. The two receivers can be used for different technologies or they can share the measurement tasks for a single technology, such as scanning and demodulating system information blocks (SIB). This case is particularly interesting when the maximum scan rate needs to be achieved. For LTE MIMO-specific measurements, the two receivers are controlled simultaneously.

In some cases, only one receiver is required, which is why the R&S®TSMW is also available as a single-channel model. A software option allows the second receiver to be quickly and easily activated at a later point in time. Although it consumes 30 % less power, the single-channel R&S®TSMW provides the full range of functions.

Architecture of the dual-channel R&S®TSMW universal radio network analyzer



Top dynamic range and measurement accuracy due to adaptive preselection

To achieve top measurement accuracy and dynamic range, the R&S®TSMW has an integrated preselection. Multiple adjustable filters reduce intermodulation in advance. The analyzer can therefore detect signals with a sensitivity that is considerably below the noise level (noise figure of 7 dB at 3.5 GHz).

Update of hardware platform via software

The hardware platform can be updated and its functionality enhanced by means of software. This allows the R&S®TSMW to be expanded in the field to handle additional technologies without having to be sent in for an upgrade. Only the specific options required are added, for example when the user wants to add LTE, LTE-M or LTE MIMO to the existing GSM/WCDMA function.

Integrated SuperSense GPS with PPS

An integrated SuperSense GPS receiver with 50 channels and a refresh rate of 4 Hz allows the analyzer to also be used in areas with weak GPS signals. The R&S®TSMW does not need a GPS signal to perform indoor measurements. GPS position fix can improve synchronization, but it is not absolutely necessary. The hardware also supports GLONASS.

Supported by many drive test tools

The R&S®TSMW universal radio network analyzer is supported by a multitude of professional drive test tools, and can be used by any specialized measurement software. Using the open ViCom interface, developers can easily integrate the R&S®TSMW and other R&S®TSMx scanner family members into their own coverage measurement software applications as an OEM receiver.

Open interfaces for integration into individual software solutions

The ViCom API provides full access to GSM, WCDMA, LTE (FDD/TDD), LTE-M, NB-IoT, TD-SCDMA, CDMA2000®, 1xEV-DO and WiMAX™ measurements as well as the scanner's L3 decoding results. The RF power scan capability of the R&S®TSMW and the data from the built-in GPS module can also be used.

For ViCom details, please contact your local Rohde&Schwarz sales office.

Flexibility in choice of drive test software

The listed, commercially available software tools support the R&S®TSMW.

Software product		Supported functionality
ROHDE&SCHWARZ	R&S®ROMES4 Network Problem Analyzer	GSM, WCDMA, LTE (FDD/TDD), LTE MIMO, CDMA2000®, 1xEV-DO, WiMAX™, RF power scan
SwissQual A Rohde&Schwarz Company	Diversity Optimizer Diversity Benchmarker	GSM, WCDMA, LTE (FDD/TDD), LTE MIMO, CDMA2000®, 1xEV-DO, RF power scan
Accuver	XCAL XCAP	WCDMA, CDMA2000®, 1xEV-DO, LTE (FDD/TDD)
Keysight Technologies	Nemo Outdoor	GSM, WCDMA, LTE (FDD/TDD), LTE MIMO, CDMA2000®, 1xEV-DO, RF power scan, WiMAX™, DLAA, ACD (LTE, WCDMA simple mode)
ascom	TEMS Investigation	GSM, WCDMA, LTE (FDD/TDD), LTE MIMO, CDMA2000®, 1xEV-DO
Dinglicom	Pilot Pioneer Pilot Navigator	GSM, WCDMA, LTE (FDD/TDD), CDMA2000®, 1xEV-DO, RF power scan

