R&S®ROMES4
Drive Test Software
Mobile coverage and QoS measurements in wireless communications
Currently, the following technologies are supported: GSM/EDGE, WCDMA/HSPA+, CDMA2000® 1xEV-DO Rev. A, WLAN (IEEE 802.11b, g), WiMAX™ (IEEE 802.16e), LTE, DAB, DVB-T, DVB-H and TETRA. Standard-compliant RF level measurements can be time- and route-triggered over a very wide frequency range (9 kHz to 7 GHz).

Due to its highly modular structure, the platform can be expanded at any time for new technologies such as LTE. The test software runs under the Microsoft Windows XP™ SP3 operating system on a standard PC. The measurement data can also be replayed under Microsoft Windows 7.

When R&S®ROMES4 is combined with the band-unlimited scanners of the R&S®TSMx family, the measurements help typical customers (such as network operators, regulatory authorities, service providers, chipset manufacturers and governmental bodies) complete their work quickly and easily.

**Key facts**
- One software solution for all technologies: “all under one roof”
- Flexible handling of software licenses reduces startup costs
- Parallel measurements with up to 16 mobile phones per license; this saves time, allowing existing resources to be utilized more effectively: reduction of operating expenses (OPEX)
- Use of highly accurate, fast RF test and measurement equipment (Rohde & Schwarz scanners): many reliable measured values and results
- Automatic evaluation after completion of measurement by means of the integrated replay function or R&S®ROMES4NPA (network problem analyzer), which considerably reduces OPEX
- Automatic identification of GSM interferences: considerable OPEX reduction (up to 80% potential savings compared with standard analysis)
- Unique scanner for TETRA networks in all bands and decoding of broadcast information

CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA).

R&S®ROMES4 Drive Test Software

Benefits and key features

**Easy operation with high flexibility**
- Easy-to-use interface that adapts to the user’s level of knowledge
- Ready to use in no time, due to workspaces and projects
- Easy system configuration with hardware-scan function
- Support of numerous map data formats such as MapInfo, ESRI, Map&Guide, LS telcom and CMRG
  ▶ page 4

**Automatic handover and neighborhood analysis**
- Automatic detection of missing neighboring cells during drive
- Enhancement of network coverage
- Indispensable for a roll-out
  ▶ page 6

**Interference analysis with interferer identification**
- Automatic measurement and identification of interferers from user’s own GSM mobile radio network
- Evaluation of BCCH and TCH channels allows full-featured analysis
- Detection of adjacent- and co-channel interferers
  ▶ page 7

**Numerous application tests (data throughput/DQA)**
- Creation of different application jobs
- Output of the most important network parameters in the form of a report or by means of KPIs
  ▶ page 8

**Full overview of layer 1 and layer 3**
- Display of mobile phone activities in protocol layer 3
- Fast analysis in the case of an interrupted connection
- Decoding of protocol messages for insight into network configuration
  ▶ page 9

**Test of speech quality**
- Full end-to-end measurement of how the customer would experience quality
- Based on PESQ standard
- Output of MOS value
  ▶ page 10

**Parallel spectrum measurement**
- Broadband spectrum measurement
- Detection of broadband interferers, neighborhood interferences or uplink activities
  ▶ page 11

**Determination of 2G and 3G base stations**
- Creation of a base station list during a drive test
- No active connection to base station necessary
- Requires only scanners and GPS
  ▶ page 12

**For indoor measurements**
- Stationary or moving measurements indoors, without GPS signal
- Intuitive operation similar to “Route Track” view
  ▶ page 13

**R&S®ROMES4NPA**

**Advanced network problem analysis**
- Analysis of one or more drive tests according to different criteria
- Automatic pinpointing of trouble spots and their causes using sophisticated algorithms
- Choice of add-on modules for speech quality, data and HSPA tests
- Software development kit (SDK) for generating user-specific add-on modules
  ▶ page 14
Easy operation with high flexibility

Selecting the user level.

