

# News from Rohde & Schwarz



Signal and ARB generators for virtually every requirement

Unrivaled vector network analyzer with up to eight test ports

Versatile infotainment test system for all stages of the production process

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**ROHDE & SCHWARZ**

New generators from Rohde & Schwarz attract a lot of attention: The Analog Signal Generator R&S®SMA100A excels at signal quality, speed and flexibility. The R&S®AFQ100A ARB waveform generator provides top-quality I/Q signals, and the R&S®SMx family offers the world's first signal generator solution for TD-SCDMA.



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Unrivaled: The new Vector Network Analyzer R&S®ZVT8 features up to eight test ports in a single unit (page 26).

The Signal Generator R&S®SMA100A provides excellent performance at a favorable price. Its high measuring speed also makes it ideal for production. This versatile instrument is practically without match (page 30).



## MOBILE RADIO

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◀ Signal Generator R&S®SMA100A

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The R&S®AFQ100A arbitrary waveform generator sets new standards in bandwidth and memory depth. Its innovative concepts that optimize its overall performance in supplying vector-modulated signals ensure a signal quality previously not feasible (page 35).



The cost-efficient Audio Analyzers R&S®UP300 and R&S®UP350 provide surprisingly good specifications in the lower price class (page 38).

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TETRA Mobile Radio System *ACCESSNET*<sup>®</sup>-T

## The key to success – versatile platform for applications

Digital PMR networks for mission-critical communications are often modified during their service life to support a variety of uses. This is achieved by integrating customer-specific applications. The TETRA Mobile Radio System *ACCESSNET*<sup>®</sup>-T is optimally prepared for handling such dynamic modifications. It features an intelligent application platform that makes powerful and comprehensive services available to external software applications.

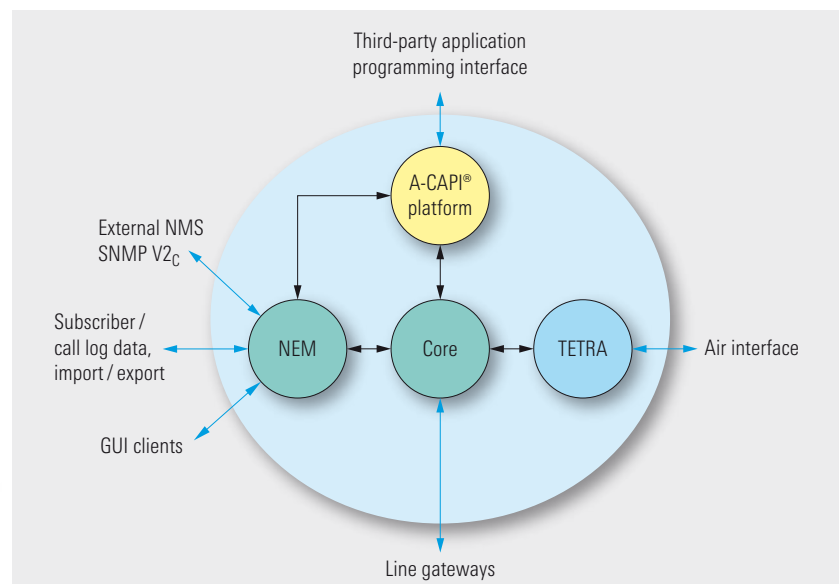
### Universal platform for software applications

Modern digital radio networks offer functionality far exceeding simple voice communications. Network subscribers today need to access distributed databases, for example, or query sensors, monitor and control systems or coordinate field service teams by remote control. The required applications help safeguard investments, and it must be possible to integrate them into a network without impairing its operation. While some user groups are fully satisfied with standard applications, others require tailor-made solutions. *ACCESSNET*<sup>®</sup>-T and A-CAPI<sup>®</sup> support both groups.

The Common Application Programming Interface (A-CAPI<sup>®</sup>) for *ACCESSNET*<sup>®</sup>-T was developed for network operators, organizations that share a common network, and application engineers designing solutions for mission-critical communications. A-CAPI<sup>®</sup> is an intelligent, versatile and reliable platform that provides the complete range of system services required by external software applications (FIG 1).

All applications can benefit from this standardized platform, which can set up a direct link to any digital system node within *ACCESSNET*<sup>®</sup>-T. Communications between external applications and A-CAPI<sup>®</sup> are based on Ethernet and the Internet Protocol (IP).

FIG 1 The A-CAPI<sup>®</sup> platform for *ACCESSNET*<sup>®</sup>-T provides all system services required by external software applications.



More information and data sheet at  
[www.rohde-schwarz.com](http://www.rohde-schwarz.com)  
 (search term: *ACCESSNET*)



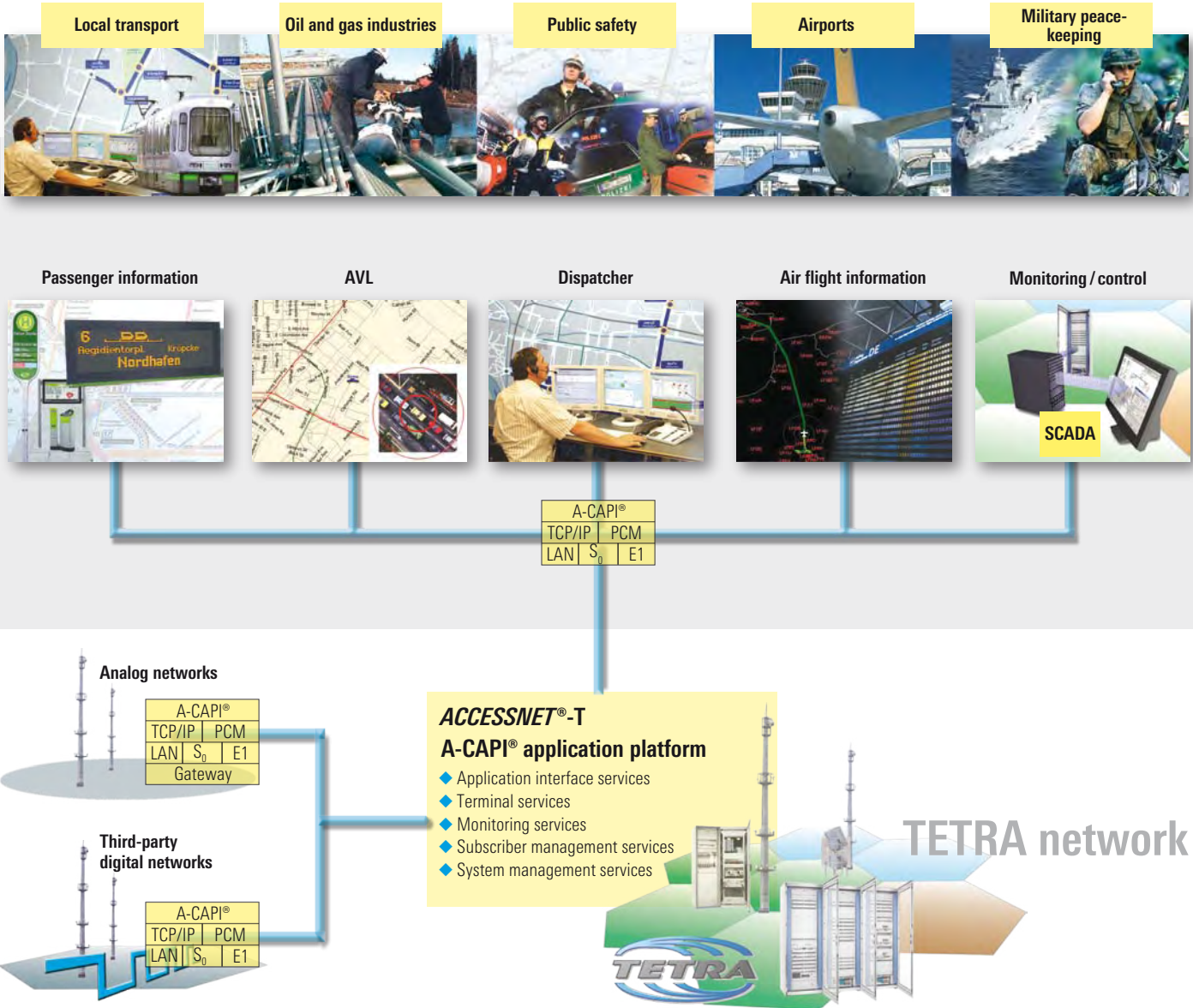


FIG 2 A-CAPI® technical reference model.

## Secure integration of applications

A-CAPI® is a powerful tool for integrating software applications into an *ACCESSNET*®-T mobile radio network. First and foremost, it provides comprehensive security measures. For example, authentication and encryption mechanisms protect the connection between

the remote application and the radio network. A-CAPI® also reliably isolates the mobile radio network from the external software application, thus preventing mutual interference. As an additional benefit, application engineers do not need to concern themselves with the physical characteristics of the TETRA air interface.

A-CAPI® allows multiple applications to be active at the same time. It provides a means of isolating and protecting applications from one another, so that their respective tasks and functionalities remain concealed from each other. This is crucial where several groups or organizations share a common mobile radio network (FIG 2).

### ► Standard services provided by the application platform

Integrating software applications takes an intelligent, flexible, reliable and well-defined platform – accompanied by an effective support program from the manufacturer.

The services offered by A-CAPI® fall into the following categories (FIG 3):

- ◆ **Application interface services** handle security aspects and monitor and control the interface.
- ◆ **Terminal services** enable external software to access voice and data services (i.e. to set up and receive calls) and provide switching functions and access to gateways.
- ◆ **Monitoring services** monitor voice and data connections.
- ◆ **Subscriber management services** handle subscriber-related data, including group management (e.g. setting access restrictions for closed user groups or virtual private networks (VPNs)).

- ◆ **System management services** control and monitor a mobile radio network and its resources (e.g. system capacity and load conditions).

### A-CAPI® fields of application

A-CAPI® covers three fields of application:

- ◆ System feature extensions (SFE)
- ◆ External device integration (EDI)
- ◆ Customer systems integration (CSI)

**SFE** expands the *ACCESSNET*®-T mobile radio network, adding complex functions such as resource monitoring and network load analysis. Other functions include radio coverage measurements and mobile fax.

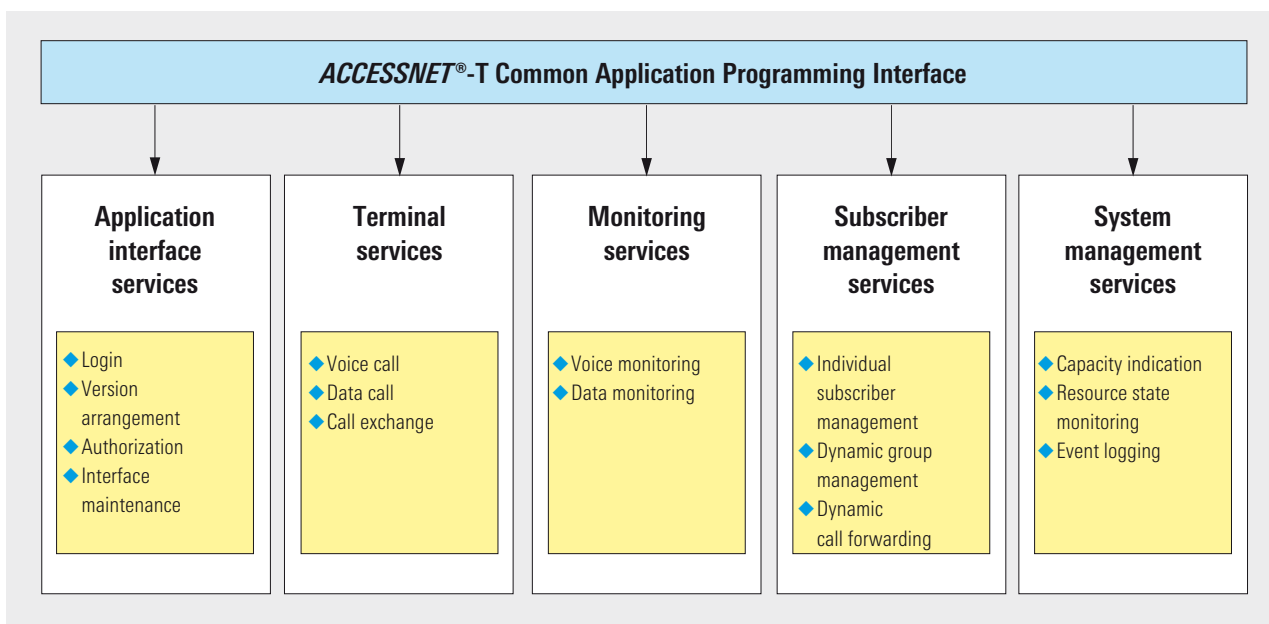
**EDI** provides access to third-party subsystems. These include voice and data recorders, voice mailboxes, dispatchers and control centers as well as automatic vehicle locationing (AVL) and telemetry systems. EDI also enables the inte-

gration of legacy systems. Analog radio channels can be assigned to a TETRA subscriber or group of subscribers using dispatcher commands and A-CAPI® terminal services.

**CSI** – generally a functional expansion of a customer's existing systems – improves system processes and operations or makes specific ones possible for the first time. A good example is a railway communications system, where the onboard unit of a train acts as a gateway for voice communications with the train driver. The onboard unit collects important data about the train and its engine and also interfaces with the public announcement equipment (FIG 4).

Status changes are transmitted in real-time to the railway control center via the mobile radio system, and the control center returns control signals to the train. Remote control units are used for voice communications between the control center and the train driver. Terminal services also play an important role in this application.

FIG 3 Services made available by A-CAPI®.



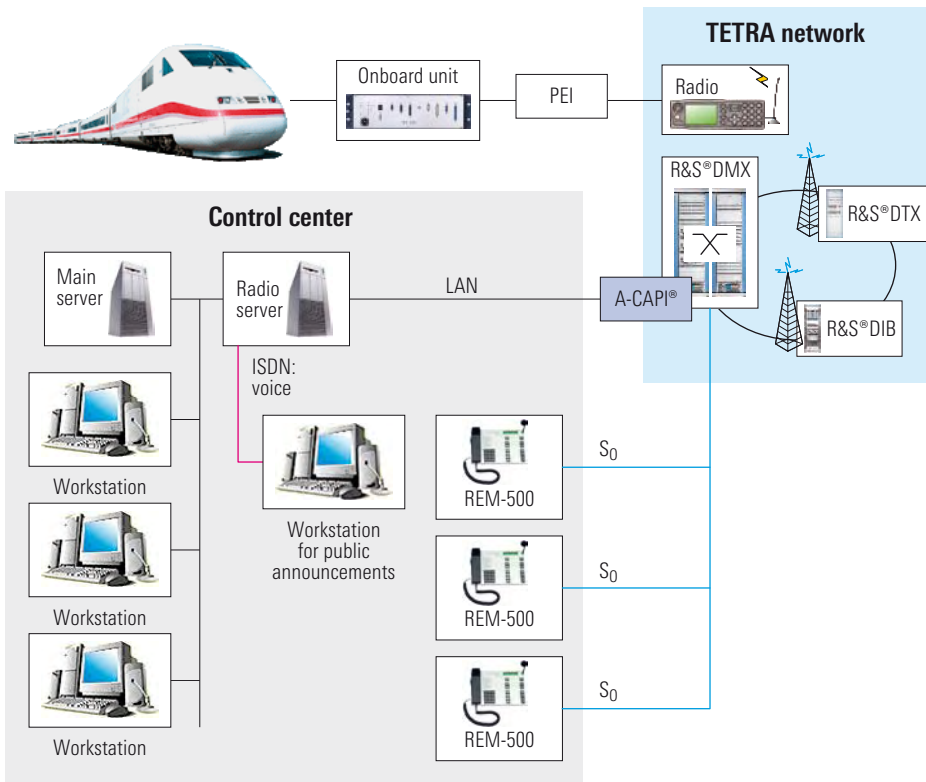


FIG 4 CSI example: railway communications system.

## A-CAPI® highlights

- ◆ A-CAPI® provides software applications with easy and comprehensive access to *ACCESSNET*®-T voice and data services
- ◆ A-CAPI® can handle software applications based on standard interfaces and protocols
- ◆ A-CAPI® supports multiple applications simultaneously
- ◆ A-CAPI® provides an effective mechanism for monitoring the connection between an application and the TETRA mobile radio network and blocks unauthorized access
- ◆ A-CAPI® conceals TETRA-specific and internal system characteristics, thus reducing the load on applications and enabling cost-effective solutions
- ◆ A-CAPI® ensures that the TETRA radio network and external applications remain isolated from one another and clearly defines responsibilities for functions and their reliable operation

## Comprehensive development support

To make the development of applications easier, Rohde & Schwarz offers a test bed that emulates A-CAPI® application services as well as the mobile radio network connected to the interface. Moreover, we offer qualified support for integration tests. The services made available by A-CAPI® are undoubtedly complex. Rohde & Schwarz, therefore, offers a comprehensive support program to help you implement your application. In addition to phone and e-mail support, we provide training courses, from introductory to advanced levels.

## A-TAPP® technical support program

To complement its intelligent and versatile A-CAPI® application platform, Rohde & Schwarz offers the *ACCESSNET*®-T Application Partner Program (A-TAPP®). This program includes various options that allow customers either to work with their regular partners to develop applications or to call on qualified and certified Rohde & Schwarz partners.

Max Zerbst

## Abbreviations

NEM	Network element manager
NMS	Network management system: handles subscriber management, network configuration, data acquisition, service and maintenance in <i>ACCESSNET</i> ®-T systems
PEI	Peripheral equipment interface: application interface on TETRA terminal (ETS 300 392-5)
SCADA	Supervisory control and data acquisition: control and process visualization systems that perform a variety of tasks related to visualization, control and integration of technical systems
SNMP	Simple network management protocol





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FIG 1 The R&S®CMU 300 now allows RF parameter tests to be combined with layer 1 signaling processes.

The R&S®CMU 300 (FIG 1) now includes a new signaling test mode that combines RF parameter tests with layer 1 signaling processes. Time-critical base station parameters can be thoroughly tested under realistic, dynamic conditions.

## Universal Radio Communication Tester R&S®CMU 300 HSDPA measurement solution with realtime functions

### When timing is critical

Classic base station measurements – as performed by the R&S®CMU 300 in the tried-and-tested non-signaling test mode – statically measure whether essential base station (BTS) parameters meet technical specifications. However, increasing data throughput rates, such as with HSDPA, mean that mobile radio links must be adapted to available radio channel resources at even shorter intervals. As a result, the time aspect of RF measurements is gaining greater significance. This calls for supplementary tests

that check whether all channel parameters are optimally set at the right time.

The R&S®CMU 300 meets these requirements by testing base stations under realistic, dynamic conditions. The tester now includes a new signaling test mode that combines RF parameter tests with layer 1 signaling processes, the first time any compact tester has offered this functionality. The new test mode provides measurement functions that were previously impossible to implement or that required significant technical effort to do so. The R&S®CMU 300 synchro-



nizes to the cell channels (CPICH, BCH) of the base station. An RF connection is sufficient; complex base station trigger interfaces are not required (FIG 2).