Specifications

Specifications		
RF characteristics		
Frequency range		30 MHz to 6 GHz
Level measurement uncertainty	S/N > 16 dB, 30 MHz to 3 GHz	< 1 dB
	S/N > 16 dB, 3 GHz to 6 GHz	< 1.5 dB
Maximum operating measurement range input level	30 MHz to 600 MHz	nom. –4 dBm
	600 MHz to 1200 MHz	nom. +1 dBm
	1200 MHz to 1700 MHz	nom. +3 dBm
	1700 MHz to 2500 MHz	nom. +5 dBm
	2500 MHz to 6000 MHz	nom. –8 dBm
Maximum permissible input level		5 dBm/0 V DC
Noise figure	with preamplifier on	
	900 MHz	6 dB (meas.)
	2100 MHz	8 dB (meas.)
	3500 MHz	7 dB (meas.)
	6000 MHz	10 dB (meas.)
Intermodulation-free dynamic range	level 2 × –45 dBm, 3.5 GHz, preamplifier on	–65 dBc (meas.) (–12.5 dBm TOI)
	level 2 × –35 dBm, 3.5 GHz, preamplifier off	70 dBc (meas.) (0 dBm TOI)
RF receive paths	independent	2
VSWR	30 MHz ≤ f ≤ 2.5 GHz	1.5 (meas.)
	2.5 GHz ≤ f ≤ 6 GHz	1.7 (meas.)
Preselection channels		5 per RF path, 3 used as tracking filters
LTE/LTE-M characteristics		
Frequency bands supported	automatic detection of carrier bandwidth	no restrictions
Measurement modes		LTE-FDD, LTE-TDD, LTE-M
Measurement speed (LTE/LTE-M)	automatic detection of all 504 physical cell IDs with SIB decoding active	max. 200 Hz/25 Hz (meas.)
Physical decoding accuracy		
Sensitivity for initial physical cell ID decoding	SYNC signal power (LTE)	–123 dBm (meas.)
	SYNC signal RE power (LTE)	–140.9 dBm (meas.)
Sensitivity after successful physical cell ID decoding	SYNC signal power (LTE)	–127 dBm (meas.)
	SYNC signal RE power	–144.9 dBm (meas.)
	RSRP (LTE-M)	–132 dBm
RS SINR dynamic range		–20 dB to +42 dB (meas.)
SYNC SINR dynamic range		–20 dB to +42 dB (meas.)
PCI false detection (ghost code)		$< 10^{-8}$
NB-IoT/Cat NB1 characteristics		
Frequency bands supported		no restrictions
NB-IoT/Cat NB1 measurement modes		standalone
		guard band
		in-band
Sensitivity for initial physical cell ID decoding	sync signal power (NSSS power)	–128 dBm (meas.)
	reference signals power (NRSRP)	–139 dBm (meas.)
Sensitivity after successful physical cell ID decoding	sync signal power (NSSS power)	–130 dBm (meas.)
	reference signals power (NRSRP)	–141 dBm (meas.)
CINR dynamic range	sync signals (NSSS CINR)	–15 dB to +30 dB (meas.)
	reference signals (NRS CINR)	–15 dB to +30 dB (meas.)
Measurement speed		5 Hz (single channel) (meas.)
Minimum layer 3 demodulation threshold	sync signal power (NSSS power)	–124 dBm (meas.)
	sync signal CINR (NSSS CINR)	–7 dB (meas.)
PCI false detection (ghost code)		$< 10^{-8}$