Featuring different user levels, R&S® ROMES4 can adapt to the user's level of knowledge. The different user levels make it possible to adjust the displayed views and signals to what is most important for the individual user. This allows experienced users as well as newcomers to work more efficiently with this drive test tool.

In addition, users can create a workspace in which to store all settings and loaded drivers. At the start of a new drive test, all they need to do is load this workspace: The test system is ready to use right away. To further simplify and speed up this procedure, users can create a project. A project contains all the settings of a workspace and reduces the overall volume of the modules to be loaded when the software is started. The startup wizard makes it possible to load and start a project, workspace or test file fully automatically.

Overview of the R&S® ROMES4 graphical user interface
Multiple wizards help users to perform application tests (e.g. an FTP download or HTTP download) when configuring a test mobile phone. In only three steps, the measurement is ready to be started. After successfully loading the drivers, R&S®ROMES4 automatically opens a selection of important windows that display measured data.

The integrated hardware scan function even automatically loads connected devices. R&S®ROMES4 then finds all test mobile phones and R&S®TSMx scanner options. After the hardware is selected, it is loaded so that no time is wasted on configuring the system.

In addition to the MapInfo map data format, R&S®ROMES4 also supports the optional use of maps that are based on ESRI, Map & Guide, LS telcom or CMRG.

R&S®ROMES4 also proves flexible when it comes to licensing. The license server model enables users to rent R&S®ROMES4 licenses for a limited period of time from a license server located at the customer site. After a defined rental period, the licenses are automatically made available to be rented again. This eliminates capital investments and fits the needs of the individual user.

Measurement data can also be converted to Google Earth format in addition to an ASCII export allowing users to easily visualize a test drive on maps without any additional expense.

When multiple and long test drives need to be evaluated automatically for errors in the network and the cause for these errors needs to be determined, the R&S®ROMES network problem analyzer (NPA) is the ideal tool. The base module (for displaying ETSI key performance indicators (KPIs) and providing an overview of the data (contained in the measurement files) is part of the equipment supplied with R&S®ROMES4. Optional modules for dedicated error analysis (of voice calls or data calls) automatically evaluate the causes of error and display them. A further module permits the analysis of coverage measurement data recorded with the R&S®TSMx scanners.
Automatic handover and neighborhood analysis

Requirements
- R&S®ROMES4
- R&S®ROMES4HOA
- R&S®ROMES4T1Q or R&S®ROMES4T1W
- R&S®TSMx GSM/UMTS scanner
- Test mobile phone
- R&S®ROMES4GSM (GSM driver) or R&S®ROMES4WCQ (Qualcomm driver) or R&S®ROMES4WCN (Nokia driver)

The automatic neighborhood analysis is based on a base station list and on the base stations' broadcast signals that are decoded by the R&S®TSMx scanners. These system information blocks (UMTS) or system information types (GSM) include information that is used by test mobile phones to identify and monitor the neighboring cells. The report containing the measured values of the neighbor channels is forwarded to the base station. The base station can use this return message to prompt a handover if necessary.

In contrast to the test mobile phones, the R&S®TSMx scanners “see” all signals. These signals can be assigned to the test-mobile-phone-referenced neighboring cells. R&S®ROMES4 is thus able to automatically compare the measured data of the scanners and the test mobile phones with a base station list and identify any missing neighboring cells. These missing cells may originate during the roll-out of a network and, in the worst case, cause a call cleardown.

The SIB analyzer integrated in R&S®ROMES4 compares the neighboring cells measured by the scanner against those in the base station list. Neighboring cells that were detected but do not appear in the list are marked in yellow, which indicates a missing neighborhood.