The R&S®CMU300 includes a realtime receiver with FEC, a TX tester and a generator and offers the following measurement functions at the best price/performance ratio ever achieved:

- ◆ Time-synchronous TX measurements for monitoring critical moments when switching between radio channel parameters (also for HSDPA)
- ◆ Special triggers for synchronizing external measuring instruments as well as the above TX measurements (also for HSDPA)
- ◆ Data analysis and decoding of DL channels (BCH, transport channels including HSDPA)
- ◆ Realtime code domain power measurement
- ◆ Analysis of bit and block error ratios of RMC (BER and BLER)
- ◆ Random access channel (RACH) preamble tests (including monitoring and evaluation of the acquisition indicator channel (AICH)) as stress test for base stations

and especially for HSDPA:

- ◆ Monitoring of max. four HS-SCCHs (from a user-defined set of up to 128 UEs)
- ◆ Throughput measurements
- ◆ Uplink stimulation for HS-DPCCH
- ◆ “Stimulate & Check” tests

## New functionalities in detail

### Expanded TX measurements

The TX measurements based on the 3GPP specification TS25.141 (FDD) in the non-signaling test mode [1] are now also available in the signaling test mode:

#### Power

- ◆ Power meter (broadband or frequency-selective)
- ◆ Code domain power (CDP)

#### Modulation

- ◆ Error vector magnitude (EVM) including magnitude error / phase error
- ◆ Carrier frequency error
- ◆ I/Q origin offset
- ◆ I/Q imbalance
- ◆ Waveform quality
- ◆ Peak code domain error power (PCDEP)

#### Spectrum

- ◆ Adjacent channel leakage power ratio (ACLR)
- ◆ Occupied bandwidth (OBW)
- ◆ Spectrum emission mask (SEM)

An automatic channel-search function is now available and facilitates code domain power and modulation measurements in the non-signaling and signaling

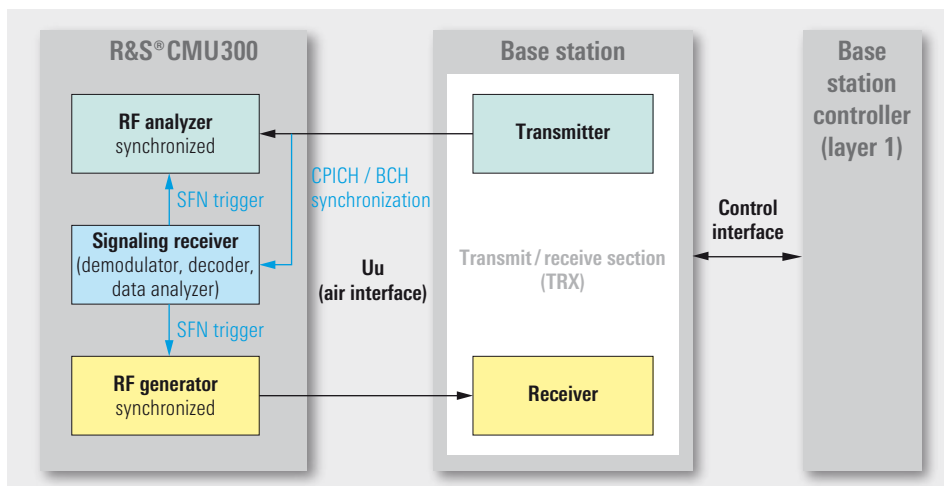
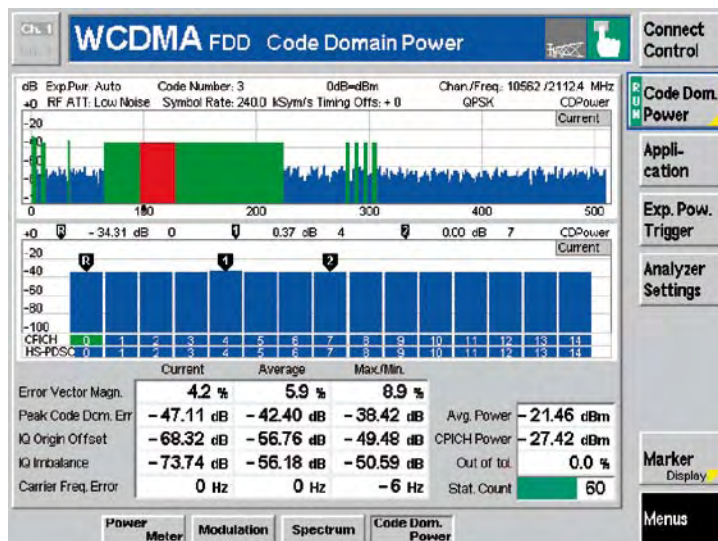


FIG 2 Test setup with the R&S®CMU300 and a base station in signaling test mode.

FIG 3 Code domain power measurement with user-defined, static channel combination (four HS-SCCHs, five HS-PDSCHs).



- ▶ test mode. With this automatic function, you can easily perform measurements in user-defined channel configurations in addition to the channels specified in the 3GPP TS 25.141 FDD R5 test models.

Also, the HSDPA channels can now be configured in the non-signaling and signaling test mode (FIG 3). In the signaling test mode, you can start all measurements at defined times without external triggering.

### Trigger

You can trigger time-synchronous measurements as follows:

- ◆ **Free Run** The R&S®CMU300 analyzes the RF signal to define slot timing.
- ◆ **Slot Trigger** Trigger signal at the beginning of each DL P-CPICH timeslot.
- ◆ **Frame Trigger** Trigger signal at the beginning of each DL P-CPICH frame.
- ◆ **Super Frame Trigger** Trigger signal assigned to a settable system frame number. The signal is repeated periodically. It can be set from 2 to 4096 frames.
- ◆ **HSFN Trigger** HSDPA trigger signal at the beginning of each HS-SCCH subframe.
- ◆ **UE ID Trigger** HSDPA trigger signal at the beginning of each HS-PDSCH subframe assigned to a specific UE ID.

These internally generated trigger signals are also available at an output to trigger further measuring instruments. You can fine-adjust the chip offset of the output triggers. In addition to these internal trigger signals, you can also trigger R&S®CMU300 measurements with an external signal whose edge and chip offset can be set (FIG 4).

### BER measurement

The realtime receiver in the R&S®CMU300 offers a new approach for analyzing the complete transmit section. The classic method of measuring physical parame-

ters such as modulation quality or code domain power has now been supplemented by the BER measurement. In contrast to pure RF parameter measurements, all of layer 1, including FEC, is tested.

Two different scenarios are possible:

**Separate measurement of the BTS downlink (DL) and uplink (UL).** The BTS DL signal is analyzed and a UL signal, which is evaluated by the BTS, is sent at the same time.

**Simultaneous measurement of both links (UL and DL).** The BTS sends the UL signal generated by the R&S®CMU300 back to the tester, where it is evaluated. In addition to the BER (FIG 5) and BLER, the R&S®CMU300 also calculates the DBLER.

### Realtime monitoring and DL channel logging

The R&S®CMU300 can document and decode DL channels in realtime at the data level, which makes data analysis a lot easier (FIG 6). Since coded data is also available via a COM interface, you can directly evaluate it online on an external PC. The online decoding program supports you in decoding data.

These tools make documenting and evaluating DL transport channel data an easy job. In addition, the system information blocks (SIB) sent by the base station in the BCH/P-CCPCH can be displayed, decoded online and evaluated (FIG 7).

The realtime receiver still ensures the continuous slot-wise measurement of code domain power bits and transmit power control bits (TPC bits). The time reference for all measurements can be determined from system frame numbers (SFN), which are also displayed.

### RACH preamble tests including AICH monitoring and evaluation

The RACH preamble test with subsequent AICH monitoring and evaluation is often used to simulate realistic stress scenarios for base stations, e.g. when several mobile phones register in successive access slots. During this test, up to  $2^{24}$  preambles of the RACH – a predefined repeating sequence of up to 64 preambles – are sent. You can set this sequence as needed (FIG 8). For stress tests, you can send preambles at millisecond intervals. Moreover, the R&S®CMU300 monitors and evaluates the received AICHs for correct data content and correct timing. You can further vary and refine the test conditions by adding additive white Gaussian noise (AWGN) (FIG 9).

### HS-SCCH information

The HS-SCCH monitor function can simultaneously analyze a maximum of four HSDPA DL control channels (HS-SCCH) from a user-defined set of up to 128 UEs. The R&S®CMU300 decodes each frame and lists the detected UEs in a table (FIG 10). Furthermore, it evaluates and displays the HS-SCCH control information, which also contains the modulation type (QPSK/16QAM), the size of the transport blocks or the number of HSDPA data channels assigned to a UE. The measurement can be triggered by a specific frame (HSFN) or started with a specific UE. During measurements on operating networks, most of the assigned UE IDs are not known. It is also difficult to predict them since they are assigned by a base-station specific algorithm. But the R&S®CMU300 also offers a solution to this problem: It includes a special UE ID scan mode that scans all HSDPA DL control channels for active UEs and stores the detected UE IDs in a table. This table is used for measuring the HS-SCCH information (or for measuring the HS-PDSCH throughput). ▶

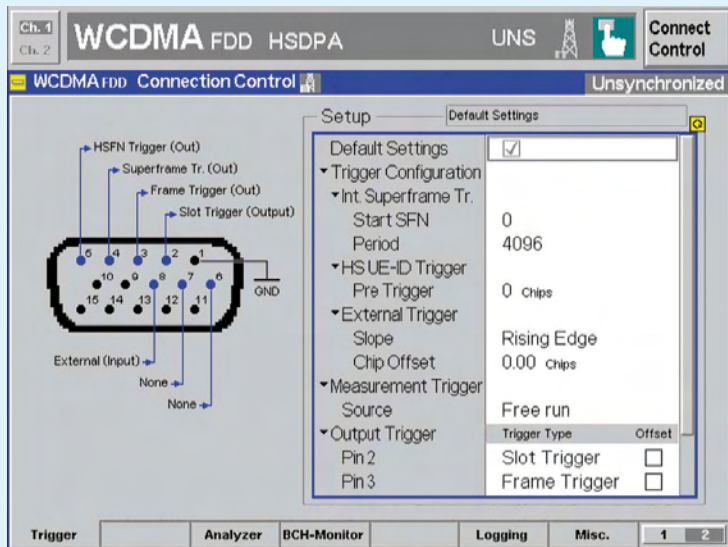


FIG 4 Trigger setup menu.

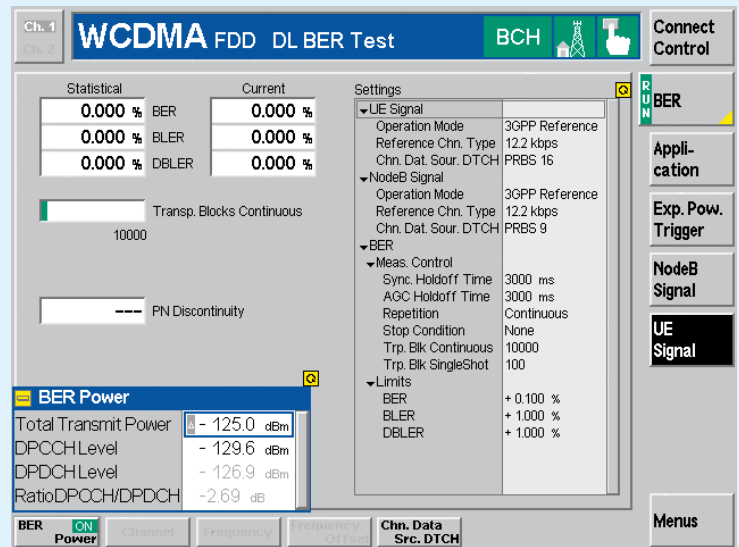


FIG 5 BER measurement.

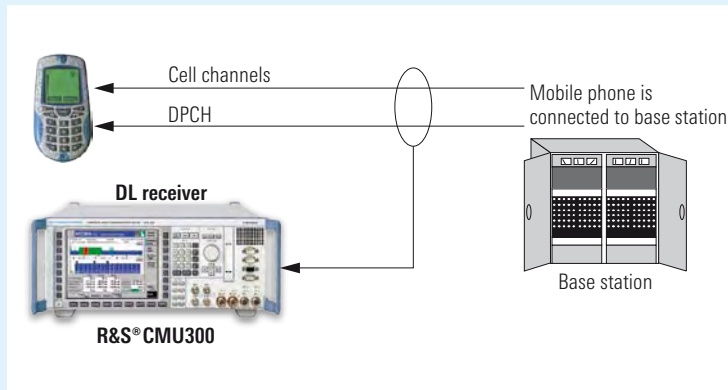


FIG 6 The R&S®CMU300 can monitor DL channels in realtime and document and decode data.

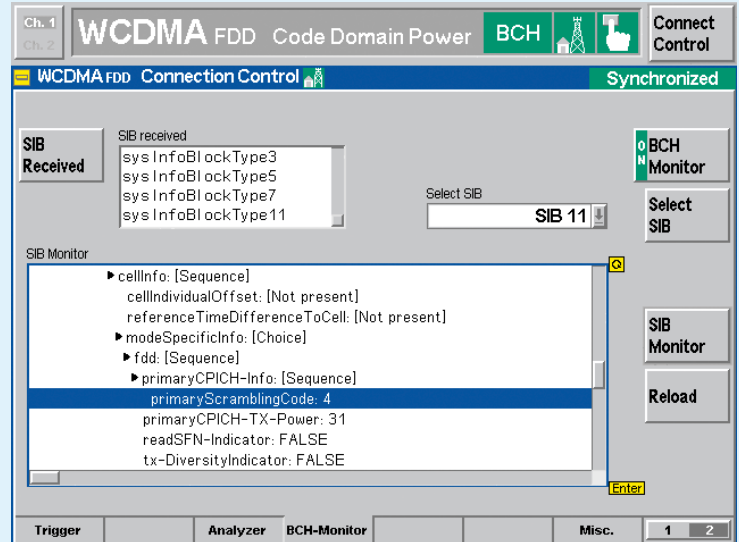


FIG 7 The system information blocks (SIB) sent by the base station in the BCH/P-CCPCH are displayed, decoded online and evaluated.

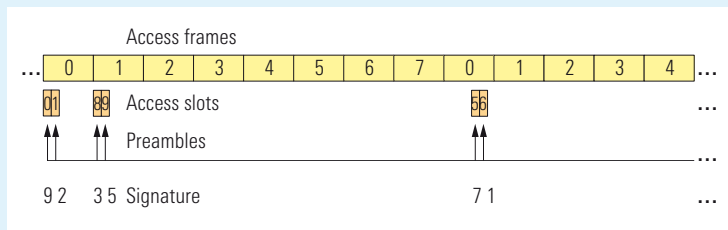
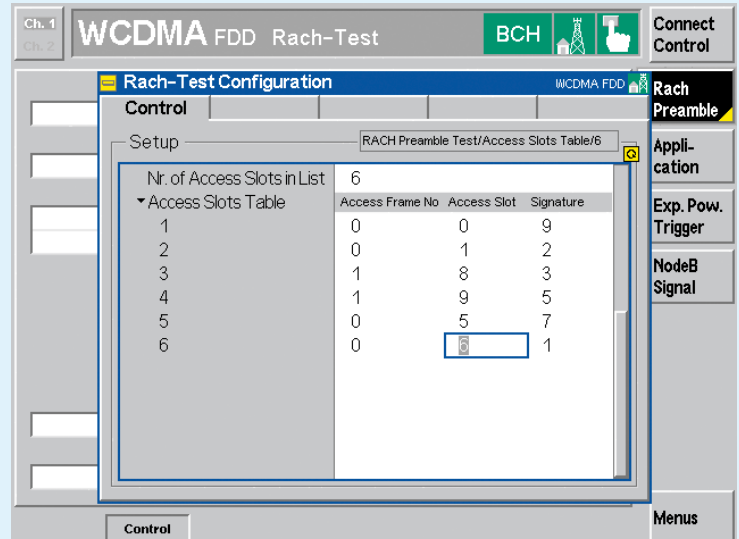


FIG 8 Example of an RACH setup.



### ► Measuring HS-PDSCH throughput

In addition to the HSDPA control channel information, the gross data rate and the effective throughput of the HSDPA DL data channels (HS-PDSCH) are particularly of interest. These two values are calculated for up to 128 UEs based on the evaluated control channel parameters. The current and average data rates, the throughput as well as the minimum and maximum values of each active UE are displayed, and the complete data rate / complete data throughput of all UEs is calculated (FIG 11). The cell data rate or the attained cell throughput is calculated very easily based on the above data. As in the HS-SCCH monitor, this measurement can also be triggered by a specific frame (HSFN) or started with a specific UE ID.

### HSDPA UL "stimulate"

The existing R&S®CMU 300 UL generator used in the non-signaling test mode [2] has been expanded in the signaling test mode to include an HSDPA UL function. In addition to the standard function (simulation of a UE by activating reference measurement channels (RMC) or physical channels), an HS-DPCCH with repeating, user-defined ACK / NACK / DTX sequences and / or sequences with channel quality information (CQI) is sent in the HSDPA UL mode. You can configure both sequences independently of each other with up to 64 values. Further user-specific parameters such as transmission time interval (TTI) as well as an independently triggered start (e.g. via HSFN / UE ID trigger) of the CQI or ACK / NACK / DTX sequences open up a variety of realistic ways to stimulate the base station (FIG 12).

### HSDPA "stimulate & check"

Another important test, which also allows the time-critical behavior of the MAC-HS to be tested dynamically, is the combination of synchronous HS-DPCCH stimulation of the base station (UL) and HS-SCCH monitoring and evaluation

(DL). This test is based on the previously described HSDPA UL generator and the DL HS-SCCH monitoring measurement in the R&S®CMU 300. By configuring a special UE ID trigger, you can simulate a realistic scenario (FIG 13): If the R&S®CMU 300 receives a special UE ID, it sends one element of the user-defined ACK / NACK / DTX sequence to the base station (UL stimulation). You can check the response of the base station (DL check) by using the HS-SCCH monitor.

## Summary

The R&S®CMU 300 provides a variety of base station tests. The classic test mode for fast and cost-efficient large-scale tests is the non-signaling mode with vector analysis and signal generator functions. The new signaling test mode functions offer a variety of analysis capabilities for characterizing base stations and thus optimizing networks. Since trigger interfaces are no longer required, the test setup is much easier – a true benefit in production and nano base station

tests. The new HSDPA measurements also make the R&S®CMU 300 a popular measuring instrument for testing complex scenarios and for launching HSDPA. A single-box solution featuring such a wide a scope of functions at such an impressive price / performance ratio has never been offered before – making the R&S®CMU 300 truly unique.

Anne Stephan, Daniel Hank

More information and data sheet at  
[www.rohde-schwarz.com](http://www.rohde-schwarz.com)  
 (search term: CMU300)

#### REFERENCES

- [1] Universal Radio Communication Tester R&S®CMU 300: Fast transmitter and receiver measurements on WCDMA base stations. News from Rohde & Schwarz (2003) No. 178, pp 25–27
- [2] Universal Radio Communication Tester R&S®CMU 300: WCDMA generator for tests on 3GPP base station receivers. News from Rohde & Schwarz (2002) No. 176, pp 17–20



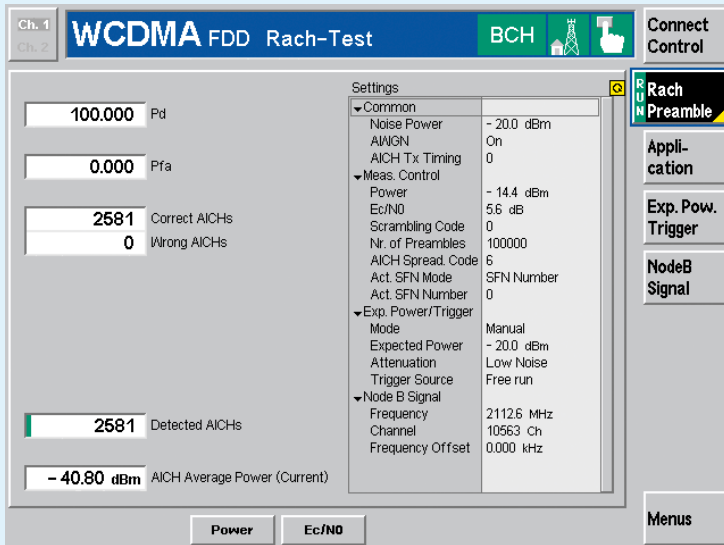


FIG 9 RACH preamble test with AICH monitoring and evaluation. The test conditions can additionally be varied and refined by adding additive white Gaussian noise (AWGN).

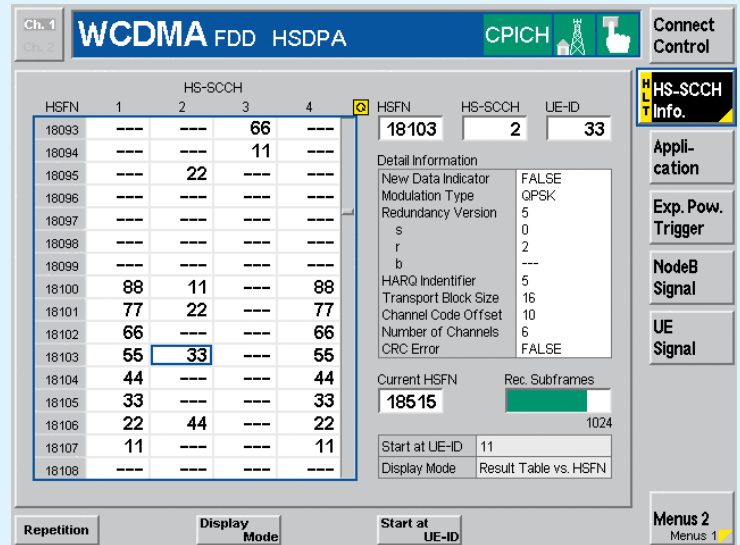


FIG 10 HS-SCCH information and HSDPA control channel information.