Specifications

WiMAX™ characteristics		
Frequency bands supported		no restrictions
Measurement speed	automatic detection of all 114 preamble indices	5 measurements/s
Preamble decoding accuracy	frame duration: 5 ms, FFT size: 1024, 10 MHz bandwidth, 2.5 GHz	±1 dB (–30 dBm to –109 dBm) (meas.)
Sensitivity for initial preamble decoding	RSSI	< –97 dBm (meas.)
Sensitivity after successful preamble decoding	RSSI	< –112 dBm (meas.)
SINR [1] dynamic range		–20 dB to +26 dB (meas.)
GSM characteristics		
Frequency bands supported		no restrictions
Measurement modes	in parallel	DB/TCH/SCH code power, TCH total in-band power, timeslot power, GSM spectrum, BCH demodulation for all system information types
Measurement speed	with SI decoding active	500 channels/s (meas.)
Sensitivity		–118 dBm (meas.)
Measurement accuracy		±1 dB (meas.)
BSIC decoding accuracy		98% for C/I > +2 dB (meas.)
BSIC decoding dynamic range		
Sensitivity for initial BSIC detection		C/I > –2 dB (meas.)
Sensitivity after successful BSIC detection		C/I > –11 dB (meas.)
BCCH decoding dynamic range		C/I > 0 dB (meas.)
WCDMA characteristics		
Frequency bands supported		no restrictions
Number of RF carrier frequencies		max. 32
Measurement speed	high speed/high dynamic range automatic detection of all 512 scrambling codes	200 Hz/80 Hz, with BCH demodulation (meas.)
Scrambling code detection sensitivity (RSCP)		
Sensitivity for initial SC detection	high speed/high dynamic range	–112 dBm/–121 dBm (meas.)
Sensitivity after successful SC detection	high speed/high dynamic range	–118 dBm/–123 dBm (meas.)
Scrambling code detection accuracy (RSCP)	E_c/I_0 > –12 dB	< 1 dB (meas.)
	E_c/I_0 < –12 dB	< 1.5 dB (meas.)
Scrambling code false detection (ghost code)		< 10^{-9}
Dynamic range E_c/I_0	high speed/high dynamic range	–22 dB/–30 dB (meas.)
Min. BCH demodulation threshold E_c/I_0		> –17 dB (meas.)
TD-SCDMA characteristics		
Frequency bands supported		no restrictions
Number of RF carrier frequencies		max. 32
Measurement speed	high speed high sensitivity	20 Hz, with BCH demodulation (meas.) 8 Hz, with BCH demodulation (meas.)
Automatic detection of all 128 scrambling codes		
Scrambling code detection sensitivity		
Sensitivity for initial BTS detection (DwPTS)	high speed/high sensitivity	–114 dBm/–113 dBm (meas.)
Sensitivity for initial SC detection (midamble)	high speed/high sensitivity	–115 dBm/–114 dBm (meas.)
Sensitivity after successful BTS detection	high speed/high sensitivity	–115 dBm/–117 dBm (meas.)
Scrambling code detection accuracy	RSCP	typ. < 1 dB (meas.)
Dynamic range E_c/I_0 (DwPTS initial detection)	high speed/high sensitivity	–7 dB/–7 dB (meas.)
CDMA2000® characteristics		
Frequency bands supported		no restrictions
Number of RF carrier frequencies		max. 32
Measurement speed	automatic detection of all 512 PN codes	80 Hz, with BCH demodulation (meas.)
PN detection sensitivity		–119 dBm (meas.)
Dynamic range	E_c/I_0	–29 dB (meas.)

[1] Derived measurement value.