This automatic neighborhood analysis works for UMTS; a comparable functionality exists for GSM. Both work in realtime.
Interference analysis with interferer identification

Requirements
- R&S®ROMES4
- R&S®ROMES4COI
- R&S®ROMES4T1Q or R&S®ROMES4T1W
- R&S®TSMx GSM scanner
- Test mobile phone
- R&S®ROMES4GSM (GSM driver) or R&S®ROMES4WCQ (Qualcomm driver) or R&S®ROMES4WCN (Nokia driver)

The R&S®ROMES4 software allows interferences to be determined automatically during the drive test. The actual interferers can be displayed on the underlaid street map in the “Route Track” view. This makes it considerably simpler to use the software and perform tests, reducing costs dramatically in comparison with the traditional method.

The evaluation is performed in three steps:
1. Automatic detection of an interference situation (type, length, location)
2. Automatic analysis of the detected interferences (test on BCCH and TCH)
3. Assignment of the actual interferers on the basis of the individual interference situation and pinpointing of the interferers on the street map (interfering base station with channel indication: BCCH, TCH, adjacent channel)

To optimize the interference analysis, not only selectable trigger thresholds (for e.g. RxLevFull, RxLevSub, RxQualFull, RxQualSub, FER) are used. Some of the test mobile phones supported by R&S®ROMES4 also provide a C/I value for the traffic channels (TCH) used. Due to the fact that, because of the SIM connection, a test mobile phone “sees” only the data of the assigned mobile radio network and is not very RF-sensitive, the use of high-grade scanners is absolutely essential.

The scanners (R&S®TSMU, R&S®TSML-x, R&S®TSMQ and R&S®TSMW) are able to instantly pick up all selected RF channels (BCCH) and demodulate the BCH information. As a result, all the data of the base transceiver stations (BTS) transmitting the signals is then available. This is especially important when performing measurements in the vicinity of national borders (faulty frequency assignment, roaming, etc.).

The combination of scanner and test mobile phone can even be used to measure the power in the timeslots used (TCH).

The assignment of BCCH and TCH interferers is very plain to see on the serving cell BCCH and the TCH.

Interference analysis with regard to traffic channels

Cx-Cx co-channel interference on TCH107 (C0 serving cell with BCCH77) is disrupted by TCH107 (by the base station identified by the scanner with BCCH71). This is shown by the green line that represents the training sequence code (TSC2); the SC would have to be yellow (i.e. TSC4).
Numerous application tests (data throughput/DQA)

The drive test report quickly shows whether there are any trouble spots.

Requirements
- R&S®ROMES4
- R&S®ROMES4DQA
- Test mobile phone
- R&S®ROMES4GSM (GSM driver) or R&S®ROMES4WCQ (Qualcomm driver) or R&S®ROMES4HPQ (Qualcomm HSPA+ driver) or R&S®ROMES4WCN (Nokia driver) or R&S®ROMES4LTS (Samsung LTE driver)

Increasingly more value is being placed on optimizing data services and on data throughput. This requires a tool that can be used to configure, display and evaluate the different data measurements and packet-switched services, i.e. the data quality analyzer (DQA). The following applications are possible: SMS, MMS, e-mail (POP3 and IMAP), ping, UDP, FTP, HTTP, video streaming.

By integrating Internet Explorer into R&S®ROMES4, measurements can be performed directly from the customer's perspective. Together with the Web 2.0 function, users can check e-mails with the web browser or view a YouTube video, for example.

An automatic realtime analysis generates multiple reports containing key benchmark data, and ETSI KPIs are calculated automatically.

The integrated VLC player allows streaming of virtually any protocols; here too, relevant KPIs are automatically provided. An individual job list consisting, for example, of an FTP download, ping or video streaming can be generated. Complex runs with multiple parallel tasks are also possible. The typical behavior of an Internet user can be simulated, e.g. surfing on the Internet while downloading a mail attachment.

Parallel jobs are configured with simple graphics.

The drive test report quickly shows whether there are any trouble spots.

The KPIS reveal the most important benchmark data of a network.
The basic functionality of R&S®ROMES4 in combination with the drivers for test mobile phones provides a large amount of information from layers 1 and 3. Users can thus see the radio conditions (GSM or WCDMA, channel, voice codec, etc.) for phone calls at a glance.