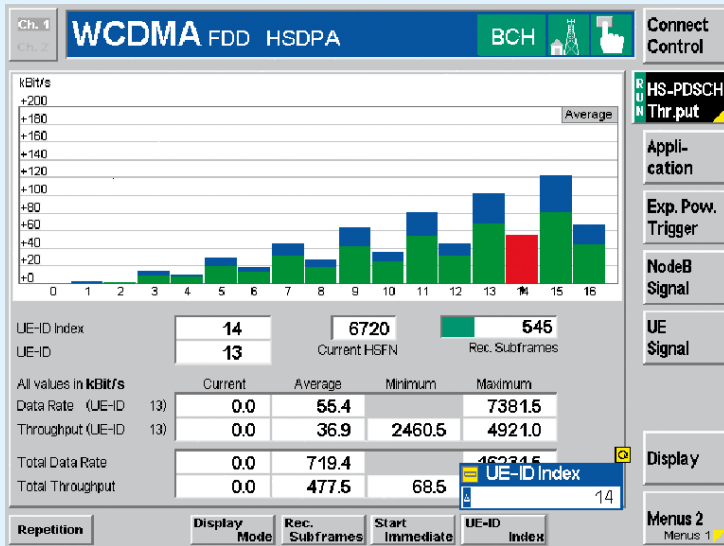


FIG 11 The throughput measurement provides information on cell throughput.

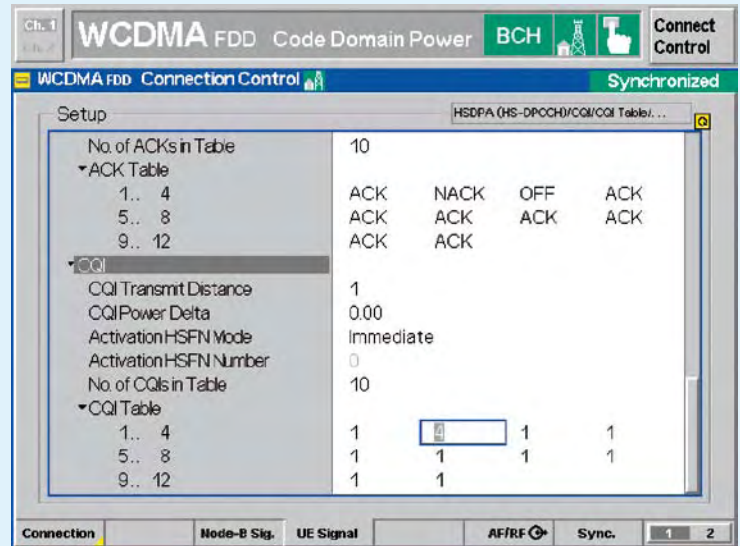


FIG 12 HSDPA UL generator.

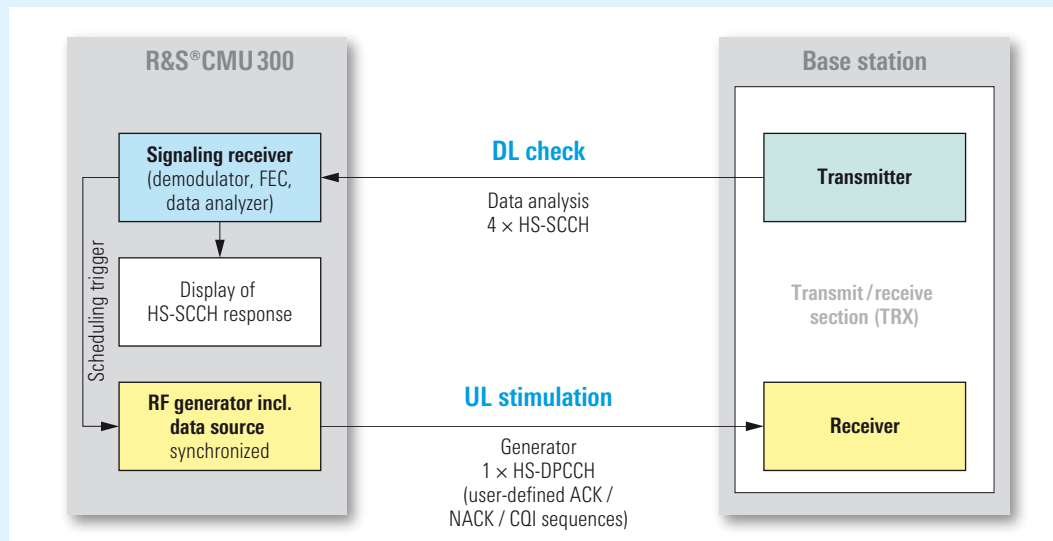


FIG 13 R&S CMU 300 test setup for HSDPA UL stimulation and DL check.

## Universal Radio Communication Tester R&S®CMU 200

# Cost-efficient models for service and production

**Due to its versatility and measurement speed together with high measurement accuracy, the Universal Radio Communication Tester R&S®CMU 200 is equally valued in production, development and quality assurance. However, cost considerations may outweigh the need for high versatility or high measurement speed in some cases. We have therefore designed two new R&S®CMU 200 models for meeting the requirements of high-end service or board-level testing/adjusting. They can be manufactured cost-efficiently and offered at a very favorable price.**

### R&S®CMU200V10 high-end service tester

A mobile radio tester for use in service must be ideal for numerous applications. In addition to general RF measurements, it must be able to handle all relevant mobile radio standards such as GSM, WCDMA and CDMA2000®. The price of a measuring instrument is the main consideration in service applications, which have lower measurement speed requirements than production applications. The new R&S®CMU 200V10 has been designed for use in service and comes equipped with all relevant software packages for measurements or signaling in line with GSM, GPRS, EGPRS, WCDMA and CDMA2000® standards. You only need the corresponding signaling module (FIG 1) to enable the functions. All other relevant measurement and generator functions are also available, of course. The setting and measurement speed is slightly lower compared to the standard R&S®CMU 200, and product-specific options cannot be installed. The high-end service tester can be equipped with the R&S®CMU-B52 and R&S®CMU-B41 options which provide comprehensive audio tests. It thus includes all required standard-specific measurement functions required for service, e.g. various power and spectrum measurements as well as BER and BLER measurements. All standard-specific signaling functions such as call setup and call release, channel and power change, handover within a standard or between WCDMA and GSM are available. The measurement and signaling functions in the R&S®CMU 200V10 are identical to those in the standard R&S®CMU 200 model provided that it is equipped with the corresponding

options. The new service tester is the ideal choice when you need extensive functionality at a favorable price.

### R&S®CMU200V30 non-signaling production tester

Signaling functionality is often not required for board-level testing or adjusting in production, where measurement speed and high measurement accuracy are the decisive factors. The new R&S®CMU 200V30 offers the high measurement and setting speed of the standard R&S®CMU 200 model. Even without options installed, it provides all GSM, WCDMA, CDMA, and 1xEVDO non-signaling transmitter measurements as well as general measurements. All production-specific transmitter measurements such as Smart Alignment (R&S®CMU-K47) and I/Q versus Slot (R&S®CMU-K48) are included. Also, an FM stereo transmitter (R&S®CMU-K14) is part of the basic version. The generator end supports CW, AM, SSB, FM and GSM (without channel coding) as standard. Channel-coded GSM, WCDMA, CDMA and 1xEVDO generator signals can be generated by means of the R&S®CMU-B21, -B68, -B83 and -B88 options (FIG 2). You can perform BER measurements on receiver modules with generator signals if a corresponding evaluation function is implemented in the modules. This method is often called single-ended BER measurement. If the receiver modules do not have any evaluation functions, you can also configure the R&S®CMU 200V30 to perform BER measurements in the GSM and WCDMA standards by installing the R&S®CMU-B21 option. The R&S®CMU 200V30 is equipped with the

R&S®CMU-B99 option as standard. As it has two identical RF connectors, this option is ideal for use in production. You can test a mobile phone at one connector while the next mobile phone is being adapted at the second connector. The R&S®CMU 200V30 offers the standard-specific measurement and generator functions required for all board-level tests, e.g. various power, spectrum and modulation measurements as well as single-ended BER measurements at high speed. The new tester is the ideal solution if high measurement speed or fast adjustment at the board level is required at a favorable price.

## Summary

Since the R&S®CMU 200V10 and R&S®CMU 200V30 have been designed for specific uses, production processes can be optimized. You can thus benefit from an even further enhancement of the already excellent price/performance ratio of the Universal Radio Communication Tester R&S®CMU 200 – at the same high measurement quality.

Rudolf Schindlmeier

More information and data sheets at  
[www.rohde-schwarz.com](http://www.rohde-schwarz.com)  
 (search term: CMU 200)

FIG 1 Measurement options with the R&S®CMU 200V10.



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	General RF tests	GSM (GPRS / EGPRS)	WCDMA	CDMA2000®
Transmitter measurements	✓	✓	✓	R&S®CMU-B83 required
Generator without channel coding	✓	✓	–	–
Generator with channel coding (single-ended BER)	–	R&S®CMU-B21 required	R&S®CMU-B68 required	R&S®CMU-B83 required
Signaling and receiver measurements	–	R&S®CMU-B21 required	R&S®CMU-B21 / -B56 / -B68 required	R&S®CMU-B83 required

FIG 2 Measurement options with the R&S®CMU 200V30.



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	General RF tests	GSM (GMSK / 8PSK)	WCDMA	CDMA2000®	1xEVDO
Transmitter measurements	✓	✓	✓	✓	✓
Generator without channel coding	✓	✓	–	–	–
Generator with channel coding (single-ended BER)	–	R&S®CMU-B21 required	R&S®CMU-B68 required	R&S®CMU-B83 required	R&S®CMU-B83 / -B88 required
BER evaluation in the R&S®CMU 200	–	R&S®CMU-B21 required	R&S®CMU-B21 / -B68 required	–	–



FIG 1 The R&S®SMx signal generators (e.g. the R&S®SMU200A, bottom in figure) are the world's first generators to supply all signals for the TD-SCDMA mobile radio standard. Options for this standard are also available for the R&S®FSQ (top), R&S®FSU and R&S®FSP analyzers from Rohde & Schwarz.

### Signal Generators R&S® SMx

## The world's first integrated signal generator solution for TD-SCDMA

**Unrivaled: The new TD-SCDMA and Enhanced TD-SCDMA options (R&S®SMx-K50 and R&S®SMx-K51) make the signal generators of the R&S®SMx family (FIG 1) the first generators worldwide to provide signals in compliance with the TD-SCDMA standard.**

### The third 3G standard

TD-SCDMA (time division synchronous code division multiple access) was proposed by the IMT 2000 (International Mobile Telecommunications at 2000 MHz) specification and approved by ITU as a standard for the third mobile radio generation in addition to 3GPP FDD and CDMA2000®. TD-SCDMA was initially developed by the Chinese Academy of Telecommunications Technology in cooperation with other partners in the industry. In the meantime, TD-SCDMA has been standardized as TDD low chip rate mode within the general framework of 3GPP. The Chinese Ministry of Information Industry (MII) is about to issue licenses for the various mobile radio standards. As the Chinese approach to 3G networks, TD-SCDMA will certainly be given special consideration.

### The standard in detail

TD-SCDMA employs time division duplex (TDD), i.e. uplink and downlink traffic are transmitted on the same carrier frequency in time multiplex. A TD-SCDMA frame has a duration of 5 ms and contains seven timeslots for data transmission. Between these timeslots, three shorter timeslots are inserted for the transmission of pilot sequences for synchronization – downlink pilot time-slot (DwPTS) and uplink pilot time-slot (UpPTS) – and of a guard period (FIG 2). The assignment of the timeslots for uplink or downlink transmission is adjustable. The timeslots from slot 1 up to the switching point are dedicated to uplink traffic, slot 0 and the remaining timeslots to downlink traffic. The transmission capacity in the uplink and downlink can thus be adapted to the current data volume. For example, five



timeslots can be allocated to the downlink to enable high-speed data transmission to a number of mobile units (for browsing on the Internet, downloading e-mails, etc), and two timeslots can be allocated to the uplink, e.g. for voice communications.

Within the timeslots, a CDMA method is used (chip rate 1.28 Mchip/s) that allows up to 16 code channels with spreading factors from 1 to 16 to be transmitted simultaneously in each timeslot. At the physical layer, a data channel (DPCH) consists of data fields and fields with control information (midamble, TPC, TFCI, sync shift) (FIG 3). The modulation modes used are QPSK or 8PSK and, for high-speed channels, also 16QAM.

### Only signals of utmost quality comply with test specifications

For tests on TD-SCDMA components, mobile phones and base stations, signal generators have to meet complex and demanding requirements. Tests on multicarrier amplifiers, in particular, place exacting demands on test signals in terms of spectral purity and adjacent channel suppression.

Especially at the beginning of a development and for testing components and amplifiers, test signals are required that optimally reflect the specific standard in terms of spectral and statistical characteristics (crest factor and CCDF). For this purpose, signals at the TD-SCDMA physical layer are used. Channel-coded data contents and the simulation of real propagation conditions are as a rule not required at this stage.

The next step usually involves testing the synchronization and demodulation of the transmitted signal in the receiver. Subsequently, channel decoding down to the transport layer is tested.

### The Rohde & Schwarz analyzers also “speak” TD-SCDMA

Options for testing TD-SCDMA signals are also available for the Analyzers R&S®FSU, R&S®FSQ and R&S®FSP. The R&S®FS-K76 option is intended for base station tests; the R&S®FS-K77 option provides all measurements required for terminal equipment. All functions are available for manual as well as remote control.

Detailed information on the TD-SCDMA functionality of Rohde & Schwarz generators and analyzers is available in a flyer which can be downloaded from the Internet (search term: TD-SCDMA).



As a last step, conformance tests are performed. For these tests, receivers are subjected to blocking or interoperability measurements, for example, applying real propagation conditions (fading, AWGN) as well as interference signals (modulated or unmodulated).

### R&S®SMx generator family: a solution that meets all requirements

The new TD-SCDMA and Enhanced TD-SCDMA options (R&S®SMx-K50 and R&S®SMx-K51) provide tailor-made solutions that fully meet the above requirements on TD-SCDMA signal generation and offer a wide scope of additional functions.

The R&S®SMx-K50 option generates standard-conforming TD-SCDMA signals for up to four uplink or downlink cells, where each cell can be configured separately. The switching point between the uplink and the downlink is variable; all timeslots can be user-configured within the limits of the standard. All specified channel types are available at the physical layer (FIG 4). Parameters such as the timeslot format, spreading factor, spreading code, power and user data can be set as required in a straightforward channel table. The R&S®SMx-K50 option also allows the easy generation of multicarrier TD-SCDMA signals [1] and is thus ideal for tests on multicarrier amplifiers.

This step involves measuring the bit and block error ratios (BER and BLER), for which the signal generator must provide fully coded data and synchronization channels.



FIG 2 Structure of a TD-SCDMA frame.

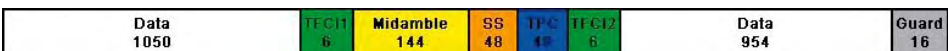


FIG 3 Typical configuration of a code channel, including data and control fields.

- The **R&S®SMx-K51 option** further expands test capabilities by adding measurement channels (reference measurement channels, 12.2 kbit/s to 2048 kbit/s) with full channel coding for the uplink and the downlink, as well as the broadcast channel (BCH) with channel coding and consecutive system frame numbers, plus all high-speed channels defined by the standard, including channel coding (H-RMC, 526 kbit/s and 730 kbit/s) (FIG 5). Bit and block errors can of course be simulated.

The flexible concept of the R&S®SMU generator family [2] allows complete tests of TD-SCDMA base stations and mobile radio units by means of a single signal generator – the tests including fading [3], the superposition of additive white noise and the simulation of a variety of interference scenarios (FIG 6).

Comprehensive graphical displays indicate the current settings and make the new options very easy to operate (frame configuration, code domain, configuration of timeslots, CCDF, FFT, etc).

## Summary

The R&S®SMx-K50 and R&S®SMx-K51 options expand the range of applications of the R&S®SMU 200A, SMATE 200A and SMJ 100A family of generators to cover all TD-SCDMA test specifications and provide tailor-made solutions for development, quality assurance and production.

Andreas Pauly

## Measurements at a glance

Spectrum measurements	R&S®SMU-K50	R&S®SMJ-K50	R&S®SMATE-K50
Single carrier	✓	✓	✓
Multicarrier with baseband	✓	✓	✓
Multicarrier with second RF in one box	✓	–	✓

Receiver measurements*	R&S®SMU-K50 and R&S®SMU-K51	R&S®SMJ-K50 and R&S®SMJ-K51	R&S®SMATE-K50 and R&S®SMATE-K51
RMC with bit error / block error insertion	✓	✓	✓
RMC with extra fading option	✓	–	–
Reference sensitivity level	✓	–	✓
Dynamic range	✓	✓	✓
Adjacent channel selectivity (ACS)	✓	✓	✓
Blocking characteristics	✓	(✓)	✓
Intermodulation characteristics	✓	(✓)	✓

\* The receiver measurements listed here are an excerpt from the 3GPP TS25.142 standard. The two-path concept implemented in the R&S®SMU / SMATE is very advantageous in most measurements because there are no problems with synchronization and no external cabling is required.

Performance measurements* (Fading measurements require an extra option)	R&S®SMU-K50 and R&S®SMU-K51	R&S®SMJ-K50 and R&S®SMJ-K51	R&S®SMATE-K50 and R&S®SMATE-K51
Demodulation under static propagation conditions	✓	(✓)	✓
Demodulation of DCH under multipath fading conditions	✓	–	–
Demodulation of DCH under moving propagation conditions	✓	–	–
Demodulation of DCH under birth / death propagation conditions	✓	–	–

\* The performance measurements listed here are an excerpt from the standard. The R&S®SMU's two-path concept with internal fading is very advantageous as it allows all of these measurements to be performed with a single generator.

State		Code Domain...		Channel Graph...							
Data	TFC1	Midamble		SS	TFC2	Data	Guard				
36	B	144		2	B	32	16				
Channel Type	Enhanced	Crt User / Mid.Shift	Slot Fmt	Spr. Fact.	Spr. Code	Power /dB	Data	DList / Pattern	DPCCH Settings	State	Do. Cfl.
0	P-CCPCH 1	Off	1/120	0 16	1	-5.00	PN 9			On	
1	P-CCPCH 2	Off	1/120	0 16	2	-7.00	PN 9			Off	
2	S-CCPCH 1		1/120	0 16	1	0.00	PN 9		Config...	Off	
3	S-CCPCH 2		1/120	0 16	1	0.00	PN 9		Config...	Off	
4	FPACH		1/120	0 16	1	0.00	PN 9			Off	
5	DPCH QPSK		1/120	0 16	1	0.00	PN 9		Config...	Off	
6	DPCH 8PSK		1/120	0 16	1	0.00	PN 9		Config...	Off	
7	HS-SCCH 1		1/120	5 16	5	-10.00	PN 9		Config...	On	
8	HS-SCCH 2		1/120	7 16	8	-15.00	PN 9		Config...	On	
9	HS-PDS.QPSK		1/120	9 16	12	-20.00	PN 9		Config...	On	
10	HS-PDS.16QAM		1/120	9 16	14	-25.00	PN 9		Config...	On	
11	DPCH QPSK		1/120	10 1	1	-65.00	PN 9		Config...	Off	
12	DPCH QPSK		1/120	0 16	1	0.00	PN 9		Config...	Off	
13	DPCH QPSK		1/120	0 16	1	0.00	PN 9		Config...	Off	

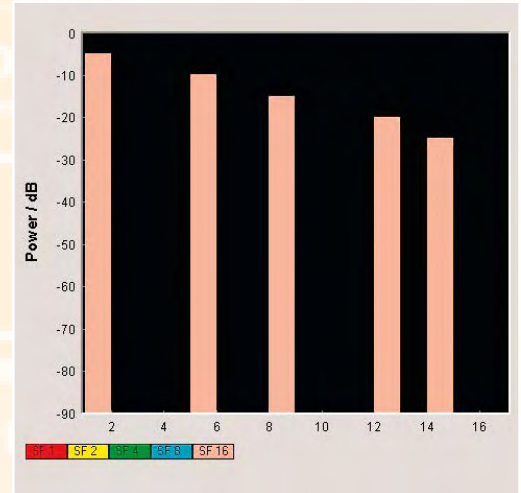


FIG 4 Channel table of a TD-SCDMA timeslot showing the configuration of the currently edited DPCH and the code domain power.