Specifications

1xEV-DO characteristics (Rel. 0/Rev. A/Rev. B)		
Frequency bands supported		no restrictions
Number of RF carrier frequencies		max. 32
Measurement speed		30 Hz, with BCH demodulation (meas.)
PN detection sensitivity		–120 dBm (meas.)
Dynamic range	E_c/I_0	–15 dB (meas.)
TETRA characteristics		
TETRA bands supported		no restrictions
Number of RF carrier frequencies	within a 10 MHz downlink band	max. 400
Channel resolution		25 kHz (QPSK)
Measurement speed		max. 8000 channels/s, 20/s for a 10 MHz block (meas.)
Sensitivity (RSSI)	RSSI measurements	–126 dBm (meas.)
	TETRA BSCH decoding (BSCH decoding for channels with SNR > 9.5 dB)	–120 dBm (meas.)
	BER measurements	–126 dBm (meas.)
TETRA2 (TEDS) characteristics		
TETRA bands supported		no restrictions
Number of RF carrier frequencies	within a 10 MHz band	max. 400
Channel resolution		25 kHz (QAM)
Channel bandwidths	autodetection	25 kHz, 50 kHz, 100 kHz, 150 kHz
Code rates	autodetection	1/2, 2/3, 1
Modulation	autodetection	4QAM, 16QAM, 64QAM
Sensitivity	RSSI measurements	–120 dBm (meas.) (for 25 kHz channel bandwidth)
	TETRA BSCH decoding (BSCH decoding for channels with SNR > 9.5 dB)	–115 dBm (meas.)
	BER measurements	
	4QAM, code rate 2/3	–115 dBm (meas.)
	4QAM, code rate 1/2	4QAM code rate 2/3 – 1.8 dB (meas.)
	16QAM, code rate 1/2	4QAM code rate 2/3 + 4 dB (meas.)
	16QAM, code rate 2/3	4QAM code rate 2/3 + 6.1 dB (meas.)
	64QAM, code rate 1/2	4QAM code rate 2/3 + 8.5 dB (meas.)
	64QAM, code rate 2/3	4QAM code rate 2/3 + 11.4 dB (meas.)
Measurement speed		max. 8000 channels/s, 20/s for a 10 MHz block (meas.)
I/Q characteristics (requires R&S®TSMW-K1)		
Digital filter bandwidth, burst		800 kHz to 20 MHz
Digital filter bandwidth, streaming	hardware requirements: Gbit LAN link, jumbo frames, hard disk transfer rate 80 Mbyte/s	max. 22 Msample/s (meas.)
Resampling rate		1 Msample/s to 23 Msample/s
Demodulation bandwidth		20 MHz
I/Q buffer size		200 Mbyte
Software support	R&S®ROMES4 drive test software not required; MATLAB® or customer-specific software must be installed	
Gbit LAN I/Q interface		
Data format	14-bit ADC resolution	8/12/16/20 bit
Digital I/Q interface (additionally requires R&S®TSMW-B1)[2)]		
Interface	direction	output
	level	LVDS
	connector	26-pin MDR
Standard protocol	sample rate	up to 23 Msample/s up to 2 × 23 Msample/s (multiplex mode)
	resolution	20 bit for I and Q, 18 bit for I and Q (multiplex mode)
	general purpose signals	unused

[2)] Suitable cable included with R&S®IQR I/Q data recorder.

Specifications		
Transfer mode	enable mode	supported
Channel multiplex	transmission of several I/Q data streams in time division multiplex	up to 8 channels
Source	interface mode 1 (enable mode)	frontends 1 and 2
Automatic gain control (AGC)	requires R&S®IQR with R&S®IQR-K1 and R&S®IQR-K104	
	target signal range	–30 dBm to –60 dBm
	adjustment steps	±4 dB
RF power scan		
Frequency range		30 MHz to 6 GHz
Frequency resolution		140 Hz to 1.438 MHz
Sensitivity	22.4 kHz RBW, RMS, at 900 MHz	
	preamplifier off	–112 dBm (meas.)
	preamplifier on	–121 dBm (meas.)
	140 Hz RBW, RMS, at 900 MHz	
	preamplifier off	–134 dBm (meas.)
	preamplifier on	–141 dBm (meas.)
Scan speed	180 kHz resolution, 100 MHz span, 20 MHz bandwidth	130 Hz (meas.)
	11.23 kHz resolution, 10 MHz span, 10 MHz bandwidth	690 Hz (meas.)
	140 Hz resolution, 1 MHz span, 1 MHz bandwidth	64 Hz (meas.)
RSSI scan speed	20 MHz span, 20 MHz bandwidth	99 GSM channels: 600 Hz (59400 channels/s) (meas.)
	20 MHz span, 20 MHz bandwidth	4 WCDMA channels: 600 Hz (2400 channels/s) (meas.)
	20 MHz span, 20 MHz bandwidth	1 LTE channel (100RB): 600 Hz (600 channels/s) (meas.)
Max. number of frequency ranges		20
Detectors		max., min., RMS, auto
CW scanning		
Sensitivity channel power RSSI scan	200 kHz channel (GSM)	–115 dBm (meas.)
	5 MHz channel (UMTS)	–99 dBm (meas.)
	20 MHz channel (LTE)	–94 dBm (meas.)
Scan rate	200 kHz channel (GSM)	680 Hz (68000 channels/s) (meas.)
	5 MHz channel (UMTS)	735 Hz (2940 channels/s) (meas.)
	20 MHz channel (LTE)	745 Hz (745 channels/s) (meas.)
Reference frequency		
Aging		1×10^{-6} aging per year
Output for internal reference signal	frequency (approx. sine wave)	10 MHz
	level	0 dBm (meas.)
	source impedance	50 Ω
Input for external reference signal	frequency	10 MHz
	max.deviation	3×10^{-6}
	input level limits	> –6 dBm, < 19 dBm
	recommended	0 dBm to 19 dBm
	input impedance	50 Ω
Physical characteristics		
RF inputs	SnapN connector	50 Ω
Data interface	RJ-45	10/100/1000BASE-T Ethernet[3]
Reference input/output	BNC female	50 Ω
Pulse input/output	2 × BNC female	5 V, TTL
GPS antenna	SMA female/active GPS antenna	50 Ω/3 V, max. 100 mA
GPS USB interface (standalone)		type B USB connector