If measurements are also taken by a scanner, the scanner’s measured data is displayed in the same window, allowing a direct comparison.

“Layer 3 View” displays all the messages, sorted by uplink and downlink. Each message is decoded and can be opened if necessary.

Besides the protocol messages, interrupted/blocked and successful connections are also displayed. When jumping to a trouble spot, all views will show measurements taken at this point in time. This makes it considerably easier to find the cause of a problem.

In addition, a filter function in “Layer 3 View” enables users to evaluate only the wanted messages.

**Requirements**
- R&S®ROMES4
- Test mobile phone
- R&S®ROMES4GSM (GSM driver) or R&S®ROMES4WCQ (Qualcomm driver) or R&S®ROMES4WCN (Nokia driver) or R&S®ROMES4LTS (Samsung LTE driver)
In recent years, the quality demands placed on wireless communications networks have become considerably more stringent. With regard to speech quality, R&S®ROMES4 offers a comprehensive end-to-end solution. The audio signal of a mobile phone is digitized by a high-quality sound card and evaluated by means of a PESQ algorithm (ITU-T P.862). The greater the difference of the transmitted voice signal to the reference signal, the poorer the speech quality. The speech quality is indicated by the mean opinion score (MOS) and can vary between 1 (poor) and 5 (very good).

The measurements can be performed using a fixed-network station, usually a speech-quality server, or using another mobile phone. The mobile phone reflects the quality as would be experienced by a customer. In contrast, a fixed-network station serves as a reference, enabling the cause of a poor MOS to be found more quickly.

The R&S®ROMES4SQA speech-quality option makes it possible to measure calls for the downlink and for the uplink. For the downlink, the server replays a reference voice signal and R&S®ROMES4 evaluates this received signal. For the uplink, the R&S®ROMES4 test system replays a voice signal and the server evaluates it by using a PESQ algorithm. Following a drive test, the measured data can be merged so that the uplink and downlink measurements are available in one log file.

**Requirements**
- R&S®ROMES4
- R&S®ROMES4SQA
- PESQ license
- Test mobile phone
- R&S®ROMES4GSM (GSM driver) or R&S®ROMES4WCQ (Qualcomm driver) or R&S®ROMES4WCN (Nokia driver)
- Audio adapter
- Professional sound card
Parallel spectrum measurement

Requirements

- R&S®ROMES4
- R&S®ROMES4T1Q or R&S®ROMES4T1W
- R&S®TSMx scanner with R&S®TSMU-K17 RF power scan
- R&S®TSMW scanner with R&S®TSMW-K27 RF power scan

In combination with an R&S®TSMU/L/Q (R&S®TSMW), the R&S®ROMES4 software can be used to perform a spectrum scan. The user can select up to 32 frequency ranges from 80 MHz to 3 GHz (30 MHz to 6 GHz). The frequency range is not limited. R&S®ROMES4 offers different display options, e.g. envelope spectrum measurement, RMS, peak or display using a predefined channel mask. In this case, the power per channel is displayed.

By means of marker functions, dedicated frequencies can be exactly measured and changes easily detected. A marker can also be defined as a reference and compared with the maximum value.

In addition, the waterfall diagram gives the user a general idea of the air interface along with a certain historical depth. This makes it very easy to locate broadband interferers or external interferences. All the user needs to do is move the mouse pointer over the waterfall diagram. At any desired spot, time stamp and frequency are displayed, enabling the user to find the center frequency of an unknown signal faster.

The spectrum function is based on an FFT analysis. Various FFT sizes allow users to set measurement bandwidths down to min. 140 Hz. The measurement accuracy can be increased by using a smaller measurement bandwidth. This procedure permits a very fast spectrum measurement without the usual sweep time of a normal spectrum analyzer. Particularly for drive tests, fast measurements are of special significance in order to achieve a sufficiently high density of results also during the drive.