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

REFERENCES

- [1] Vector Signal Generator R&S®SMU200A: Signals for testing multicarrier power amplifiers. News from Rohde & Schwarz (2005) No. 188, pp 19–21
- [2] Vector Signal Generator R&S®SMU200A: The art of signal generation. News from Rohde & Schwarz (2003) No. 180, pp 21–27
- [3] Vector Signal Generator R&S®SMU200A: Digital fading simulator with unrivaled characteristics. News from Rohde & Schwarz (2004) No. 184, pp 16–18

Dedicated Channels (DCH)

State: On

Coding Type: RMC 384 kbps

Resource Units On Physical Layer: RMC 12.2 kbps, RMC 64 kbps, RMC 144 kbps, RMC 384 kbps

Mapping On Physical Channels: Slot 0 (On), Slot 1 (On), Slot 2 (On), Slot 3 (On), Slot 4 (On), Slot 5 (On)

Spreading Code Selection For Used DPCHs: Auto

Bit Error Insertion: State On, Bit Error Rate 0.100 000 0, Insert Errors On Transport Layer

Block Error Insertion: State On, Block Error Rate 0.100 0

FIG 5 Configuration of measurement channels and channel coding.

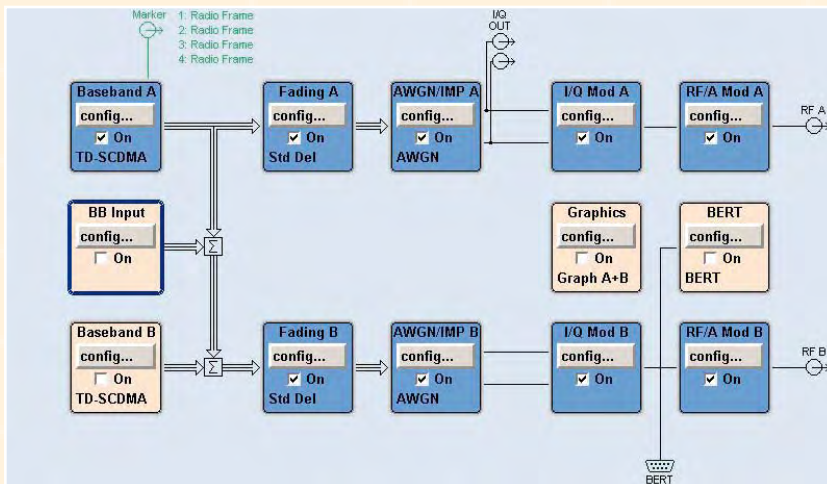


FIG 6 Typical settings on the R&S®SMU200A for a conformance test.





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## A wealth of T&M solutions for network specialists

**Every new mobile radio technology calls for specialized high-performance T&M solutions. Rohde & Schwarz keeps its eye on these dynamic advancements right from the start and offers a comprehensive portfolio of T&M solutions for manufacturers and network operators.**

### Solutions for any task

At the end of 2005, more than two billion mobile radio subscribers worldwide had at least one mobile phone. They use their phones not only for calls and SMS but, increasingly, also for broadband data services such as multimedia messaging service (MMS) or Internet via terminal. Mobile phone owners in Asia, America and Europe still differ widely in their day-to-day use of wireless data services. In Japan or Korea, for example, friends enjoy linking together for Internet gaming. Today, it no longer matters where a user lives – the main thing is that the mobile radio network works.

As a result, up to 30% of network capacity at many operators is already being taken up by Internet or MMS and SMS use. In Europe, for example, network

operators handle up to a billion SMSs per month.

This is an enormous challenge for network specialists at mobile radio providers. They must ensure that customers are satisfied with the quality of voice and data transmission at all times. The hardware and software solutions in the base stations and backbone must operate flawlessly 24 hours a day.

To meet these demanding challenges, network operators turn to the experts from Rohde & Schwarz. Our company has been providing comprehensive T&M solutions in this market since digital mobile radio was introduced in Europe more than 15 years ago. Network operators rely on Rohde & Schwarz measuring instruments at all phases, first to calibrate tools during network planning and later to perform measurements on net-



work base stations. When they need to optimize their base stations, they call on the experts from Rohde & Schwarz to provide them with T&M equipment and customized applications.

Rohde & Schwarz furnishes network operators and network equipment suppliers worldwide with T&M solutions for the GSM / GPRS / EDGE, WCDMA 3GPP and CDMA2000® standards. We also offer a complete T&M portfolio for setting up and operating mobile radio networks using WCDMA HSDPA. Network specialists can depend on us for T&M solutions in all areas (FIG 1):

- ◆ System testing at test laboratories
- ◆ Terminal testing at test laboratories
- ◆ Installation, operation and servicing of base stations
- ◆ Radio network planning and optimization

## System-testing solutions for test laboratories

Network operator laboratories must have at hand all system components they need for performing tests on new modules and software versions without affecting the existing network. The rapid evolution of standards calls for flexible measuring instruments. A good example is the compact Universal Radio Communication Tester R&S®CMU 300, which has been specially designed for system, regression and approval testing on base stations (FIG 2). This tester includes an analyzer and a generator which it uses to perform transmitter and receiver measurements for the GSM, GPRS, EDGE and UMTS standards.

Its new realtime analyzer functions make it ideal for monitoring the new high-speed control and broadcast channels in the HSDPA standard (introduced

in 3GPP release 5), as well as for monitoring the data throughput of a cell, specific to individual subscribers.

When combined with an RNC (radio network controller) simulator such as offered by Nethawk, the R&S®CMU 300 is ideal for high-level field service.

You can also use power meters and combined spectrum/signal analyzers to perform tests on transmitter units. Rohde & Schwarz offers solutions ranging from power sensors and the Handheld Spectrum Analyzer R&S®FSH 3 (FIG 5) to the portable (with optional battery pack) R&S®FSP spectrum/signal analyzer (FIG 5), whose excellent price/performance ratio makes it the industry benchmark in the mid-range class. Standard measurement routines such as channel-power measurement at the press of a button paired with the capability to demodulate both UMTS and

FIG 1 Rohde & Schwarz offers a comprehensive T&M portfolio for network operators and suppliers.

Area	Radiocommunications testers	Signal analyzers	Signal generators	Drive test systems
<b>System testing at test laboratories</b>	Base station tests: R&S®CMU 300	R&S®NRT / NRP R&S®FSH R&S®FSL / R&S®FSP R&S®FSQ R&S®TSMU	R&S®SMU 200A / R&S®SMJ 100A R&S®SML R&S®SMR	Monitoring: R&S®ROMES with R&S®TSMU
<b>Terminal testing at test laboratories</b>	Mobile phone / protocol tests: R&S®CMU 200 R&S®CRTU Power supply: R&S®NGMO	R&S®FSP	R&S®SMU 200A / SMJ 100A	Monitoring: R&S®ROMES with R&S®TSMU and test mobile phone
<b>Installation, operation and servicing of base stations</b>	Base station tests: R&S®CMU 300	R&S®NRT / R&S®NRP R&S®FSH R&S®FSL / R&S®FSP		Function tests: R&S®ROMES with R&S®TSMU and test mobile phone
<b>Radio network planning and optimization</b>	Mobile phone tests: R&S®CMU 200	R&S®ESPI R&S®TSMU R&S®FSP R&S®FSH	R&S®SMU 200A / R&S®SMJ 100A Power amplifiers	R&S®ROMES with R&S®TSMU and various test mobile phones as well as applications (speech quality, QoS, and many more)



FIG 2 The R&S®CMU200 (top) tests all mobile radio phones while the R&S®CMU300 (bottom) specializes in base stations.



FIG 3 The R&S®CRTU-W/-M platform for protocol tests.



FIG 4 The Vector Signal Generator R&S®SMU200A (top) and the high-end R&S®FSQ signal analyzer set up for measurements on a power amplifier.

▶ GSM signals make the two analyzers ideal for numerous measurement tasks involving the base station transmitter.

The future-proof high-end R&S®FSQ signal analyzer (FIG 5) with a demodulation bandwidth of up to 120 MHz for all conventional modulation modes (e.g. for the WiMAX standard) is ideal for high-end applications that push the limits of dynamic range and noise characteristics.

Vector signal generators of type R&S®SMU200A or R&S®SMJ100A are used for testing receive modules (FIGS 4 and 6). They can generate any type of standard-compliant digitally modulated signals, and you can superimpose fading, noise and other baseband errors on the signals as needed. You can easily create reference measurement channels (RMC) in accordance with specifications as well as modulated interferers using the integrated baseband generator and the intuitive operating concept.

If you need to generate unmodulated signals, e.g. for RF fading simulators or also as interferers, you can use the Signal Generator R&S®SML, which offers an outstanding price/performance ratio. The high-end R&S®FSQ signal analyzer and the Vector Signal Generator R&S®SMU200A paired with the user-friendly application software for the R&S®FSMU-W enable you to perform tests in accordance with the TS25.141 specification.

### Terminal-testing solutions for test laboratories

Rohde & Schwarz offers RF and protocol T&M solutions for tests necessary during servicing, as well as for regression, compatibility and interoperability tests. The R&S®CMU200 test platform (FIG 2) and the R&S®CRTU protocol tester (FIG 3) cover all major standards ranging from GSM, GPRS and CDMA2000® to UMTS,

HSDPA and even HSUPA. These test solutions can generate message logs as well as perform RF, handover, acoustic, and data application tests.

The Vector Signal Generators R&S®SMU200A and R&S®SMJ100A are especially useful in cell selection tests. They can generate additional passive signals for the DUT that, however, are digitally modulated in realtime and possess variable noise components.

If you need to perform precise power consumption measurements under a wide variety of conditions at high resolution and speed, the solution is the Dual-Channel Analyzer / Power Supply R&S®NGM02 (FIG 7). It is ideal for tasks such as determining operating time and performing battery tests on mobile phones. You can also use it to optimize application software such as Java applets, since every access of the SIM card increases the current, thus reducing operating time.





## T&M solutions for base station installation, operation and servicing

The most vulnerable part of a base station is the antenna system on the mast, including its dipole, RF cable and amplifier. The system must withstand humidity, wide temperature fluctuations and electrostatic discharges, which clearly explains why approx. 75 % of all measurements in the field focus on determining the transmit and receive characteristics of antenna systems.

Since the introduction of cross-polarized antennas, the matching measurements commonly used to obtain information about an antenna system's operating state have become less significant. Today, decoupling and cable fault measurements are also required. The Handheld Spectrum Analyzer R&S®FSH (FIG 8) has been specially designed for this purpose. No matter whether an antenna system is equipped with or without a mast amplifier, the R&S®FSH can very

accurately measure and document the return loss, cable faults and decoupling. In addition, the analyzer can measure the spectrum, which provides valuable information about any interferers in the uplink or downlink.

The compact R&S®FSH with its new code domain power measurement function and its favorable price/performance ratio can handle almost any measurement task in field service. In addition, new instruments purchased as of late 2005 can also be equipped with the new R&S®FSH-K4 option, which analyzes the power and modulation quality of the major downlink channels (CPICH, P-CCPCH and SCH).

The newest R&S®FSL spectrum analyzer – which can also be battery-operated and features RF characteristics unique in its class – is making a name for itself in field service. It is used to locate noise sources (e.g. defective mast amplifiers) and any type of interference signal.

In contrast, measurement tasks on base station transmitters that involve the complete analysis of all code channels have become significantly less common in practice and call for an analyzer with additional decoding capabilities. The perfect tool for these tasks is the mid-range R&S®FSP spectrum/signal analyzer, which can measure modulation quality and code domain power in battery operation.

Users who provide high-level service are also increasingly turning to the Universal Radio Communication Tester R&S®CMU300, combined with an external RNC simulator or Node B configurator such as Nethawk.

Hands-on experience has revealed that the various measuring instruments are used quite differently in the field:

**FIG 5** The full range of analyzers from Rohde & Schwarz covers virtually every requirement for performance level, frequency range and functionality. Left to right: R&S®FSQ (top), R&S®FSU, R&S®FSP, R&S®FSH3.



**FIG 6** The multipurpose Vector Signal Generator R&S®SMJ100A is redefining the medium range.



**FIG 7** The intelligent Dual-Channel Analyzer / Power Supply R&S®NGM02 offers a variety of functions, making it a must for network specialists.



**FIG 8** The R&S®FSH3, the do-it-all solution for measurements required during installation and on-site maintenance, used for measuring a mobile radio antenna.

- ▶ ◆ 85 % Handheld Spectrum Analyzer R&S®FSH, especially for antenna and TX tests
- ◆ 10 % battery-powered mid-range R&S®FSL / R&S®FSP spectrum/signal analyzers
- ◆ 5 % Universal Radio Communication Tester R&S®CMU 300

Using different units for different tasks makes T&M budget planning easy and efficient.

## Mobile radio from A to Z – a long tradition at Rohde & Schwarz

Rohde & Schwarz entered the field of digital communications T&M in 1990 when it introduced the first base station tester for mobile radio. It has been a leading player ever since. Customers in the US, Asia and Europe turn to Rohde & Schwarz for T&M solutions covering established cellular technologies such as GSM / GPRS / EDGE, WCDMA FDD (UMTS), HSDPA and CDMA2000®. In addition to coverage measurement solutions for WCDMA HSDPA – scheduled for launch in summer 2006 – Rohde & Schwarz already offers a comprehensive T&M portfolio for signal generation, signal analysis, radiocommunications tests and protocol tests. The T&M solutions for 1xEV-DO are being expanded so that they will also be available for Release A in fall 2006.

Users working on broadband wireless solutions such as WiMAX (IEEE 802.16-2004, IEEE 802.16b) and WiBro also rely on T&M equipment and applications from Rohde & Schwarz. Moreover, Rohde & Schwarz provides measuring equipment to the terminal and base station design engineers as well as network operators who will turn DVB-H into a market force as a mobile broadcast technology together with its corresponding applications.

## T&M solutions for radio network planning and optimization

The rapidly growing number of subscribers calls for ever denser radio networks. To optimize radio network planning and simulation, calculations are more and more often based on real measurement data. Radio network planners know that planning tools can only be as good as the quality of the data available for complex calculations.

Continuous wave (CW) measurements are used to calibrate planning tools. During these measurements, the Vector Signal Generator R&S®SMJ 100 A, R&S®SMU 200 A or Signal Generator R&S®SML generates partly unmodulated signals that are applied to the antenna systems via a measurement amplifier. Highly precise and fast test receivers such as the Radio Network Analyzer R&S®TSMU (FIG 9) or the precompliance Test Receiver R&S®ESPI – together with Coverage Measurement Software R&S®ROMES – measure these signals and provide realistic information about the path loss in the relevant frequency range.

Since the R&S®TSMU is continuously being enhanced, it can decode and measure downlink control channels at unrivaled speed without having to register on the network. This function is the main precondition for fast neighborhood analysis when optimizing handover procedures. This measurement data enables you to proactively analyze interference in critical areas even in the planning phase.

The R&S®TSMU, which is configured as a GSM scanner, supplies a variety of parameters together with Coverage Measurement Software R&S®ROMES and a GPS receiver: position data, channel number (GSM), level, cell identity, network and country code – all 10 to 20 times faster than with conventional test mobile phones.

In addition, you can use the R&S®TSMU to analyze co-channel or adjacent-channel interferers in realtime during the drive test by implementing the latest version of Coverage Measurement Software R&S®ROMES, a GSM test mobile phone and a list of base stations.

Radio networks are optimized by using analyzers that determine network quality from the customer's point of view when combined with test mobile phones. The Radio Network Analyzer R&S®TSMU has become the benchmark for many network operators. In addition to the 2G and 3G standards implemented earlier, the R&S®TSMU now also offers CDMA2000®.

Why do you need the R&S®TSMU in addition to the test mobile phone? To yield meaningful results, measurements must be performed at high speeds. The R&S®TSMU performs measurements approx. 30 times faster than a test mobile phone. Furthermore, high sensitivity and dynamic range are critical to





detecting and analyzing possible weak points such as:

- ◆ Interferences (frequency reuse analysis)
- ◆ Interferers
- ◆ Incorrectly adjusted antennas (alignment, tilt)
- ◆ Reversed sectors
- ◆ Problems in parameterization, e.g. during handover
- ◆ HSDPA, ACK/NACK and CQI analysis in relation to the received quality of the radio channel

Coverage Measurement Software R&S®ROMES enables you to perform measurements in several different cellular networks during a drive test, e.g. in HSDPA, 1xEV-Do and GSM networks. Moreover, you can perform them simultaneously if you preconfigure the software for the specific standard needed. R&S®ROMES is the core component in a variety of solutions ranging from a portable system in a backpack for indoor applications and a test-kit system up to the configurable system installed in the test vehicle. Depending on the hard-

**FIG 9** The Radio Network Analyzer R&S®TSMU running Coverage Measurement Software R&S®ROMES during network performance analysis.



ware used, the software supports various radio standards such as WLAN, GSM, EDGE, GPRS, UMTS, HSDPA, and CDMA2000®, as well as analog and digital broadcasting standards such as DAB and DVB.

Detecting and analyzing weak points in the network, as well as points to be optimized, is the main focus of the coverage measurement solutions from Rohde & Schwarz. If you need to analyze and process the results further, you can directly upload them to analysis or processing platforms from various manufacturers. By using the export capability, you can output the results as an ASCII file and also import them into customer-specific evaluation solutions and planning tools.

To fully meet customer-specific requirements, Rohde & Schwarz is continuously enhancing Coverage Measurement Software R&S®ROMES by working closely with leading network operators. In GSM, one of the main focal points is interference analysis of broadcast and data channels. Network operators have already been using this measurement solution for several years to improve network quality despite limited frequency resources.

In UMTS, the primary challenges are encountered in neighborhood and handover analysis. Rohde & Schwarz has optimized this analysis by adding the new BCH demodulator measurement function to the R&S®TSMU. Coverage Measurement Software R&S®ROMES automatically compares the base station list with the data of the test mobile phone. The high-performance R&S®TSMU enormously speeds up the measurement due to its several thousand software rake fingers.

R&S®ROMES includes a data quality analyzer (DQA) module for evaluating and analyzing data applications.

The module supports up to five mobile phones in parallel and records their data. It automatically generates statistics of measured services, which are based on set parameters and specifications.

Test mobile phones must be tested and verified at regular intervals. This is an easy job for the Universal Radio Communication Tester R&S®CMU 200, whose high ACLR measurement accuracy enables it to meet the demanding power-control measurement requirements.

Coverage measurement systems from Rohde & Schwarz are especially valued for their ability to detect and analyze irregularities in the network, tasks that cannot be handled by the fixed network monitoring systems in the operation & maintenance center (OMC) or the radio network controller (RNC).

Marcus J. Donhauser; Christian Müller

**More information, data sheets and application notes at [www.rohde-schwarz.com](http://www.rohde-schwarz.com)**

**Selected application notes**

- 1CM60 Optimization of HSDPA networks with the R&S®CMU 300 and R&S®ROMES
- 1CM56 3GPP base station test measurements
- 1EF44 Measurement on 3GPP Base Station Transmitter Signals
- 1EF52 Testing Mobile Radio Antenna Systems with the R&S®FSH3
- 1MA40 Testing Power Amplifiers for 3G Base Stations
- 1MA48 Generating and Analyzing 3GPP Multicarrier Signals with High Dynamic Range
- 1MA62 Remote Setup for 3G High Dynamic Multicarrier Signals with R&S®SMIQ03 HD and R&S®FSU/FSQ
- 1MA67 Tests on 3GPP WCDMA FDD Node Bs in accordance with Standard TS25.141
- 1MA82 HSDPA Test and Measurement Requirements
- 1MA84 HSDPA – Challenges for UE Power Amplifier Design



FIG 1 Vector Network Analyzer R&S®ZVT 8 – the world's first eight-port analyzer.

## Vector Network Analyzer R&S®ZVT 8

# Unrivaled – up to eight test ports in a single unit

Commercially available network analyzers offer two, three or four test ports, which are not always enough to provide complete characterization of components and modules. The new Vector Network Analyzer R&S®ZVT 8 does away with this limitation – it offers up to eight test ports in a single

unit.

### Identical platform yields analyzer compatibility

The R&S®ZVT 8 is based on the same instrument platform as the R&S®ZVA and R&S®ZVB network analyzers. This means that the user interface and remote control commands are identical for the three instruments. Compatibility of the analyzer models enables identical instrument settings and provides comparable results. For example, the results from an R&S®ZVA in development can be compared to those yielded by an R&S®ZVB or an R&S®ZVT 8 in production.

The R&S®ZVT 8 has been optimized for production applications and is therefore supplied without a display. Yet it can be used for R&D applications as well. You merely need to connect a display, mouse

and keyboard to the analyzer, and it can be manually operated like the other units (FIG 1).

### Customized solutions due to modular design

The R&S®ZVT 8 base model comes with two test ports. Further test ports can be added (FIG 2). Due to its modular design, the analyzer can be accurately scaled to a specific test application, which is of particular interest in production. You can buy exactly the number of ports you need. If you ever need more, for example to test new devices, you can add new ones up to a maximum configuration of eight.