[3] Jumbo frames are recommended for measurements with R&S®TSMW-K1. All measurement speed specifications can vary depending on the speed of the PC used.

Specifications

GPS receiver		
Sensitivity	cold start	–148 dBm
	tracking	–162 dBm
Acquisition	cold start	26 s
	hot start	< 1 s
Channels		50
System requirements	controller (Pentium IV, 2 Gbyte RAM, Gigabit Ethernet (jumbo packets of at least 4 kbyte, flow control enabled), USB 1.0, USB required only if GPS is used as standalone application)	
General data		
Environmental conditions		
Temperature	operating temperature range	+5 °C to +40 °C
	permissible temperature range	0 °C to +50 °C
	storage temperature range	–25 °C to +85 °C
Damp heat		+40 °C, 95 % relative humidity, cyclic, in line with EN 60068-2-30
Mechanical resistance		
Vibration	sinusoidal	5 Hz to 55 Hz, 0.15 mm constant amplitude, 55 Hz to 150 Hz, 0.5 g constant, in line with EN 60068-2-6
	random	10 Hz to 300 Hz, acceleration 1.2 g RMS, in line with EN 60068-2-64
Shock		40 g shock spectrum, in line with MIL-STD-810E, method no. 516.4, procedure I
Power rating		
Rated voltage		9 V to 18 V DC
Rated current		max. 10 A
	use with R&S®TSMW-Z1 external power supply	100 V to 240 V AC, 47 Hz to 63 Hz, 2.5 A
Product conformity		
Electromagnetic compatibility	EU	applied harmonized standards: EN 61326-1 (industrial environment), EN 61326-2-1, EN 55011 (class B), EN 61000-3-2, EN 61000-3-3, 72/245/EEC chapter 3.2.9, in line with EMC directive 2004/108/EC and 72/245/EEC
Electrical safety	EU	applied harmonized standard: EN 61010-1, in line with Low Voltage Directive 2006/95/EC
	Korea	KC mark
	USA	UL 61010-1
	Canada	CAN/CSA-C22.2 No. 61010.1-04
International safety approvals	VDE – Association for Electrical, Electronic and Information Technologies	VDE-GS mark, certificate no. 40023750
	CSA – Canadian Standards Association	$_{c}$CSA$_{us}$ mark, certificate no. 1986837
Dimensions and Weight		
Dimensions	W × H × D	180 mm × 130 mm × 270 mm (7.1 in × 5.12 in × 10.63 in)
Weight		approx. 5.1 kg (11.26 lb)
Calibration interval		12 months

Measured values (meas.)
Characterize expected product performance by means of measurement results gained from individual samples.

Nominal values (nom.)
Characterize product performance by means of a representative value for the given parameter (e.g. nominal impedance). In contrast to typical data, a statistical evaluation does not take place and the parameter is not tested during production.