A special threshold value is provided for monitoring the spectrum. Spectra that do not show any test points above this threshold value are not displayed at all. Unimportant measurement data is not recorded. Frequency markers and the entire spectrum can be exported to an ASCII format.
The R&S®TSMU/L/Q and R&S®TSMW scanners enable users to estimate the geographic position of base stations. Using the R&S®TSMQ or R&S®TSMW scanner, the determination of GSM, WCDMA and CDMA2000® 1xEV-DO base stations can even be made in parallel, i.e. simultaneously.

For the calculation algorithm, only the measurement parameters of a highly accurate GPS receiver (with output of the PPS time reference signal, already installed in the R&S®TSMW) and of the 2G and/or 3G scanner are needed.

By means of the R&S®ROMES4 software and the R&S®ROMES4LOC driver, the scanners not only detect the main levels of the BTS (2G: RxLev; 3G: RSCP) but also demodulate the broadcast channels (BCH). Important time information as well as details of the transmitting BTS are thus obtained.

The maximum likelihood method is used to calculate the geographic position of the individual BTS from the measured data provided by the GPS receiver, the BCH time information and changes in the level during the drive test.

Following the drive test, the results of the calculation are exported to a base station list and the located base stations are then displayed on an underlaid street map.

Marking the BTS opens another window in which the characteristic data of the BTS is displayed.

The calculated position of a BTS lies within an error ellipse (approx. 200 m) that is also exported. Base stations whose positions have been estimated only very roughly can thus be filtered out during export.
High-quality wireless communications coverage (primarily with regard to data traffic) inside buildings, e.g. at airports, shopping malls and trade-fair arenas, is becoming increasingly important. Since GPS reception indoors is only possible to a limited extent or not at all, an alternative to conventional navigation display (GPS data on a map) must be found.

The R&S®ROMES4IND indoor driver option of R&S®ROMES4, a completely new development, provides a separate means of navigation that makes it possible to display positions on a floor plan. Measurements can be taken at specific points (hot spots, e.g. in conference rooms) or along a specific path (continuous, e.g. in a corridor). Combined DUTs (comprising buildings and outdoor areas such as a company’s premises) can be optimally surveyed and georeferenced. The software also displays a smooth transition to areas covered by GPS. The use of different layers is a very simple solution for handling multiple stories. Due to the complete integration of the indoor functionality into the R&S®ROMES4 map display, operation is intuitive.

For indoor measurements

Requirements
- R&S®ROMES4
- R&S®ROMES4IND
- Test mobile phone and/or scanner
- R&S®ROMES4WCQ (Qualcomm driver) or R&S®ROMES4WCN (Nokia driver) or R&S®ROMES4LTS (Samsung LTE driver)
The measurement data is analyzed according to specific criteria that depend on the modules selected. In all modules, the analysis criteria can be adapted to user-specific limit values and settings.

The R&S®ROMES4NPA basic package (included in R&S®ROMES4 as of version 4.50), already includes the following modules:
- NQA (network quality analyzer) for voice calls, basic module
- DQA (data quality analyzer) for PS data connections, basic module
- Generic signals (for user-selectable linking of signals)

The following add-on modules are available as options:
- R&S®ROMES4N11: NQA for GSM/WCDMA voice calls, expansion for problem spot detection. Analysis of voice calls for network problems, which can be selected from more than 140 different problem categories; listing of the problem spots together with type and cause of problem
- R&S®ROMES4N20: data module for EDGE and HSPA for high-speed data links including problem spot detection. Specific analysis of high-speed data links for achievable data rates and analysis of possible problems as well as IP data analyzer for analyzing IP-based data traffic and associated problems. When IP-based data services are used, e.g. web browsing or e-mail, this module analyzes the results and shows problem spots and their cause
- R&S®ROMES4N15: coverage module with display of coverage data on a raster map. Coverage data (GSM, WCDMA, TETRA or LTE) measured with the Rohde & Schwarz scanners is rasterized and displayed on the map using Google Maps. This makes the generation of coverage plots an easy task. Likewise, optimizations can be checked by means of a before-and-after comparison

A comprehensively documented software development kit (SDK) is provided as an option allowing users with specific knowledge in mobile radio networks and programming skills to generate their own add-on modules for any types of analysis.