## Options for complex test setups

The R&S®ZVT8 can be equipped with options for direct generator and receiver access, e.g. for complex test setups including external components such as couplers or amplifiers (FIG 3). Options enabling time domain analysis and measurements on frequency-converting DUTs further enhance analyzer functionality.

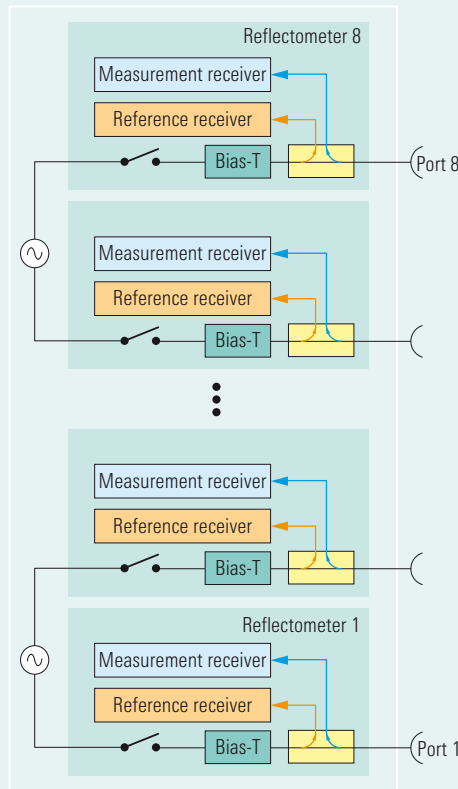
## Automatic eight-port calibration unit

The R&S®ZVT8 is the only network analyzer to offer full eight-port calibration. This is done with the automatic Calibration Unit R&S®ZV-Z58 (FIG 4), which is controlled by the R&S®ZVT8. Full eight-port calibration is necessary in order to extract S-parameter data in s8p format. It also enables all 64 S-parameters from  $s_{11}$  to  $s_{88}$  to be analyzed simultaneously, and thus for the first time allows the full characterization of components with five to eight test ports. While manual calibration is also possible, automatic calibration will save considerable time.

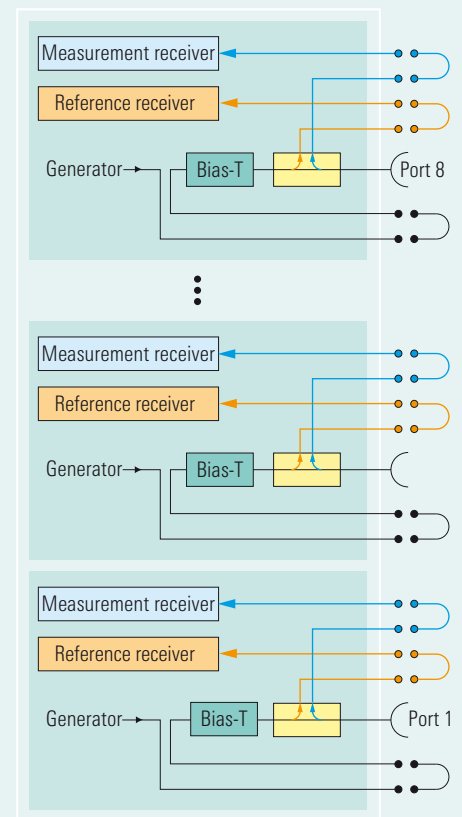
## Parallel measurements save time

Each internal generator is connected to two test ports either in parallel or sequentially (FIG 2). If the test ports are connected in parallel, several DUTs can be measured simultaneously in realtime, since each test port is equipped with a separate measurement receiver and reference receiver.

The R&S®ZVT8 eight-port model, for example, can simultaneously measure two four-port DUTs, or four two-port DUTs, or eight one-port DUTs. This means that throughput in production can be quadrupled, for instance, by measuring four two-port DUTs in parallel. ▶



**FIG 2**  
Block diagram of the R&S®ZVT8.



**FIG 3**  
The R&S®ZVT8 with optional direct generator/  
receiver access.

**FIG 4** Automatic Calibration Unit R&S®ZV-Z58.



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### ► Mixer measurements without an external generator

The R&S®ZVT8 hardware concept enables mixer measurements without requiring an external generator to supply the LO signal. Mixer measurements require two generators. The R&S®ZVT8 three-port model already features two internal generators. Especially in the case of swept LO signals, internal generators are considerably faster than externally controlled sources.

### Intermodulation measurements on amplifiers and mixers

Intermodulation measurements on amplifiers usually require two generators, whose signals are combined in a two-tone signal, which is taken to the amplifier. If equipped with three or more ports, the R&S®ZVT8 carries out intermodulation measurements on amplifiers without an external generator. Intermodulation measurements on mixers necessitate a third generator to supply the LO signal for the mixer. The R&S®ZVT8 is the only network analyzer to offer three or more internal sources (starting from the five-port model). It is thus capable of performing intermodulation measurements on mixers without the need for an external generator (FIGs 5 and 6).

### Multipoint measurements

The trend toward integrating components into modules is leading to a greater demand for module tests – for example with antenna switching modules for mobile radio applications. The R&S®ZVT8 performs tests on such modules quickly and easily. FIG 7 shows a test setup for measuring such a module, with the analyzer directly controlling the internal DUT switch. Current measurements can be performed at the same time via the DC inputs on the R&S®ZVT8.

Another application of the R&S®ZVT8 involves the testing of switches equipped, for example, with one input and multiple outputs. Using the Direct Generator / Receiver Access options (R&S®ZVT-B16), the R&S®ZVT8 can even capture signals separately by means of all its measurement and reference receivers – i.e. up to sixteen in the case of the R&S®ZVT8 eight-port model.

For example, if a switch has one input and eight outputs, one port of the analyzer is connected to the input of the switch and six further ports to six outputs of the switch (FIG 8). Outputs seven and eight are directly connected to the

measurement and reference receiver inputs of port 8, which is fitted with the R&S®ZVT-B16 option. The eight receivers of a four-port analyzer can also be used for directly measuring wave quantities.

Technologies such as smart antennas and MIMO (multiple input, multiple output) are increasingly being used in mobile radio and other wireless communications systems such as WLAN. All these technologies open up new fields of application for multipoint measurements, for which the R&S®ZVT8 is the ideal choice.

Andreas Henkel

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

#### Condensed data of the R&S®ZVT8

Number of test ports	2 to 8
Frequency range	300 kHz to 8 GHz
Measurement time per point	<3.5 µs
Measurement time (201 points)	4.5 ms
Data transfer time (201 points)	
Via IEC/IEEE bus	<2.9 ms
Via VX11 (LAN at 100 Mbit/s)	<1.3 ms
Via RSIB (LAN at 100 Mbit/s)	<0.7 ms
Switching time between channels	<1 ms
between instrument setups	<10 ms
Dynamic range at 10 Hz measurement bandwidth	
between test ports	>120 dB, typ. 130 dB
Output level at test port	>+13 dBm, typ. +15 dBm
Level sweep range	>40 dB, typ. 50 dB
IF bandwidths	1 Hz to 1 MHz
Number of channels, diagrams and traces	>100 (depending on available RAM)
Number of points per trace	2 to 20001
Operating system	Windows XP Embedded



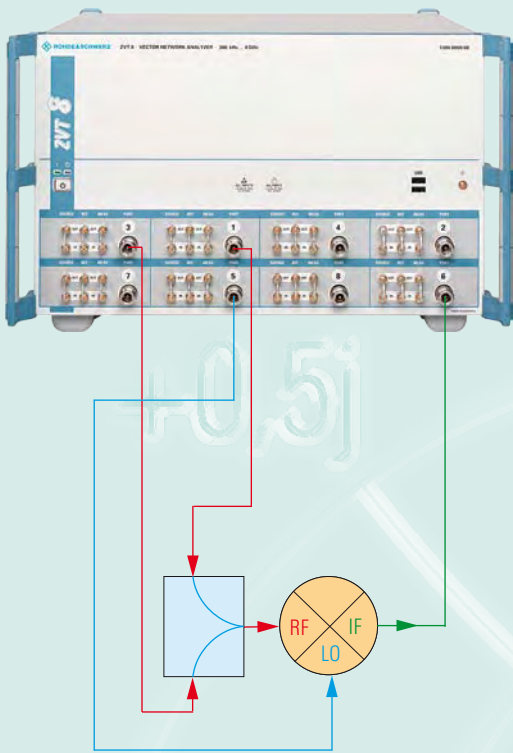


FIG 5 Test setup for an intermodulation measurement on a mixer.

FIG 6 Result of an intermodulation measurement performed on a mixer.

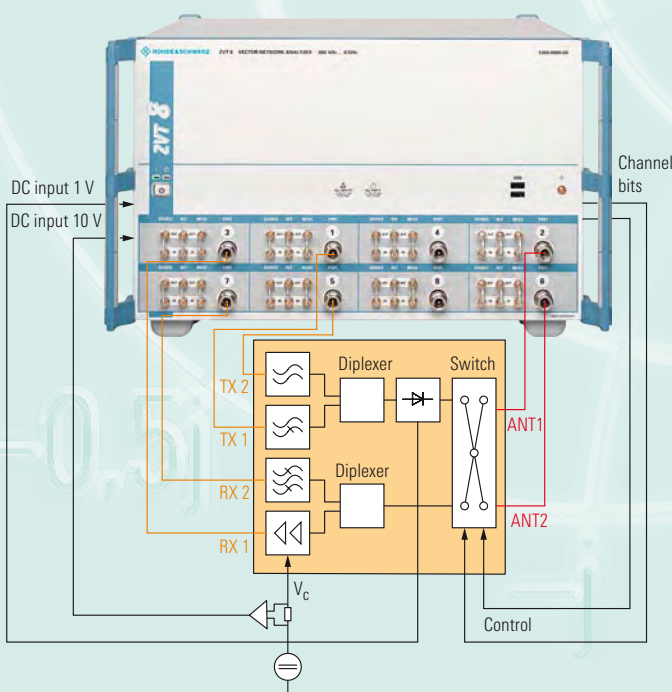


FIG 7 Measurement of a complex multiport module.

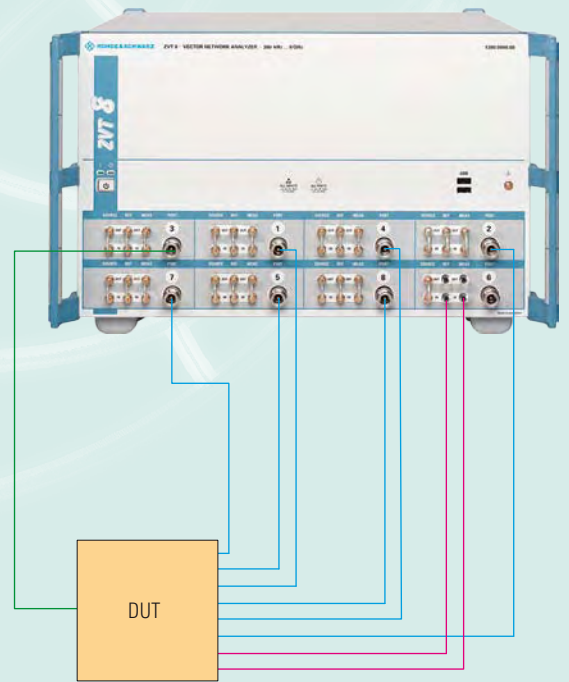


FIG 8 Measurements on a switch with one input and eight outputs pose no problems for the R&S® ZVT 8.



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FIG 1 The R&S®SMA100A offers excellent performance and compact design at a favorable price.

### Signal Generator R&S®SMA 100 A

## Analog signal generator that meets virtually every requirement

**Signal quality, speed and flexibility – these are the criteria by which signal generators are measured today. The R&S®SMA100A perfectly meets these criteria, and thus is a premium-class analog generator that is impressive due to its outstanding characteristics.**

### Premium signal quality

The Signal Generator R&S®SMA100A (FIG 1) combines premium signal quality with very high setting speed, which makes it ideal for any task. Whether in development, production, service or maintenance, the R&S®SMA100A does an excellent job. Covering a wide frequency range of 9 kHz to 3 GHz, it is suitable even for EMC applications.

The R&S®SMA100A is the ideal solution for measurement applications requiring high spectral purity, e.g. adjacent-channel or phase-noise measurements, and is also optimal for use as a local oscillator or VCO.

Due to an innovative synthesizer concept, the standard version of the instrument already offers excellent values in terms of SSB phase noise (typ.  $-135$  dBc (1 Hz) at a carrier frequency of 1 GHz and 20 kHz carrier offset) and nonharmonic suppression ( $<-80$  dBc for frequencies  $<1.5$  GHz).

With the Enhanced Phase Noise Performance and FM /  $\varphi$ M Modulator option (R&S®SMA-B22), high-grade reference oscillators are added to the generator synthesizer, even further improving SSB phase noise (typ.  $-140$  dBc (1 Hz) at a carrier frequency of 1 GHz and 20 kHz carrier offset) for frequency offsets of up to approx. 100 kHz (FIGs 2 and 3). The option contains a phase-locked loop, which is connected after the synthesizer and improves nonharmonic spurious suppression to typ.  $<-100$  dBc (for frequencies  $<1.5$  GHz).

Unlike conventional signal generators, the R&S®SMA100A generates frequencies down to 6.6 MHz by division of the fundamental frequency range. In the lower frequency range from 6.6 MHz, this yields spectral purity on par with that of high-grade crystal oscillators.

The oven-controlled crystal oscillator (OCXO) built in as standard provides very high frequency accuracy and stability. Even these characteristics are further improved with the R&S®SMA-B22 option.

Due to its sophisticated RF design, the signal generator also stands out for excellent broadband noise (typ.  $< -160$  dBc (1 Hz) at a carrier frequency of 1 GHz), a value that conventional generators can usually achieve only by inserting steep-edged filters after the synthesizer.

### Ideal for use in production

In production and ATE applications, the test equipment must provide short setting times in order to ensure high throughput and thus low measurement costs. The R&S®SMA100A features the very short level and frequency setting times that Rohde & Schwarz signal generators are known for and is thus an ideal choice in time-critical measurement systems. Even in normal operation (remote control via the IEC/IEEE bus, trigger to EOI), very short setting times of typ. 1.5 ms are achieved for the frequency (to an offset of  $< 1 \times 10^{-7}$  from the set frequency) and the level (to an error of  $< 0.1$  dB of the set level). A further significant reduction in setting time (to  $< 450$   $\mu$ s) is obtained in the list mode, which uses frequency and level settings previously stored in a list.

In the fast hopping mode, the generator features setting times as short as in the list mode. Plus, up to 10000 frequency and level pairs can be addressed as desired via a serial bus.

The electronic attenuator enables rapid and wear-free level setting of the R&S®SMA100A. The normal mode uses purely electronic level setting, ranging from  $-145$  dBm to  $+13$  dBm (typ.  $+21$  dBm in the overrange; see green trace in FIG 4). Higher output levels of up to typ.  $+26$  dBm can be supplied in the high-power mode (with the electronic attenuator bypassed; see blue trace in FIG 4). In this mode, the lower limit for electronic level setting is  $-20$  dBm.

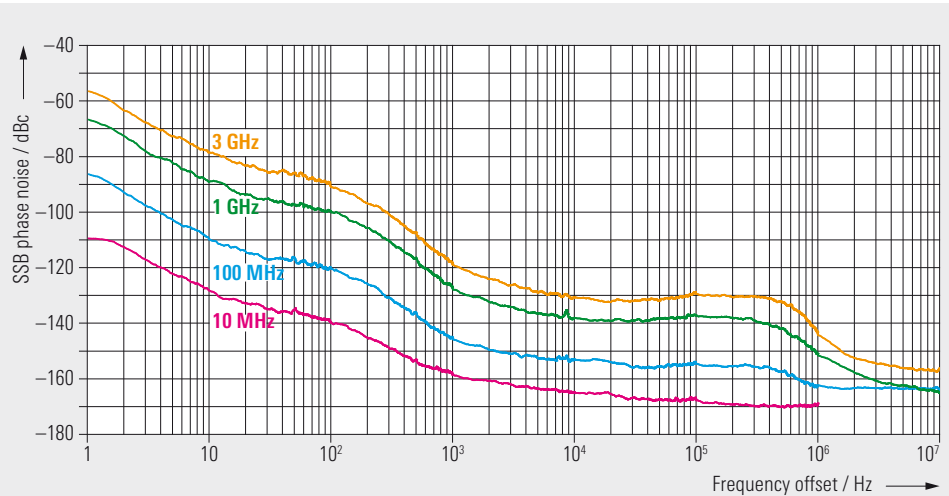


FIG 2 Typical SSB phase noise at different RF frequencies with the R&S®SMA-B22 option (measurement bandwidth 1 Hz).

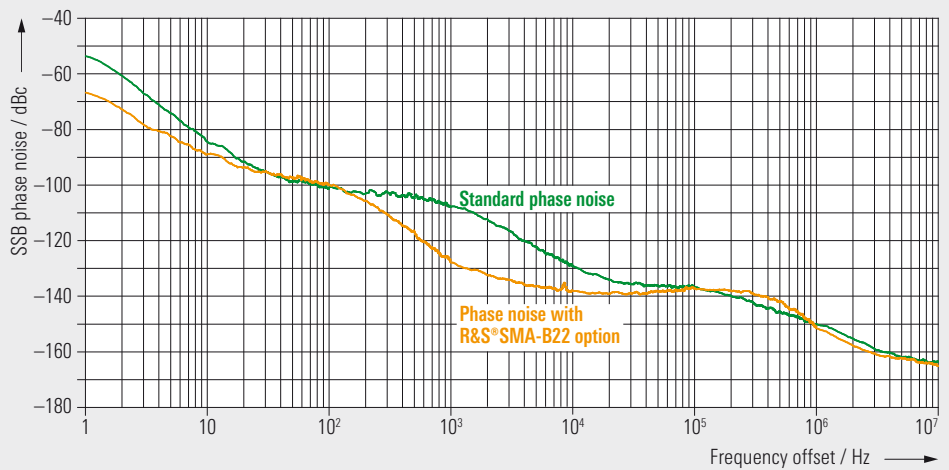
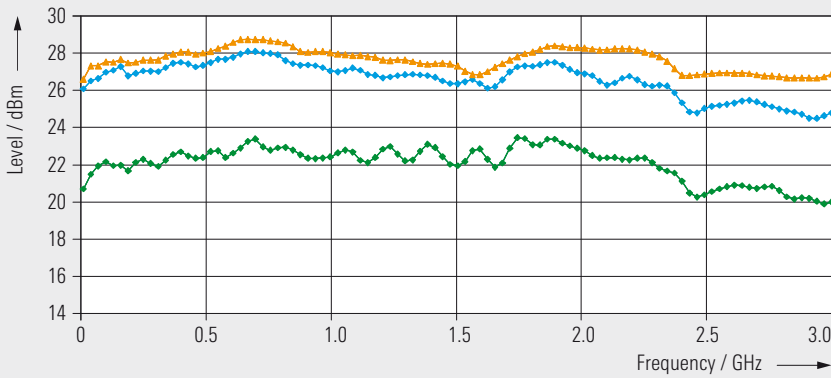


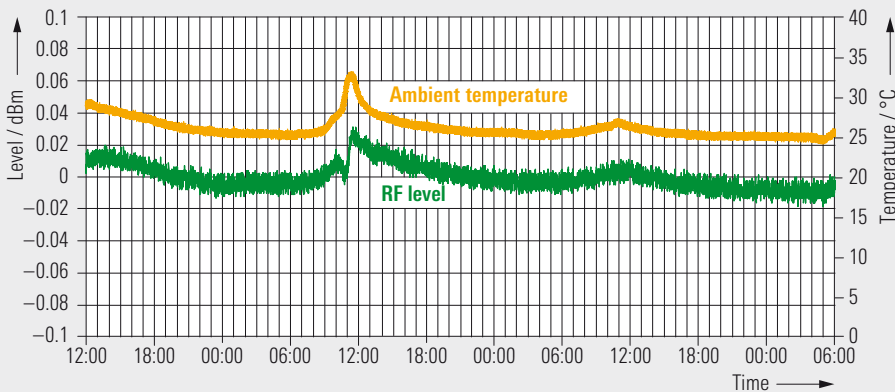
FIG 3 Typical SSB phase noise with and without the R&S®SMA-B22 option (f = 1 GHz, measurement bandwidth 1 Hz).