Ordering information

Designation	Type	Order No.
Base unit		
Universal radio network analyzer	R&S®TSMW	1503.3001.03
Scope of delivery: R&S®TSMW, LAN cable, USB cable, 2 × antennas (820 MHz to 960 MHz, 1700 MHz to 2170 MHz), GPS antenna, 12 V DC power cable (cigarette lighter connector), CD		
Universal radio network analyzer, without I/Q streaming capabilities	R&S®TSMF	1503.3001.04
R&S®TSMW options		
TD-SCDMA scanner option	R&S®TSMW-K20	1515.7320.02
GSM/WCDMA scanner option	R&S®TSMW-K21	1503.4514.02
CDMA2000®, 1xEV-DO Rev. A scanner option	R&S®TSMW-K22	1503.4520.02
CW scanner option	R&S®TSMW-K25	1514.4262.02
TETRA scanner option (for R&S®ROMES4)	R&S®TSMW-K26	1510.8792.02
TETRA Rel. 2 (TEDS) scanner option (for R&S®ROMES4)	R&S®TSMW-K26Q	1510.8792.03
TETRA DMO scanner option (for R&S®ROMES4)	R&S®TSMW-K26D	1510.8792.04
RF power scanner option	R&S®TSMW-K27	1503.4537.02
WiMAX™ scanner option	R&S®TSMW-K28	1503.4543.02
LTE scanner option	R&S®TSMW-K29	1503.4550.02
LTE MIMO scanner option	R&S®TSMW-K30	1514.4085.02
LTE DL allocation analyzer scanner option (up to Rel. 12)	R&S®TSMW-K31	3590.6813.02
LTE eMBMS scanner option	R&S®TSMW-K32	1514.4256.02
LTE UL allocation analyzer (up to Rel. 12)	R&S®TSMW-K33	4900.5129.02
NB-IoT/Cat NB1 scanning	R&S®TSMW-K34	1515.7436.02
LTE-M scanning	R&S®TSMW-K35	4900.7480.02
Automatic channel detection option (ViCom only, not for R&S®ROMES4)	R&S®TSMW-K40	1515.5440.02
Gigabit LAN I/Q interface	R&S®TSMW-K1	1503.3960.02
R&S®Digital I/Q Interface (hardware option)	R&S®TSMW-B1	1514.4004.02
Single receiver option	R&S®TSMW-K71	1514.4027.02
Additional software		
Drive test software	R&S®ROMES4	1117.6885.04
R&S®TSMW driver for R&S®ROMES4 drive test software	R&S®ROMES4T1W	1117.6885.02
R&S®ROMES4 option, base station position estimation	R&S®ROMES4LOC	1117.6885.32
R&S®ROMES4 driver, automatic channel detection	R&S®ROMES4ACD	1506.9869.02
ViCom R&S®TSMx scanner interface/API	R&S®VICOM	4900.7309.02
System components		
AC power supply	R&S®TSMW-Z1	1503.4608.02
19" rack adapter	R&S®TSMW-Z2	1503.3901.02
Backpack system	R&S®TSMW-Z3N	1514.4091.02
Lithium-ion rechargeable battery, 91 Wh, 14.4 V, 138.8 mm × 103.1 mm × 59.4 mm (5.46 in × 4.06 in × 2.34 in)	Anton Bauer Dionic HC (Product Code 86750074)	Not included, must be purchased locally.
Twin battery charger for Anton Bauer Dionic HC rechargeable battery	R&S®TSME-Z3BC2	1519.0920.02
Transit case with rollers	R&S®TSMW-Z5	1117.9955.02
Soft carrying bag	R&S®HA-Z220	1309.6175.00
Portable system suitcase	R&S®TS51GA30	1090.7993.12
Magnetic antenna mount without GPS	R&S®TSMW-ZA1	1145.6705.00
Fixed antenna mount without GPS	R&S®TSMW-ZA2	1145.6711.00
Magnetic antenna mount with GPS	R&S®TSMW-ZA3	1145.6728.00
Fixed antenna mount with GPS	R&S®TSMW-ZA4	1145.6734.00
Antenna, 400 MHz to 440 MHz (requires antenna mount)	R&S®TSMW-ZE2	1117.8165.00
Antenna, 380 MHz to 430 MHz (requires antenna mount)	R&S®TSMW-ZE7	1519.5709.02
Antenna, 698 MHz to 2700 MHz (requires antenna mount)	R&S®TSMW-ZE8	1506.9852.02
Antenna emitter, 430 MHz to 470 MHz	R&S®TSMW-ZE9	1519.5709.03