If multiple drive tests are selected, the user can draw statistical conclusions about quality in the measured areas. A comparison between various network operators in the same area is also possible (benchmarking).

A local database (R&S®ROMES4N51, based on SQLite; also runs on laptops) can store measurement data and the R&S®ROMES4NPA analysis results. This information can be aggregated and queried in accordance with diverse criteria such as specific areas, times, technologies, etc. A further way to evaluate analysis results in greater detail is to use sophisticated filter algorithms (e.g., for examining only one driver or one cell).
R&S®ROMES4NPA considerably helps to save time and reduce costs by automatically analyzing the measured data. Optimizing the results no longer requires time-consuming, manual checking and analysis of data that may not even contain any problems.

Its sophisticated algorithms make R&S®ROMES4NPA a very effective tool for finding the causes of existing problems. More in-depth analyses can be performed at any time.

A large amount of measured data can be automatically processed in minimum time and on an identical basis; reports – for management and for general documentation – are generated without the user having to take action.
System configuration for different application scenarios

R&S®ROMES4 and the connected measuring equipment (test mobile phones, R&S®TSMx scanners, etc.) can be used and delivered in various configurations:
- With user-specific cabling/configured by customer
- As a test suitcase
- As a backpack, especially for indoor measurements
- As a turnkey test vehicle

User-specific cabling.

Test suitcase.

Backpack.

Turnkey test vehicle.
System components

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<th>Technology</th>
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<th>Nokia GSM and UMTS</th>
<th>Qualcomm CDMA2000 1xEV-DO</th>
<th>Beazcom WIMAX</th>
<th>Samsung LTE</th>
<th>TETRA PEI</th>
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A list of test mobile phones supported by R&S®ROMES4 is separately available.

System requirements

**Recommended**
- Intel Core 2 Duo 2 GHz
- 2 Gbyte RAM
- 80 Gbyte hard disk
- DVD-ROM drive
- USB 2.0/Firewire interfaces and LAN interface
- 15” monitor with a resolution of 1024 x 768 pixel
- Microsoft Windows XP SP3
- Alternatively possible for R&S®ROMES replay: Microsoft Windows 7

**Recommended notebook**
- Dell Latitude E6500
Example 1: LTE

Coverage analysis
This essential analysis determines whether an LTE signal of sufficient strength is available at the test site. The results can be displayed in an easy-to-read manner with the R&S®ROMES4 software by using a TopN View and plotted on a map.

As a signal strength, the R&S®TSMW delivers either the RSRP value or the power of the P-SCH/S-SCH channels. In addition to signal strength, the reference signal received quality (RSRQ) and the signal to interference-plus-noise ratio (SINR) are displayed for every cell. If one of these values is too low, this indicates interferences, intermodulation or other types of disturbance. In this case, the R&S®TSMW and R&S®ROMES4 offer a more detailed cause analysis.

Data throughput measurement using the LTE test mobile
R&S®ROMES4 collects scanner data and measurement data from the Samsung LTE test mobile. One of the most important parameters is data throughput. If it is too low, the cause may be a low-order modulation format such as QPSK or the use of SISO rather than MIMO. A comparison with the scanner data permits further conclusions about possible causes. Interferences, multipath propagations, handover failures or also weak network coverage might be the cause of error.

In addition to data throughput measurement, measurement data of layer 1 and layer 3 messages are recorded.

Requirements
- R&S®ROMES4
- R&S®ROMES4DQA
- R&S®ROMES4LTS (Samsung LTE driver)
- R&S®ROMES4T1W (scanner driver)
- R&STSMW scanner

TopN View shows the signals of the eNodeBs, sorted by their strength.
Interference analysis
LTE is a single frequency network (SFN) that is identified by a reuse factor of 1. This means that neighboring cells use the same frequency ranges. Interferences are therefore especially frequent and must be analyzed to avoid capacity losses to the greatest possible extent. This is a special challenge for T&M equipment because the interferences can also affect the T&M equipment itself.