### Condensed data of the R&S®SMA 100 A

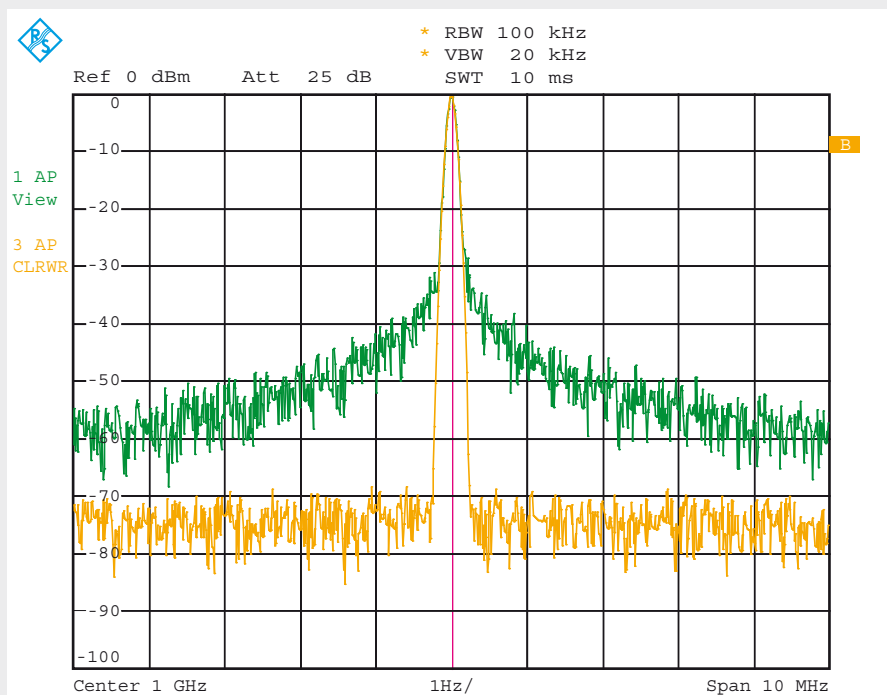
<b>Frequency</b>	
Frequency range	9 kHz to 3 GHz
Setting time	$< 3$ ms
Setting time in list mode	$< 450$ $\mu$ s
<b>Level range</b>	$-145$ dBm to $+18$ dBm (up to typ. $+26$ dBm overrange)
<b>Spectral purity</b> (at f = 1 GHz)	
Nonharmonics (carrier offset $> 10$ kHz)	$< -80$ dBc; typ. $-90$ dBc $< -90$ dBc; typ. $-100$ dBc with R&S®SMA-B22 option
SSB phase noise (carrier offset 20 kHz, 1 Hz measurement bandwidth)	$< -131$ dBc; typ. $-135$ dBc $< -136$ dBc; typ. $-140$ dBc with R&S®SMA-B22 option
Broadband noise (carrier offset $> 10$ MHz, 1 Hz measurement bandwidth)	$< -153$ dBc; typ. $-160$ dBc
<b>Modulation modes</b>	AM, FM/ $\phi$ M, pulse
<b>Clock frequency range</b>	100 kHz to 1.5 GHz
<b>Interfaces</b>	IEEE 488.2, LAN (100BaseT), 2 $\times$ USB, 1 $\times$ USB slave



**FIG 4** Maximum output power across the entire frequency range using different level modes (green: normal mode; blue: high-power mode; orange: with R&S®SMA-B103L option (RF path without attenuator)).



**FIG 5** High level repeatability ensures extremely accurate results in series measurements.



**FIG 6** Frequency modulation with noise (green: with FM noise, orange: CW).

► For applications requiring only high output levels of  $> -20$  dBm, a favorably priced frequency option without an attenuator is available (R&S®SMA-B103L). Overvoltage protection across the entire frequency range is implemented in the R&S®SMA100A as standard to protect the unit against high external feedback power.

The high level accuracy and repeatability of the R&S®SMA100A ensure results of utmost precision in series measurements (FIG 5). Complex and time-consuming level calibration is a thing of the past. On top of this, the generator is of highly compact design – while offering a wide range of outstanding features and capabilities, it takes up no more than two height units.

### Versatile analog modulation capabilities

The R&S®SMA100A performs amplitude and pulse modulation as standard. Frequency and phase modulation with a bandwidth of 10 MHz can optionally be implemented (R&S®SMA-B20/-B22), which makes the generator suitable for all common receiver measurements. The FM/φM modulator option is implemented by means of a direct digital synthesizer (DDS) and offers a modulation bandwidth of 10 MHz for FM and φM.

Due to digital deviation setting, the phase noise caused by modulation does not become visible until FM deviation is equal to or exceeds 100 kHz (at a carrier frequency of 1 GHz). The generator is thus ideal as a reference for phase noise measurements. It can be synchronized to the DUT by means of frequency modulation, which enables phase noise measurements even on free-running VCOs.

The RF signal can be internally modulated by means of the built-in LF generator (0.1 Hz to 1 MHz sinewave) or



the optional multifunction generator (R&S®SMA K24, bandwidth 10 MHz). The multifunction generator supplies various waveforms including sine wave, square wave, user-programmable trapezoidal waveforms or noise with selectable bandwidth. Modulation signals can be added together with different weighting. The modulation signals for AM, FM and  $\phi$ M and for the LF output can be set independently of one another. Based on this concept, the R&S®SMA100A offers a level of modulation flexibility previously unknown in analog signal generators.

Using noise as a modulation signal, the generator supplies adjustable phase or FM noise to simulate, for example, a VCO or an interference signal of variable spectral purity for receiver tests (FIG 6).

Moreover, the R&S®SMA-B20 and -B22 FM and  $\phi$ M options can be used to implement extremely fast frequency changes across a limited frequency range. Direct access to the DDS yields frequency setting times of typ.  $<10 \mu\text{s}$  across a range of max. 40 MHz. This allows fast frequency hopping transmitters to be simulated, for example.

For pulse modulation, the R&S®SMA100A includes as standard a high-quality pulse modulator with an on/off ratio of  $>80 \text{ dB}$  and a rise/fall time of typ. 10 ns as well as a basic pulse generator. Optionally, a high-performance pulse generator with a minimum pulse width of 20 ns and a variety of setting options is available (R&S®SMA-K23). This option makes the R&S®SMA100A also suitable for measurements on radar systems.

### Optional clock generator

Tests on integrated RF circuits frequently require an ultra-pure clock signal in addition to the RF signal. In the past, the

clock signal was usually delivered by an extra signal generator. This is different in the case of the R&S®SMA100A. Equipped with the clock synthesizer option (R&S®SMA-B29), it delivers a low-jitter clock signal that can be set independently of the RF output signal. The clock signal is available as a differential signal in the frequency range from 100 kHz to 1.5 GHz at two separate connectors on the rear of the unit. It is thus possible to test mixed-signal ICs such as A/D converters using only one signal generator.

### Other special features

For many years, the HP 8662/63 was one of the most commonly used analog high-end signal generators. It was part of many test systems, e.g. the HP 3048A phase noise measurement system. The HP 8662/63 is no longer avail-

able and must be replaced by newer equipment in case of failure. The R&S®SMA100A is an ideal replacement for the HP generator since it offers an HP 8662A/63A-compatible mode in addition to the common SCPI remote-control command set. Based on this mode, the R&S®SMA100A can replace generators of the HP 8662/63 family without requiring the test system to be reprogrammed.

In areas where security is an issue, unauthorized access to internal instrument data and settings must be prevented. This may be the case, for example, during servicing or transport. To meet this requirement, the R&S®SMA100A can be fitted with an ejector option (R&S®SMA-B80), by means of which the storage medium (CompactFlash™ card) can be removed from the signal generator at the press of a button and kept or transported separately from the generator (FIG 7). ▶



**FIG 7** The R&S®SMA-B80 ejector option allows generator data and settings to be stored on a removable CompactFlash™ card.

### ► Intuitive operation and a variety of connectors

The generator is based on the same operating philosophy as the known generators of the R&S®SMx family (see page 16). The 320 × 240 pixel (¼ VGA) color display shows the signal flow in a straightforward manner as a block diagram (FIG 8). Thus, you can immediately see the activated and deactivated functions and where you can make settings.

The generator is operated via the rotary knob, the cursor and function keys or a USB mouse and/or keyboard. In addition, the R&S®SMA100A can also be manually operated from an external PC using remote desktop control (e.g. VNC).

The generator can be remotely controlled via LAN or an IEC/IEEE bus. Hardware for a USB slave connector has been implemented, and the connector will later be available for remote control when appropriate software is added. Two USB connectors on the front and the rear panel allow the connection of a memory stick or a hard disk for data storage or firmware upgrades.

Moreover, power sensors of the R&S®NRP family can be connected to the generator, allowing the unit to perform high-speed, high-precision power measurements.

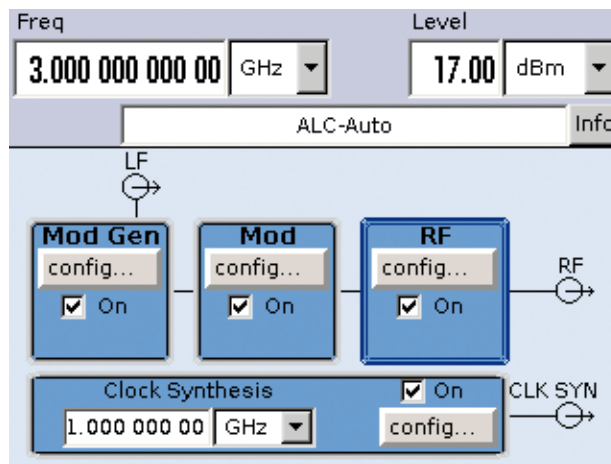
### Summary

The R&S®SMA100A perfectly rounds out the Rohde & Schwarz portfolio of high-end signal generators. In addition to the established R&S®SMU 200A, SMJ 100A and SMATE signal generators for digital modulation, Rohde & Schwarz now offers a signal generator for analog applications that meets virtually every requirement.

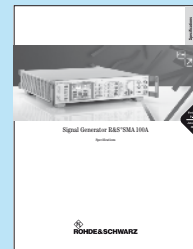
The R&S®SMA100A offers excellent performance and compact design at a favorable price and is therefore a highly attractive instrument. Its high measurement speed also makes it an ideal choice in production. In short, it is unrivaled in its ability to handle almost any job.

Günther Klage

**FIG 8**  
The R&S®SMA100A features the innovative user interface that is standard on generators of the R&S®SMx family.



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





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FIG 1 The convenient user interface makes it easy to control the R&S®AFQ100A – both in local and remote mode.

The R&S®AFQ100A arbitrary waveform generator (FIG 1) sets new standards in bandwidth and memory depth. It offers unprecedented signal quality, employing innovative concepts that optimize the generator's overall performance in supplying vector-modulated signals.

R&S®AFQ100A arbitrary waveform generator

## Top-quality I/Q signals for sophisticated radio scenarios

### Indispensable: ARB generators

The growing demand for transmission bandwidth in mobile radio not only calls for ever wider frequency bandwidths of the communications systems but also for very high signal quality. At the same time, the demands placed on modulation methods are becoming more stringent, requiring the transmission rate for a given bandwidth to be maximized. Typical modulation methods employed are OFDMA for the WiMAX standard as well

as the concepts devised for the further development of 3GPP (EUTRA).

Arbitrary waveform generators featuring versatile programming options are important tools in the development of new radio systems. They enable new modulation modes to be tested before generators tailored to such modes are available. As a rule, two-channel instruments allowing the generation of the inphase (I) and the quadrature (Q) component are used.

- ▶ Taking into account the high demands currently placed on signal quality, it is obvious that not just any conventional dual-channel arbitrary waveform generator will do. To handle the problems typically encountered in vector modulation such as carrier leakage, sideband suppression, I/Q imbalance, frequency response of the baseband and the RF, a top-quality, versatile generator is needed that allows signal impairments to be minimized by means of fine-adjustable compensation units.

This is where the R&S®AFQ100A comes into its own. It not only offers excellent technical data as an arbitrary waveform generator but also stands out for its sophisticated, perfectly matched hardware and software concept, which offers maximum performance in its interaction with other system components.

### Highlights of the I/Q specialist

#### Excellent technical data

Featuring a maximum clock rate of 300 MHz, the generator supplies signals up to a system bandwidth of 200 MHz. The extremely deep waveform memory of up to 1 Gsample allows even long, broadband waveforms to be stored. And the generator's analog frontend sets standards in signal purity.

#### Integrated clock rate converter

In addition to its excellent basic characteristics, the R&S®AFQ100A offers a variety of outstanding features that make it a high-quality baseband source. One of these highlights is the integrated clock rate converter (FIG 2). Data can be read from the internal memory at a selectable speed that can be optimally adapted to the useful signal. The R&S®AFQ100A digitally converts the I/Q samples to the higher clock rate of the D/A converter in realtime. The loss-free resampling thus carried out allows the D/A converter to be operated at a fixed clock rate. This

means that the anti-aliasing filters will be perfectly matched to any bandwidth of the I/Q output signal. This yields ideal signal characteristics.

In addition, resampling enables data to be read from the memory at a minimum clock rate as required for the system, which allows a maximum signal duration for a given memory depth. For example, the R&S®AFQ100A can output a GSM signal with a duration of 1000 s at a clock rate of 1 MHz. Without the clock rate converter, only a fixed clock rate of 300 MHz and thus a signal duration of only 3.3 s would be possible.

#### Adjustable filters

Equally important is the capability to correct the magnitude and phase of a strong frequency response – e.g. of an external I/Q modulator – by means of adjustable filters. An external program determines the frequency response and transfers results to the R&S®AFQ100A. Before the signal is output to the system, it is subjected to inverse filtering, i.e. the values of an inverse filter are taken into account. This yields a flat frequency response and maximum sideband suppression throughout the system. Filtering is performed in realtime, meaning that waveforms need not be recalculated before they are output, which saves considerable time.

#### Correction of level offset, delay and gain

The R&S®AFQ100A features level offset, delay and gain correction separately for the I and Q channels. It is thus possible to correct delays and other effects introduced by external cables or any elements connected after the generator. Conversely, such impairments can be deliberately produced in order to test the robustness of receivers (FIG 3).

#### Output of signals at the IF

Instead of delivering I and Q signals in the baseband, which is the normal case,

the R&S®AFQ100A can output the signals at the IF. This means that the frequency of the RF signal can be shifted without any modification being required to the external upconverter (or the RF modulator). The digitally implemented I/Q modulator of the R&S®AFQ100A offers virtually ideal characteristics, including absolutely linear frequency response and frequency changes almost without delay. Its high clock rate allows IF signals to be used for applications up to 100 MHz.

#### Intuitive software

This host of functions is controlled via a graphical user interface. This is done either directly by means of a display, mouse and keyboard connected to the generator or by remote control via a LAN from any PC in the network.

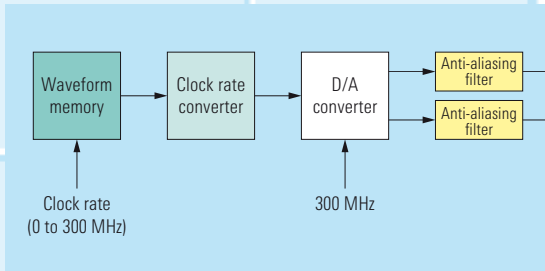
The R&S®WinIQSIM2 software serves as a graphical user interface for manual operation (FIG 4). In addition to controlling the R&S®AFQ100A, it allows the generation of waveforms in line with a variety of standards including WiMAX and 3GPP FDD.

Wolfgang Kufer

More information and specifications at  
[www.rohde-schwarz.com](http://www.rohde-schwarz.com)  
 (search term: AFQ)







### Condensed data of the R&S® AFQ 100A

Channels	two, for the I and Q components
Memory	256 Msamples to 1 Gsample, can be segmented
Bandwidth	2 × 100 MHz, optionally with generation of IF signal
Outputs	analog balanced and unbalanced, digital
SFDR (spurious free dynamic range)	typ. 80 dB
Frequency response	typ. 0.05 dB
Impairments	level, phase and delay can be precisely set

FIG 2 Block diagram of the R&S® AFQ100A.

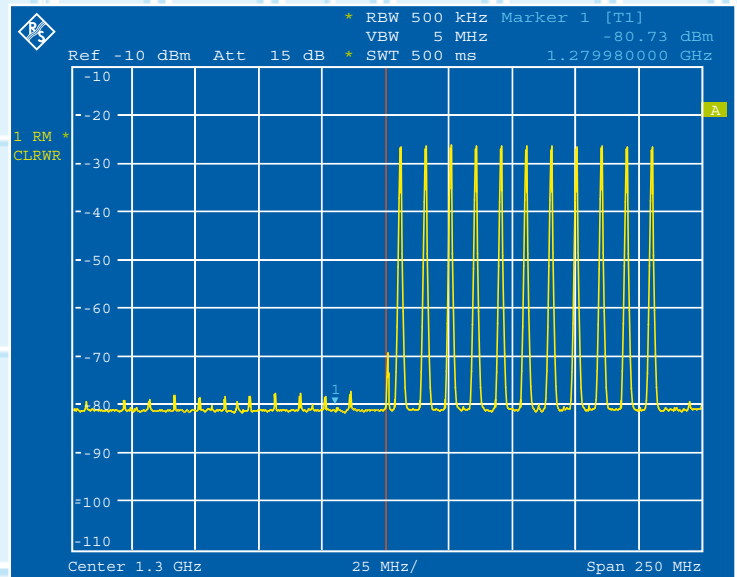
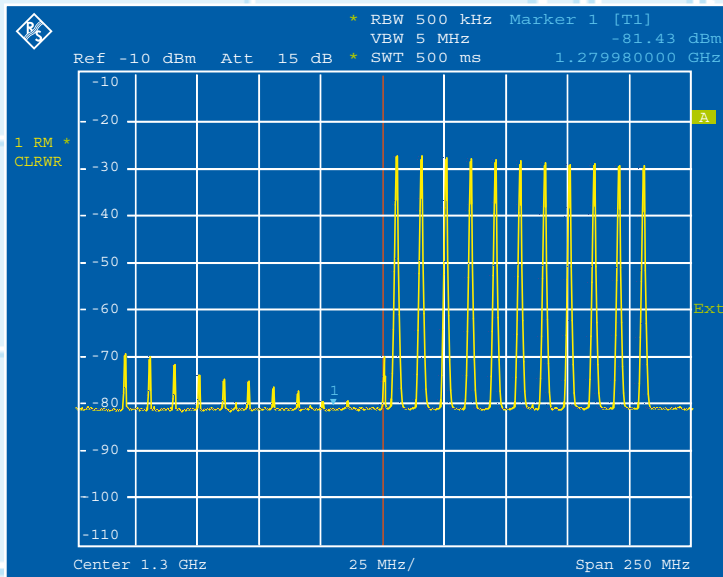


FIG 3 Example of a multicarrier signal without compensation (left) and with compensation (right).

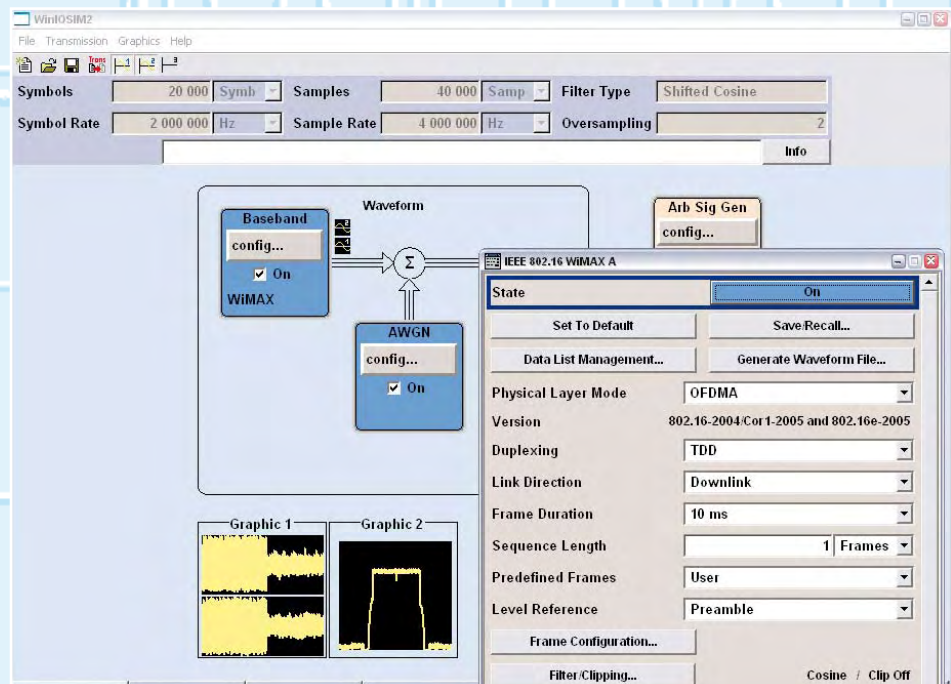


FIG 4 R&S® WinIQSIM2 software for controlling the R&S® AFQ100A in manual mode.