Designation	Type	Order No.
Single-port ultrawideband antenna, 698 MHz to 6000 MHz	R&S®TSME-Z10	4900.1917.02
Three-port antenna, 698 MHz to 2690 MHz (MIMO) + GPS	R&S®TSME-Z11	4900.1923.02
Two-port MIMO reference antenna, 698 MHz to 2700 MHz	R&S®TSME-Z12	4900.1930.02
Three-port MIMO antenna, 698 MHz to 3800 MHz (MIMO) + GPS/GNSS for drive testing	R&S®TSME-Z13	4900.1946.02
Four-port MIMO antenna, 698 MHz to 3500 MHz (MIMO2x2) + 5150 MHz to 5850 MHz (MIMO2x2) for drive testing	R&S®TSME-Z14	4900.1952.02
Single-port ultrawideband antenna, 698 MHz to 3800 MHz with magnetic mount	R&S®TSME-Z15	3652.7281.02
GPS RF recording kit for the R&S®TSMW	R&S®TSMW-Z20	1506.9775.02

Please consider using adaptors for antennas with SMA connector.

Warranty		
Base unit		3 years
All other items [1]		1 year
Options		
Extended warranty, one year	R&S®WE1	Please contact your local Rohde&Schwarz sales office.
Extended warranty, two years	R&S®WE2	
Extended warranty with calibration coverage, one year	R&S®CW1	
Extended warranty with calibration coverage, two years	R&S®CW2	
Extended warranty with accredited calibration coverage, one year	R&S®AW1	
Extended warranty with accredited calibration coverage, two years	R&S®AW2	

[1] For options that are installed, the remaining base unit warranty applies if longer than 1 year. Exception: all batteries have a 1 year warranty.

Your local Rohde&Schwarz expert will help you determine the optimum solution for your requirements.
To find your nearest Rohde&Schwarz representative, visit www.sales.rohde-schwarz.com

Service that adds value

- Worldwide
- Local and personalized
- Customized and flexible
- Uncompromising quality
- Long-term dependability

Rohde&Schwarz

The Rohde&Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, monitoring and network testing. Founded more than 80 years ago, the independent company which is headquartered in Munich, Germany, has an extensive sales and service network with locations in more than 70 countries.

www.rohde-schwarz.com

Mobile network testing

The company's broad and diverse product portfolio for mobile network testing addresses every test scenario in the network lifecycle – from base station installation to network acceptance and network benchmarking, from optimization and troubleshooting to interference hunting and spectrum analysis, from IP application awareness to QoS and QoE of voice, data, video and app based services.

www.rohde-schwarz.com/mnt

Sustainable product design

- Environmental compatibility and eco-footprint
- Energy efficiency and low emissions
- Longevity and optimized total cost of ownership

Certified Quality Management
ISO 9001

Certified Environmental Management
ISO 14001

Regional contact

- Europe, Africa, Middle East | +49 89 4129 12345
  customersupport@rohde-schwarz.com
- North America | 1 888 TEST RSA (1 888 837 87 72)
  customer.support@rsa.rohde-schwarz.com
- Latin America | +1 410 910 79 88
  customersupport.la@rohde-schwarz.com
- Asia Pacific | +65 65 13 04 88
  customersupport.asia@rohde-schwarz.com
- China | +86 800 810 82 28 | +86 400 650 58 96
  customersupport.china@rohde-schwarz.com

PD 5213.9934.12 | Version 22.00 | July 2019 (jr)
R&S®TSMW Universal Radio Network Analyzer
Data without tolerance limits is not binding | Subject to change

5213993412

5213.9934.12 22.00 PDP 1 en