The R&S®TSMW was developed specially for this task and features an impressive C/I value of –20 dB. Therefore, even signals that are 20 dB weaker than the strongest noise can be measured. This makes it possible to identify the interferers and to reduce interferences.

Furthermore, the R&S®TSMW can distinguish between signals that have the same physical cell ID but come from different eNodeBs. It makes no difference whether the measurement is performed in the FDD mode or in the TDD mode.

Cyclic prefix analysis
A special feature of the Rohde & Schwarz LTE drive test solution based on the R&S®TSMW is the channel impulse response (CIR) measurement. This involves a channel measurement performed over a period of time.

R&S®ROMES4 displays the multipath propagation of the signals – also referred to as echoes – in a power versus time diagram. LTE as an OFDM standard has a defined frame length and a fixed guard interval, also referred to as a cyclic prefix. This value is necessary in order to wait for echoes in the receiver. A cyclic prefix that is too short or an echo that is too long can cause problems with the subsequent frames. This is referred to as intersymbol interference (ISI). This effect is indicated by a low SINR.

R&S®ROMES4 can measure the length of the cyclic prefix and match it against the multipath propagation. This enables the user to draw a conclusion about how often multipath propagation disturbs the subsequent symbol and whether a longer cyclic prefix would be better or the network needs to be optimized e.g. by adding eNodeBs.

Demodulation of the eNodeB broadcast information
The R&S®TSMW can scan LTE signals and also demodulate broadcast signals. The broadcast information is demodulated (MIB and SIBs) by previously detected eNodeBs to learn more about the base station. Based on this information, the user knows the country, the network and the cell the received signal originates from. Neighborhood relationships (Intra-RAT and Inter-RAT) and handover thresholds are also visible. All these values make it easier to assign the signals and to detect problem spots.
Applications

Example 2: HSPA(+)

Requirements
- R&S®ROMES4
- R&S®ROMES4DQA
- Test mobile phones and/or scanner
- R&S®ROMES4WCQ (Qualcomm driver) or R&S®ROMES4WCN (Nokia driver)
- R&S®ROMES4HPO (Qualcomm HSPA+ option)
- R&S®TSMQ drive test scanner or R&S®TSMW drive test scanner

Display of channel quality indication (CQI), the most important parameter.

Overview of decoded packets.

Statistical evaluation of block size versus bit error ratio.

Upgrading existing UMTS networks and rolling out HSPA(+) networks place highly complex demands on network optimization. In order to be successful on the market, high data rates must be reliably available. There may be diverse reasons for insufficient data throughput; they have to be uncovered and eliminated.

R&S®ROMES4 provides more than 15 HSPA(+) specific views. They show all the important parameters in a fast, straightforward manner and inform users quickly about performance.

By downloading and uploading large files from and to specific servers, R&S®ROMES4 makes it possible to perform end-to-end tests that take into account the overall infrastructure (data card – air interface – RAN – core network). Depending on the test mobile, MIMO and 64QAM messages are supported.

And all this can be done not just for one network operator but also for several network operators in parallel. Depending on the expected data rate and the existing network structure, the R&S®ROMES4 measurement PC can constitute a limitation in this scenario. This limitation can, however, be eliminated by the R&S®ROMES4NET multiprocessor architecture option, so that an unlimited number of networks can be measured at full performance.

To optimize an HSPA(+) network, the first thing to do is to monitor the data throughput by means of the DQA. If the throughput is too low for the network structure, the next step is a CQI measurement. If this value is very low on average, the reason may be insufficient coverage or pilot pollution. In the case of pilot pollution, the number of signals of equal strength at this location should be reduced. A scanner is especially advantageous because it can reliably detect all signals on the air interface.