## Audio Analyzers R&amp;S®UP 300 / R&amp;S®UP 350

# Versatile audio analyzers for laboratory, service and production

The Family 300 has again been expanded, this time with two audio analyzers. The Audio Analyzer R&S®UP300 (FIG 1) includes analog inputs and outputs, while the R&S®UP350 additionally offers digital audio interfaces.

## Remarkable functionality in lower price segment

The R&S Smart Instruments™ product family continues to grow: The three RF measuring instruments Spectrum Analyzer R&S®FS300, RF Signal Generator R&S®SM 300 and Dual-Channel Arbitrary/Function Generator R&S®AM300 have now been joined by two analyzers for the audio frequency range. With a frequency range from 10 Hz to 80 kHz, these two analyzers can han-

dle any of today's common applications. Due to their extensive functionality and excellent specifications, they are outstanding in the lower price segment. The R&S®UP300 offers all measurements common in today's audio T&M and can generate the required test signals; its analog inputs and outputs are dual-channel. The R&S®UP350 additionally includes digital audio interfaces and can measure digital audio protocols and sampling rates as well.



FIG 1 The new audio analyzers feature a broad scope of functions, good technical characteristics and compact design.





**FIG 2** In addition to the analog interfaces of the R&S®UP300 (left), the R&S®UP350 offers digital audio interfaces in consumer and professional format.

## Diverse test signals

The generators in the Audio Analyzers R&S®UP300 and R&S®UP350 provide all test signals for measurements in the laboratory, service, production or in university education. Inherent distortion of significantly less than  $-90$  dB at some fundamentals also enable you to measure high-end units. The R&S®UP350 outputs all signals to the analog or digital interfaces (FIG 2). A brief list of the test signals is provided here:

- ◆ **Sinewave signals** for measuring frequency response, level linearity or harmonic distortion; the level or frequency of the signals can be swept.
- ◆ **Dual-channel sinewave signals**, whose level and frequency can be individually set in each channel; useful when measuring channel crosstalk in both directions, for example.
- ◆ **Two-tone signals** for modulation distortion analysis and difference frequency distortion measurement; the test signals meet the relevant standards and can be set within wide limits.

- ◆ **Multitone signals** with up to 17 sine-wave signals whose frequency and level can be set; this quickly yields information about a DUT's frequency response.
- ◆ **Sinewave burst signals** – whose burst, interval time, frequency and level can be set – for testing the dynamic response of audio circuits.
- ◆ **Noise** for broadband stimulation of DUTs; can also be superimposed on the sinewave signals.

## Excellent measurement characteristics

The technical concept used in “large” Rohde & Schwarz audio analyzers has also been implemented in the R&S Smart Instruments™. After being processed in the analog input stages, the analog signals to be measured are digitized and then evaluated with measurement routines. This approach offers a number of benefits:

- ◆ All measurement functions provided at the analog interfaces are also avail-

able at the digital audio interfaces of the R&S®UP350.

- ◆ Operation is always the same, truly a benefit for occasional users.
- ◆ The measurement methods at analog and digital interfaces are identical. Moreover, all filters are implemented digitally, meaning that they also have the same characteristics. These two factors are particularly beneficial if measurements taken in front of and behind a D/A converter have to be compared.

Both analyzers can measure analog audio signals up to a bandwidth of 80 kHz (FIG 3). The R&S®UP350 additionally analyzes digital audio signals at a sampling rate up to 192 kHz. These features are new in this product class and cover the complete frequency spectrum of state-of-the-art audio equipment. Another surprising feature in this product category is that the analyzers have true dual-channel operation. In other words, the signals in the two channels are processed in parallel and the measurement results are provided at the



- ▶ same time – thus, switchover between the input connectors is not required.

The two analyzers offer the following measurement functions:

- ◆ **Level measurements** can be executed using rms, peak or quasi-peak weighting since the instruments include all rectifiers required for performing measurements on consumer and professional audio equipment.
- ◆ **Selective level measurements** with bandwidths that can be set individually are always required when very small signals have to be verified in broadband interference.

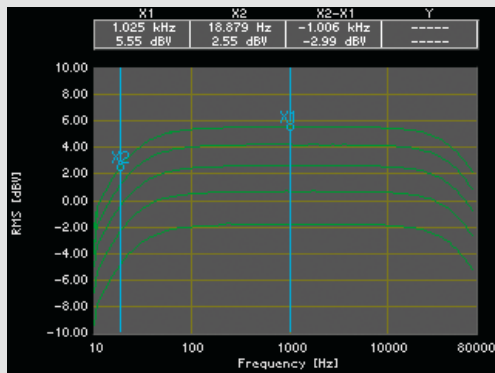


FIG 3 Bandwidths of up to 80 kHz allow measurements on broadband audio equipment.

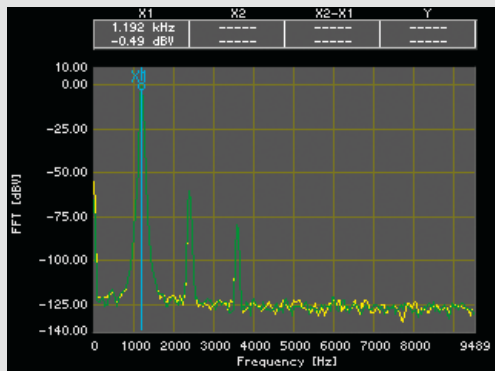


FIG 4 FFT analysis that supports up to 16 k points and provides numerous window functions – impressive in this product class. The spectral composition of signals up to 80 kHz in bandwidth can be displayed.

- ◆ **DC measurements** complete the scope of level measurements.
- ◆ **Total harmonic distortion (THD) measurements** including selection of weighted harmonics.
- ◆ **THD + N and SINAD measurements** for total harmonic distortion including noise.
- ◆ **Modulation distortion analysis and difference frequency distortion measurement** for detecting intermodulation distortion by using the corresponding test signals.
- ◆ **Frequency and phase measurements.**
- ◆ **Polarity measurements** to detect any potential polarity reversals in the signal path.
- ◆ **FFT analysis** supports an FFT size up to 16 k points and provides numerous window functions, making it possible to display the spectral composition of signals down to a resolution of <3 Hz (FIG 4). This is also a feature previously offered only in very expensive audio analyzers.

### The R&S®UP350 – analog and digital

All R&S®UP300 functions are also offered by the R&S®UP350. But you can also use the R&S®UP350 for measurements on digital audio equipment and for applications with mixed analog/digital interfaces. The dual-channel, digital audio interfaces are designed as BNC connectors and as optical interfaces (TOSLINK).

In addition to the above test signals, the generator also creates data for the digital audio protocol. The channel status data can be output in professional studio format as well as in consumer format. The validity bit can be set by the user, and the parity bit is also set.

The analyzer also performs the specified measurement functions in the case of

digital audio signals. Moreover, it evaluates digital audio protocols, displays validity bits and evaluates the received audio data stream for block errors, sequence errors and preamble errors. Depending on the data contents of the channel status bits, it automatically switches to professional or consumer format and displays the meaning of the channels status bits in plain text.

The R&S®UP350 is capable of the basic sampling rates 32 kHz and 44.1 kHz, as well as 48 kHz and its multiples 96 kHz and 192 kHz. The analyzer can measure the sampling rate of incoming data signals.

### Wide range of filters

Even expensive audio analyzers from other manufacturers often offer filters only as options. Rohde & Schwarz audio analyzers take a different approach: The R&S®UP300 and R&S®UP350 include digital filters, as is common in high-end equipment. A variety of weighting, third-octave and octave filters are provided as standard, and up to three filters can be combined.

### Aural monitoring of measured signals

You can connect commercial headphones to the standard 3.5 mm socket to listen to audio signals to be measured. When measuring levels, you can switch this output to permit aural monitoring of the filtered signal.

### Remote control via USB

The two audio analyzers can be remote-controlled from a PC via the standard USB interface. The required software drivers are available for LabView, LabWindows/CVI, or they can be directly



**FIG 5** Operation is easy and menu-guided. Even occasional users quickly come up to speed. The high contrast TFT color display makes reading the settings and results easy even under difficult lighting conditions.

linked as a dynamic link library (DLL) to any common programming language or development environment. The command structure is easy to understand and is designed for fast programming. As is common for all instruments from Rohde & Schwarz, the software drivers for the two new analyzers are continuously updated and provided via the Internet.

### Family 300 – a powerful platform

Both analyzers are based on components of the tried-and-tested Family 300. All members of the family have almost the same “look” and include the bright 5.4" TFT display which is used to make most of the settings (FIG 5). Operation is largely menu-guided, as on high-end instruments from Rohde & Schwarz. Measurement results are displayed as numeric values but can also be presented as informative graphics and evaluated using cursors.

The members of the Family 300 are of modular design; production is economical due to the standardized use of all basic modules such as housing, processor, power supply, etc. Sturdy protective guards make the analyzers ideal for day-to-day operation outside the laboratory. The instruments have an adjustable handle for easy carrying or for setting them up on a lab bench. To make the most of available space, several members of the Family 300 can be stacked. If you remove the handle and the protective guards, the instruments can be installed in a 19" rack. Since they are quite slim, you can even place two of them next to each other.

## Summary

The R&S®UP300 and R&S®UP350 are favorably priced audio analyzers that will impress you not merely because of their excellent specifications. They are also handy and compact making them ideal for day-to-day operation outside the laboratory. A bright TFT color display indicates settings and measurement results. Operation is easy, which is particularly beneficial for occasional users. Despite their lower price range, the analyzers offer all the important functions of state-of-the-art audio analyzers. The R&S®UP300 has two dual-channel analog inputs and outputs with an analysis bandwidth of up to 80 kHz. The R&S®UP350 additionally offers digital audio interfaces up to a sampling rate of 192 kHz.

Klaus Schiffner

More information and data sheet at  
[www.rohde-schwarz.com](http://www.rohde-schwarz.com)  
 (search term: UP300 / UP350)



#### Condensed data of the R&S®UP300 / R&S®UP350

Frequency range	10 Hz to 80 kHz
Input voltage	up to 33 V
Input noise	<2 µV (A weighted)
FFT	up to 16 ksamples

#### Additional data for the R&S®UP350

Sampling rates	32 kHz to 192 kHz
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## Automatic RF Test Chamber R&amp;S®TS7123

# Wide RF test chambers for larger DUTs

**In addition to the narrow RF Test Chambers R&S®TS7121 for RF**

**tests on small modules and devices,**

**Rohde & Schwarz now offers the wider**

**RF Test Chambers R&S®TS7123x**

**for DUTs requiring more space.**

**Featuring high shielding effective-**

**ness and rugged design, the new**

**chambers enable interference-free**

**and reliable tests on modules and**

**devices with radio interfaces meeting**

**a variety of standards including ISM,**

**GSM, CDMA2000®, WCDMA, WLAN,**

**Bluetooth®, WiMAX, etc.**

## Size and design for every requirement

To obtain reproducible results when testing radio interfaces of modules and devices, external interference must be screened out. Conversely, nearby systems and equipment must be protected against interference that may be produced by such tests. RF test chambers are an ideal means of performing such tests, as their high shielding effectiveness prevents mutual interference.

To meet this requirement, Rohde & Schwarz has expanded its portfolio of RF test chambers [1] suitable for use in production by adding the wider RF Test Chambers R&S®TS7123. The R&S®TS7123 chambers are twice as wide and have the same basic design as the R&S®TS7121 RF test chambers [2], which were developed to meet the requirements of automatic production lines. These requirements include long life, rugged design and automatic opening and closing of the RF chamber.

Featuring high shielding effectiveness between 300 MHz and 6 GHz, the RF test chambers perform tests on modules and devices with radio interfaces meeting a wide variety of standards, including ISM, GSM, CDMA2000®, WCDMA, UMTS, WLAN, Bluetooth®, WiMAX, etc. Such interfaces are used, for example, in mobile radio, automotive and wireless data communications applications.

The R&S®TS712x product family, therefore, includes two base models that differ mainly in width (FIG 1). Plus, an automatic and a manual version of each model is available, indicated by the letters A and M in the type designation.

The narrow R&S®TS7121 model has a width of 155 mm and is particularly suitable for testing mobile phones or small modules such as RFID modules, radio sensors and receivers as well as remote keyless entry and Bluetooth® modules.

The manual version of the wider RF chamber, the R&S®TS7123M, has been devised for applications in service, quality control and R&D. The automatic version, the R&S®TS7123A, is opened and closed automatically as required for production lines. The automatic and the manual versions of the RF test chambers have the same basic design, ensuring the same test functionality for both versions in development, production and service.

## Wide range of applications

The new R&S®TS7123 model with a width of 330 mm enables tests on devices requiring up to double-height DIN radio slots, which makes it suitable, for example, for automotive applications such as tests on car radios or navigation or infotainment systems. Test chamber dimensions are shown in detail in FIGs 3 and 4.

The R&S®TS7123 RF test chamber also provides room for integrating subsystems for generating special ambient conditions. A good example can be found in pressure chambers used for tests on tire pressure monitoring systems, where not only the radio interface is tested but also the functioning of tire pressure sensors under various pressure conditions as occur in car tires. For this application, Rohde & Schwarz offers the R&S®TS7810 RF test system (FIG 2) with the





FIG 1 Product range of Shielded RF Test Chambers R&S®TS 712x. All models are optionally available with an elevated cover.

FIG 2 RF Test System R&S®TS 7810 and RF Test Chamber R&S®TS 7123A with integrated pressure chamber for testing tire pressure sensors.



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► R&S®TS7123A RF test chamber including software [3]. Another application consists of functional tests on WLAN routers, where the WLAN Protocol Tester R&S®PTW70 [4] is used to measure the receive sensitivity (FIG 5).

### Numerous extras and options

To support users in implementing their specific applications, Rohde & Schwarz offers a large number of options, including various antenna couplers, ready-made absorbent material and an elevated cover allowing additional test equipment to be installed above the DUT (FIG 6).

Antenna couplers for GSM, CDMA2000® and WCDMA as well as a Bluetooth® antenna are currently available. The

antenna couplers are attached to the side panel of the RF chamber (FIG 7); the Bluetooth® antenna can be mounted in any position desired by the user. Customer-specific antenna couplers, e.g. WLAN or ISM, can also be integrated.

The optional absorbent material attenuates acoustic and high-frequency electromagnetic waves and thus ensures reproducible and stable audio and RF measurements.

In the course of product refinement, both RF test chambers have been equipped with an exchangeable connector plate with two feedthrough filters in addition to the four RF connectors already available. The feedthrough filters can be used for supplying power to and exchanging data with the DUT and for controlling test modules in the RF chamber. The exchangeable connector plate makes it possible to add user-specific feedthroughs without having to modify the RF test chamber. For example, you can add USB feedthrough filters or feedthroughs for fiber-optic links or pressurized air. However, care must be taken to ensure that the extra feedthroughs do not diminish the shielding effectiveness below the required value. Conversely, the chamber's shielding effectiveness will increase as the number of feedthroughs decreases.

Gert Heuer

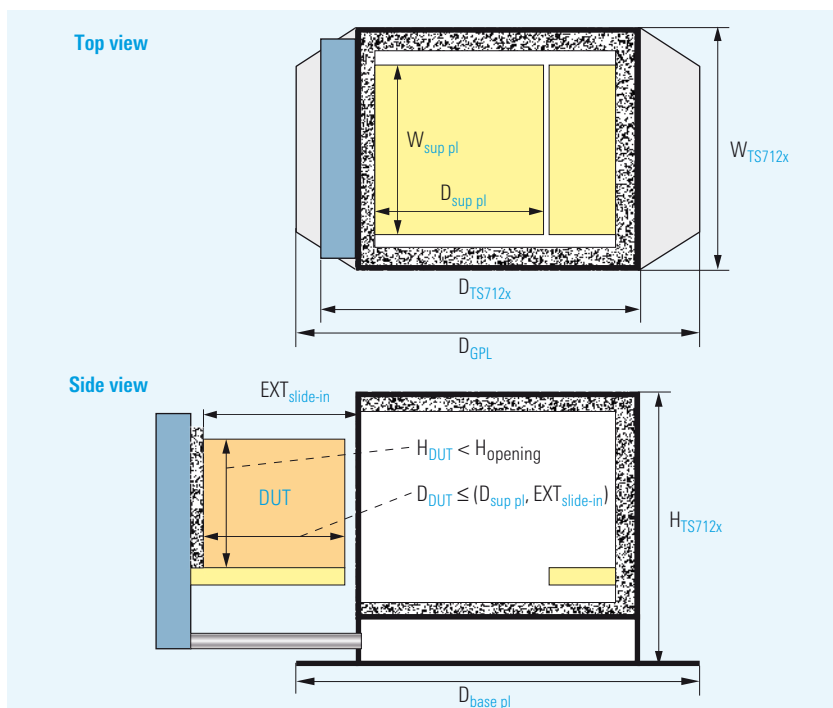


FIG 3 Dimensions of RF test chambers.

FIG 4 Main dimensions of the Shielded RF Test Chambers R&S®TS712x.

Dimensions (incl. absorbent material)	R&S®TS7121A*	R&S®TS7123A*
Overall dimensions (with RF chamber closed) (W × H × D) $_{TS712x}$	155 mm × 305 mm × 428 mm (6.1" × 12" × 16.9")	330 mm × 347 mm × 428 mm (13" × 13.1" × 16.9")
Depth of base plate $D_{base pl}^{**}$	600 mm	600 mm
Dimensions of supporting plate (W × D) $_{sup pl}$	80 mm × 194 mm (3.1" × 7.6")	245 mm × 230 mm (9.6" × 9")
Extension range of slide-in unit (Ext $_{slide-in}$ )	0 to 210 mm (0 to 8.2")	0 to 230 mm (0" to 9")
Max. DUT dimensions (W × H × D) $_{DUT}$ (standard configuration)	80 mm × 130 mm × 194 mm (3.1" × 5.1" × 7.6")	245 mm × 165 mm × 230 mm (9.6" × 6.5" × 9")

\* The manual and the automatic versions have identical dimensions, excluding the handle on the manual version.

\*\* The automatic versions come with a base plate that extends beyond the length of the RF test chamber.



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**FIG 5** WLAN Protocol Tester R&S®PTW70 with manually controlled RF Test Chamber R&S®TS7123 M.



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**FIG 6**  
Manually controlled RF Test Chamber R&S®TS7123 with elevated cover and removable servicing panel (on request).

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



**REFERENCES**

- [1] Versatile Shielded RF Test Fixture R&S®TS7110: Test fixture for modules and units with radio interface. News from Rohde & Schwarz (2003) No. 179, pp 4–7
- [2] Automatic/manual RF Test Chambers R&S®TS7121: Reliable RF tests on small modules and devices. News from Rohde & Schwarz (2005) No. 187, pp 6–8
- [3] RF Test System R&S®TS7810: Testing tire pressure sensors in the automotive industry. News from Rohde & Schwarz (2005) No. 186, pp 14–16
- [4] WLAN Protocol Tester R&S®PTW70: Multimode protocol analysis in WLANs. News from Rohde & Schwarz (2005) No. 188, pp 22–25



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**FIG 7**  
Antenna coupler for GSM, CDMA2000® and WCDMA.



## Infotainment Test System R&amp;S® ATSI

# Fast, comprehensive tests in automobile production

The new R&S® ATSI infotainment test system is the follow-up to the Automotive Verification Test System R&S® AVTS, which has been tried and tested by many renowned automobile manufacturers. The R&S® ATSI performs automatic tests on broadcast receivers, sound systems, TV receivers, navigation systems and mobile phones. The architecture of the new system is based on application-specific modules, making it highly flexible in all stages of the production process. Due to the system's versatility, the test sequence can be optimized and costs for rework reduced. The R&S® ATSI is equipped with a large number of monitoring functions such as continuous selftest and monitoring of all radiated test signals.



FIG 1 Infotainment tests: Ever shorter innovation cycles and the increasing diversity of applications can only be mastered with fast and future-proof test systems.

## Test system for production – versatile and future-proof

Comprehensive communications and infotainment components are already an integral part of today's automotive equipment in the volume sector. Original equipment manufacturers (OEM) thus face a challenging task, for they must fulfill high customer requirements for these components with respect to quality and reliability – despite ever shorter innovation cycles and increasing diversity of applications (FIG 1).