A low CQI is due to a small block size and a low-order modulation. By increasing the two, the throughput rates of a network can be optimized.
Example 3: TETRA

R&S®ROMES4 is the software platform for measurements on the TETRA air interface. It analyzes TETRA networks and solves other tasks of TETRA network operators and users. These are related to network acceptance tests, identifying and eliminating interferers, as well as comparison measurements and performance measurements. For TETRA measurements, R&S®ROMES4 controls the R&S®TSMW wireless communications scanner.

For such tasks, the following capabilities are indispensable:
- Mobility and speed – use in vehicles, helicopters and on foot
- Highly accurate coverage measurements of TETRA networks using a passive RF scanner
- Spectrum analysis for identifying interferers
- Measurement and identification of TETRA base stations
- Subsequent problem analysis – uncovers problems in the TETRA network and analyzes them on the basis of the test data obtained with R&S®ROMES4

In the downlink, the R&S®TSMW in the D-CT and D-CTT operating modes measures the following parameters:
- Frequency range 100 MHz to 1000 MHz, with parallel measurements of all channels in a 10 MHz block
- Channel resolution 25 kHz (with QPSK)
- Automatic detection of the broadcast synchronization channel (BSCH)
- Up to 20 Hz measurement rate for the carrier measurements of up to 2 × 400 channels simultaneously (10 MHz block, QPSK), with:
  - Channel number and frequency
  - Power of each base station
  - MCC, MNC, TN, FN, MFN
  - BER before Viterbi
  - AACH BER
  - Frequency error and phase error
  - SNR
  - Delay spread
  - Inband spectrum
  - Constellation diagram
  - BCH demodulation incl. decoding of neighboring cells
  - Measurement of co-channel interference
  - Channel impulse response (channel sounder)

The R&S®ROMES4TEP software option controls radios from Sepura, EADS and Motorola via the standardized PEI interface to perform call control and data transfer, to emulate user behavior in the network and to provide additional status information.

The TETRA test solution from Rohde & Schwarz takes into account technological advances in trunked radio (e.g. TEDS, quality-of-service requirements for radios) and is continuously enhanced.

Requirements
- R&S®TSMW drive test scanner
- R&S®TSMW-K26 TETRA option for R&S®TSMW
- R&S®ROMES4
- R&S®ROMES4T1W
- R&S®ROMES4TEP

The TETRA spectrum scan displays all channels in a 10 MHz band.
## Ordering information

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From pre-sale to service. At your doorstep.

System support worldwide
- Test systems are located and supported today in Canada, China, Israel, Japan, Korea, Spain, Taiwan, the United Kingdom, and the USA (and the list keeps growing)
- Three fully equipped, independent teams are available for on-site system calibrations worldwide

Hotline service
- Availability of a team of designated system specialists
- Access to system specialists for reference systems that mirror exact customer configurations
- Availability of local and regional call center services

Calibration service
- On-site calibration of the complete test system
- Disassembly, calibration and re-assembly performed by a specialized and experienced team
- Accreditation in line with EN ISO/IEC 17025
- Calibration certificate in line with EN ISO 9001
- Optional DKD calibration traceable to national/international calibration standards
- Shortest possible system downtime; typically only one week for a full calibration of a test system and all of its components
- No packing and transport of the test system necessary

Repair service
- Repair of the system hardware
- Access to a common pool of spare parts and loan units
- Related travel and transport costs
- On-site repair by local service technician if possible
- Escalation procedure

Software service
- The software service includes the following:
  - Corrections and minor enhancements
  - Implementation of changes in line with the applicable recommendations
  - Delivery of updated software including documentation on the system download database at Rohde & Schwarz, which can be accessed by the customer via the Internet
  - If applicable, revalidation of the supplied software (to be performed by an accredited test house)

Hotline service
- Availability of a team of designated system specialists
- Access to system specialists for reference systems that mirror exact customer configurations
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The Rohde & Schwarz global service network
About Rohde & Schwarz

Rohde & Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established more than 75 years ago, Rohde & Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

Environmental commitment

- Energy-efficient products
- Continuous improvement in environmental sustainability
- ISO 14001-certified environmental management system

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