The employed test equipment must feature high flexibility and upward compatibility to meet the needs of this trend, for it must not only ensure that the components have been correctly installed but also verify the proper functioning of the entire communications and infotainment system – and for a wide range of configuration levels.

This is where Rohde & Schwarz facilitates production with its R&S® ATSI infotainment test system. The system offers special features and increases efficiency:

- ◆ It reduces production time and minimizes the frequency of errors by using automatic test sequences
- ◆ It minimizes the costs for rework by verifying the correct installation of the infotainment components already early on in production, i. e. before final production
- ◆ It ensures that a high level of quality is maintained in production at locations anywhere in the world
- ◆ It can be economically enhanced for future versions
- ◆ It requires no special know-how for on-site maintenance

## The best solution for any application

Application-specific function modules ensure utmost operational flexibility and reduce the costs of installing, operating and maintaining the system (FIG 2). The R&S®ATSI supports a wide variety of test strategies in all stages of the production process:

- ◆ Conventional testing of the finished vehicle on the assembly line or in the test chamber
- ◆ Testing vehicle modules prior to installation (e.g. loudspeaker in the door module)
- ◆ Mobile testing with handheld measuring equipment via radio interfaces

The function modules for generating the test signals are equipped with a LAN interface. They can therefore be installed exactly where the individual test signals are needed – and still be remote-controlled and monitored from a central control PC. This largely avoids time-consuming laying of RF cables.

## User-friendly configuration

User-friendly software packages support the modular system concept:

- ◆ All function modules are equipped as standard with software whose uniform graphical user interface allows them to be operated autonomously with fixed settings (FIG 3).
- ◆ The R&S®ATSI-K7 system configuration software provides a representation of the entire system installed in the production facility, including all distributed components such as active antennas, splitters, monitoring modules, etc. It centrally manages all configuration data for the different test scenarios and evaluates the self-test signals of the modules, allowing errors to be instantly located.
- ◆ The R&S®ATSI-K1 test sequencer makes it easy to program test sequences such as AM, FM and DAB radio tests on different frequencies, including the measurement of ambient noise.

## Test signals for all cases

- ◆ Analog sound broadcasting: AM, FM
  - ◆ Digital broadcasting: DAB/DMB repeater
  - ◆ Analog TV: PAL/NTSC/SECAM
  - ◆ Digital TV: DVB-T/DVB-H, ATSC repeater
  - ◆ Mobile phone: GSM/CDMA/WCDMA frequency ranges
  - ◆ Navigation system: GPS
  - ◆ Loudspeaker/sound system
  - ◆ ISM (keyless entry, TPMS)
- ◆ The R&S®ATSI-K2 interface software uses the interface to the master production computer in customer-specific versions.

FIG 2 Function modules of the R&S®ATSI infotainment test system in the rack.



44490/4

### ► Hot plug-in – installation and maintenance made easy

Sensor antennas continuously receive all radiated signals on the air interface and thus seamlessly monitor the integrity of the entire system. If an error occurs, the system configuration software analyzes the problem and outputs a message to the master production computer via the interface software. In the event of a defective module, all you need to do is replace the affected module, and the software takes care of the rest. Since the system does not have to be powered down in order to replace the module, the other test signals remain available. If backup modules are installed, the software automatically switches to a redundant module when an error occurs, allowing the system to continue operating virtually without interruption.

### On request: single-source, all-in-one solutions

Rohde & Schwarz not only provides system components but also offers single-source, all-in-one solutions. On request, system specialists will advise you in advance with regard to designing the test concept and provide support in selecting suitable locations – e.g. by analyzing the EMC environment – while taking the specific production environment into account. After installing and configuring the system, they will parameterize it for the different types of vehicles and optimize the test sequence until the start of series production.

To ensure that the entire system functions flawlessly during the operation phase, all parameters should be verified and recalibrated regularly. For this purpose, the service team from Rohde & Schwarz has a comprehensive test equipment pool for on-site use.

### Summary

The R&S®ATSI infotainment test system allows fast and comprehensive automatic testing of the installation and operability of infotainment and communications components in vehicles. Besides conventional final acceptance tests, it also tests subsystems before they are integrated into the vehicle, thus considerably reducing test times and ensuring competitive advantages. Hand-held equipment is available for wireless interfaces such as WLAN, Bluetooth® or proprietary standards, which makes it possible to perform mobile tests as well.

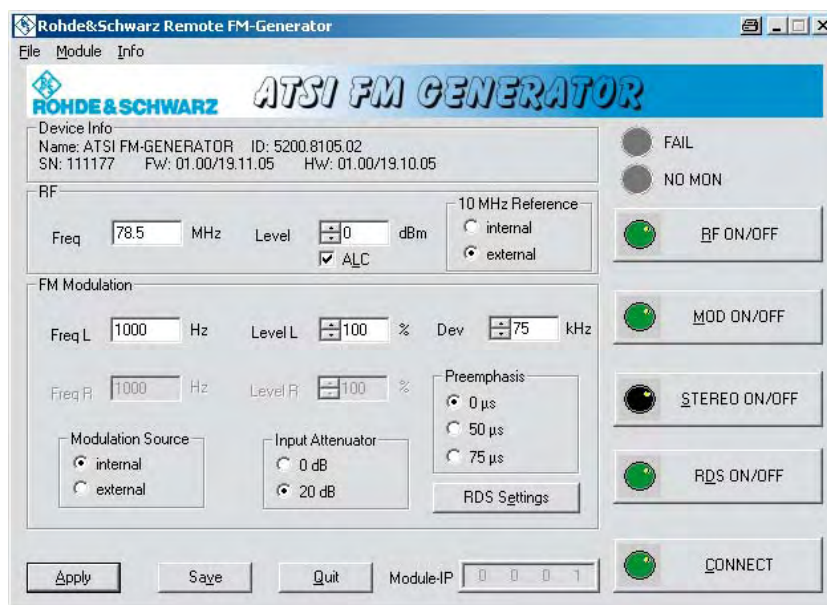
The individual modules of the system are autonomous and can be operated independently of each other or combined into a system via LAN. Continuous monitoring of all components ensures maximum availability. The test system is rounded out by a large number of antennas that are specially designed for use in production. Customer-specific requirements are taken into account on an individual basis.

There are plenty of reasons for choosing the R&S®ATSI – renowned automobile manufacturers are already working with the test system.

Dietmar Weber



FIG 3 A uniform user interface for all function modules simplifies parameterization (here, for example, the FM generator).





## DTV in France – transmitters installed at 2876 m

**Rohde & Schwarz supplied and installed about 30 liquid-cooled high-power transmitters of the R&S® NV 7000 series for network operators in France. Nine of these transmitters were installed under adverse conditions at the Pic du Midi (2876 m) in the Pyrenees.**

Since an observatory is located at the summit of the Pic du Midi, it was essential not to mar the atmosphere with heat generated by the transmitters.



Foto: Autor

Since September 2005, 50 % of the French population has gained access to digital terrestrial television. The primary objective is to reach 85 % of TV viewers by 2007. Rohde & Schwarz actively participated in the rollout of this project. The Munich-based company supplied and installed the corresponding transmitters despite extremely short deadlines.

A very special station for this rollout was the site Pic du Midi covering the Toulouse area with more than two million viewers. Eight transmitters for four multiplexes are operated in passive standby, a fifth multiplex is served by one transmitter with dual drive. They provide power of 500 W and 650 W at an effective radiated power of 13 kW. But two major problems had to be solved for this site: access and cooling.

Since the summit of the Pic du Midi can only be reached by inclined railway or helicopter, one of the main difficulties was transporting the material. Air transport was selected for all material. This was not very easy – even if the weather was pleasant in the valley, it was always very windy at the summit and helicopters had to cope with these conditions. The task was extremely difficult since the mast had to be approached within less than 1 m. Only very skilled pilots can manage such flight maneuvers.

Cooling required special engineering for two reasons: Temperatures drop to as low as  $-35^{\circ}\text{C}$  in winter. For this reason, heat exchangers have to run in a kind of air mixing chamber. Moreover, only a minimum of warm air could be expelled to the outside – an observatory is located at the summit making it essential not to mar the atmosphere. As a result, an indoor solution was selected. The cooling units were installed in a jacket tube connected to a bypass system. The warm air was fed back to the inlet of the cooling unit. A second identical cooling system was installed for passive standby.

The French company Klein SAS received the order for planning and implementing the site-specific cooling system and the French company Sogetrel was responsible for installing it. The complete project was managed by ROHDE & SCHWARZ France, whose technicians were responsible for installing the system and stayed several weeks in the Pyrenees to accomplish the task on time.

Jean-Michel Croquevielle

## VHF TV Transmitters R&amp;S®NM/NW8200

# Multistandard air-cooled VHF TV transmitters

The new VHF TV Transmitters R&S®NM/NW8200 now also offer the innovative engineering of the air-cooled R&S®NH/NV8200 UHF transmitter family for analog and digital TV for VHF band III. Compared to the currently available R&S®NM/NW7001 family of VHF transmitters, the output power has been increased by 50% owing to innovative circuitry and state-of-the-art cooling technology – with the same footprint, of course. Particular emphasis has been placed on operating reliability, long life, minimum energy consumption and ease of service, supported by various monitoring and diagnostic options.

## All standards – analog and digital

The air-cooled VHF TV Transmitters R&S®NM/NW8200 (FIG 1) have been designed for all digital and analog TV and sound broadcasting standards, e.g. including the following:

- ◆ **Analog TV:** B/G, D/K, M/N, I, SECAM, PAL, NTSC
- ◆ **Digital TV:** DVB-T, DVB-H, ATSC, MediaFLO™, DMB-T, etc
- ◆ **Digital sound broadcasting:** DAB

Since the VHF TV Transmitters R&S®NM/NW8200 have the same design as the UHF transmitters, they largely contain the same equipment – the multistandard TV Exciter R&S®Sx800, the Control Unit R&S®NetCCU800 as well as all frequency-independent components. With the same or slightly reduced volume of cooling air in comparison with the UHF transmitters, power levels up to 3 kW analog combined as well as 1.95 kW for DVB-T and ATSC can be implemented in one transmitter rack.

## Multistandard R&S®VM8350 A1 TV amplifier

The multistandard air-cooled R&S®VM8350 A1 TV amplifier (FIG 2) operates in the broadband from 170 MHz to 254 MHz. Its output power is 750 W for analog TV combined, 325 W for DVB-T and 485 W for ATSC. It is based on the broadband air-cooled



**FIG 1**  
Compared to the R&S®NM/NW7001 family of transmitters, the output power of the new VHF TV Transmitters R&S®NM/NW8200 has been increased by 50%.



**FIG 2** The multistandard air-cooled R&S®VM 8350 A1 TV amplifier supplies 750 W for analog TV combined, 325 W for DVB-T and 485 W for ATSC.

R&S®VH8200 A1 TV amplifier for band IV/V and thus has the same built-in power supply unit as well as identical frequency-independent modules.

Also, the innovative heat sink technology, which is outstanding for its highly effective thermal properties has been incorporated – yielding maximum heat conductivity combined with an optimized number of cooling fins at relatively low pressure loss.

The amplifier has several self-protection and monitoring functions:

- ◆ Power reduction in case reflection is detected
- ◆ Overtemperature switch-off
- ◆ Transistor failure detection
- ◆ Input level monitoring
- ◆ Output power monitoring

Since the amplifier does not adjust the output power if a transistor fails, the remaining transistors continue operation at their original level control. The linearity of the output stage, the precorrection and the quality data of the transmitter system remain unchanged.

The integrated CAN bus interface transmits all relevant operating parameters and fault messages to the transmitter control unit. You can also call up such data via the Web interface of the transmitter control unit and thus optimally prepare for any servicing that may be required. Additional features are associated with the CAN bus but the actual function of the amplifier is not impaired if the connection to the CAN bus is missing.

## Advantageous logistics

The use of identical equipment parts in the R&S®NM/NW8200 and R&S®NH/NV8200 transmitter series also make this transmitter family logistically beneficial for transmitter operators (smaller inventory of spare parts).

You can easily switch from analog to digital operation or change the frequency since all frequency-dependent components are broadband and operate from 170 MHz to 254 MHz. This particularly applies to frequency-response-compensated directional couplers that are used to measure output power and reflection. If you change the frequency, you only have to change the transmit frequency. The modules do not have to be adjusted.

Redundant key modules such as exciter standby or fans in active standby ensure high operating reliability, even in single transmitters. In transmitter systems, operating reliability can be further enhanced by standby concepts such as active output stage standby, passive transmitter standby, passive exciter and output stage standby as well as n + 1 standby.

Uwe Dalisda; Reinhard Scheide

### Condensed data of the R&S®NM/NW8200

Frequency range	170 MHz to 254 MHz
RF output power	analog TV combined 750 W to 3 kW
	digital TV, DVB-T/-H 325 W to 1.95 kW
	digital TV, ATSC 485 W to 1.95 kW
Analog TV standards	B/G, D/K, M/N, I
Color transmission	PAL, SECAM, NTSC
Audio transmission	dual-sound in line with IRT
	FM single-sound and NICAM 728 (–13 dB / –20 dB)
	FM single-sound (–10 dB)
	BTSC multiplex channel
Dimensions (W × H × D)	600 mm × 2000 mm × 800 mm

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





Measurement	Poor		Excellent		Weight	Result
	No	Yes	No	Yes		
SYNC					70	15 points
LEVEL	-23.9 dBm	± 1 %	± 20 dBm	22 %	-20	1.16 % (of sum)
FREQUENCY OFFSET	409.5 Hz	± 20000 Hz	± 0 Hz	100 %	-	20 points
SYMBOL RATE OFFSET	349.2 Hz	± 10000 Hz	± 0 Hz	99.9 %	-20	1.54 % (of sum)
MER (RMS) (dB EQUALIZER ON)	41.3 dB	± 0 dB	± 0 dB	66.5 %	0.1	53 points
MER (RMS) % (EQUALIZER ON)		%	%	85.5 %	0.1	4.09 % (of sum)
EVM (RMS) (EQUALIZER ON)	0.52 %	%	%	85.5 %	0.1	68 points
MER (RMS) (dB EQUALIZER OFF)	30.1 dB	± 0 dB	± 0 dB	89.4 %	0.1	5.24 % (of sum)
MER (RMS) % (EQUALIZER OFF)	3.11 %	%	± 0 dB	8.833 %	0.1	71 points
		%	%	3.75 %	0.1	5.47 % (of sum)
		%	%		0.1	1 points
		%	%		0.1	7.71e-002 %
		%	%		0.1	3 points
		%	%		0.1	0.231 % (of sum)

FIG 1 The new R&S®EFA TxCheck software for the TV Test Receiver R&S®EFA evaluates test parameters fully automatically.

The new, free-of-charge R&S®EFA TxCheck software for the TV Test Receiver R&S®EFA (FIG 1) evaluates measurements performed on TV signals fully automatically and visualizes results in a straightforward manner. Plus, it performs a lot of routine tasks, thus reducing the work load for the operator.

### TV Test Receiver R&S®EFA

## Fully automatic quality control of TV signals

### Up to 30 fully automatic measurements

Rohde & Schwarz offers a wide range of T&M equipment for testing the quality of digitally modulated TV signals. The equipment includes industry-recognized, high-grade and mature test routines and also helps you analyze a large variety of parameters quickly and reliably. Interpreting results correctly, however, takes appropriate skills and experience. The new R&S®EFA TxCheck software from Rohde & Schwarz considerably facilitates this task and also frees you from routine work.

R&S®EFA TxCheck is installed on a PC, which is connected to the TV Test Receiver R&S®EFA via an RS-232-C or GPIB link, which may also be established using a USB adapter. The R&S®EFA performs the measurements and transfers the results to the PC, where they are processed and saved. The test receiver is controlled from the PC. A large number of measurements can thus be carried out fully automatically, so that no manual intervention is needed. The program performs up to 30 discrete measurements, depending on the digital TV standard selected.

## Evaluated and delimited

The program then evaluates each test parameter and displays results color-coded and stating a percentage value. Two limit values can be defined for each parameter: a lower limit (Poor), which is the alarm threshold, and an upper limit (Excellent), which is the ideal value. Results are marked in color ranging from green to red, depending on where they are positioned between the two limit values (FIG 2). Results are obtained using either linear, quadratic, exponential or logarithmic functions. If a result falls below the alarm threshold, the corresponding row in the table is shown with a red background (FIG 3). The parameter in question is also included in the summary at the end of the test report.

The R&S®EFA TxCheck software package contains templates for the DVB-T, DVB-C and J.83/A/B/C digital TV standards as well as for ATSC. These templates already include meaningful limit values for measurements on transmitters or cable TV modulators. The templates can of course be modified and saved as new files, allowing multiple members of a testing crew to use the same, customized templates.

## Weighted and concise

The straightforward test report greatly facilitates result interpretation. And this is not all R&S®EFA TxCheck can offer: Each measurement can be assigned a weighting factor that determines its impact on the overall result. Weighting factors can also be modified in the templates as well as exported and imported. As a final step, the software combines the results of all measurements in a single, cumulative value referred to as the EFA TxCheck quality value. This value is output numerically and as a color bar (FIG 4).

MEASUREMENT RESULTS					
<input type="checkbox"/> disable all	Measurement	Poor	Excellent	Weight	Result
	SYNC:	No	Yes		
<input checked="" type="checkbox"/> LEVEL:	-23.9 dBm	± 5 dB	± 20 dBm	70	15 points 1.16 % (of sum)
<input checked="" type="checkbox"/> FREQUENCY OFFSET:	409.5 Hz	± 30000 Hz	± 0 Hz	20	20 points 1.54 % (of sum)
<input checked="" type="checkbox"/> SYMBOL RATE OFFSET:	349.2 Hz	± 10000 Hz	± 0 Hz	20	20 points 1.54 % (of sum)
<input checked="" type="checkbox"/> MER (RMS) dB (EQUALIZER ON):	41.3 dB	30 dB	47 dB	80	53 points 4.09 % (of sum)
<input checked="" type="checkbox"/> MER (RMS) % (EQUALIZER ON):		3.2 %	4.5 %	80	68 points 5.24 % (of sum)
<input checked="" type="checkbox"/> EVM (RMS) (EQUALIZER ON):	0.52 %	2.2 %	3.2 %	80	71 points 5.47 % (of sum)
<input checked="" type="checkbox"/> MER (RMS) dB (EQUALIZER OFF):	30.1 dB	30 dB	42 dB	80	1 points 7.71e-002 %
<input checked="" type="checkbox"/> MER (RMS) % (EQUALIZER OFF):	3.11 %	3.2 %	8 %	80	3 points 0.231 % (of sum)

FIG 2 The R&S®EFA TxCheck software presents results color-coded and in a straightforward manner.

<input checked="" type="checkbox"/> BER AFTER RS:	0.	1E-7	1E-11	80	80 points 24.5 % (of sum)
<input checked="" type="checkbox"/> SHOULDER ATTENUATION (LOWER):	32.7 dB	35 dB	53 dB	65	0 points 0 % (of sum)
<input checked="" type="checkbox"/> SHOULDER ATTENUATION (UPPER):	40.8 dB	35 dB	53 dB	65	21 points 6.44 % (of sum)

FIG 3 Results outside the defined limit are highlighted in red.



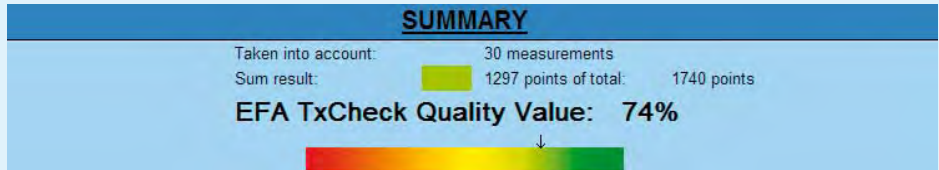


FIG 4 R&S®EFA TxCheck says it in a nutshell: The software combines all results in a single, conclusive value – the EFA TxCheck quality value.

► Complete recording of results

The R&S®EFA TxCheck software provides you with a complete report of a transmitter or modulator test at the press of a key. The report not only contains the measured data and its evaluation, but also important settings such as the frequency, SAW filters, loop bandwidths, etc. You can enter additional information on a measurement in a comment field. Moreover, up to eight graphic representations can be stored (FIG 5). Results are presented in a straightforward manner and can easily be archived and / or printed. Archiving requires only a limited amount of memory space.

R&S®EFA TxCheck frees you from having to perform time-consuming individual measurements that pose the risk of operator errors. Moreover, you no longer need to generate reports on your own or archive numerous individual results. The software comes in the new version 1.2 and can be used with all digital models of the R&S®EFA TV test receiver. It can be downloaded free of charge from the Rohde & Schwarz website (approx. 3.25 Mbyte).

Christoph Balz

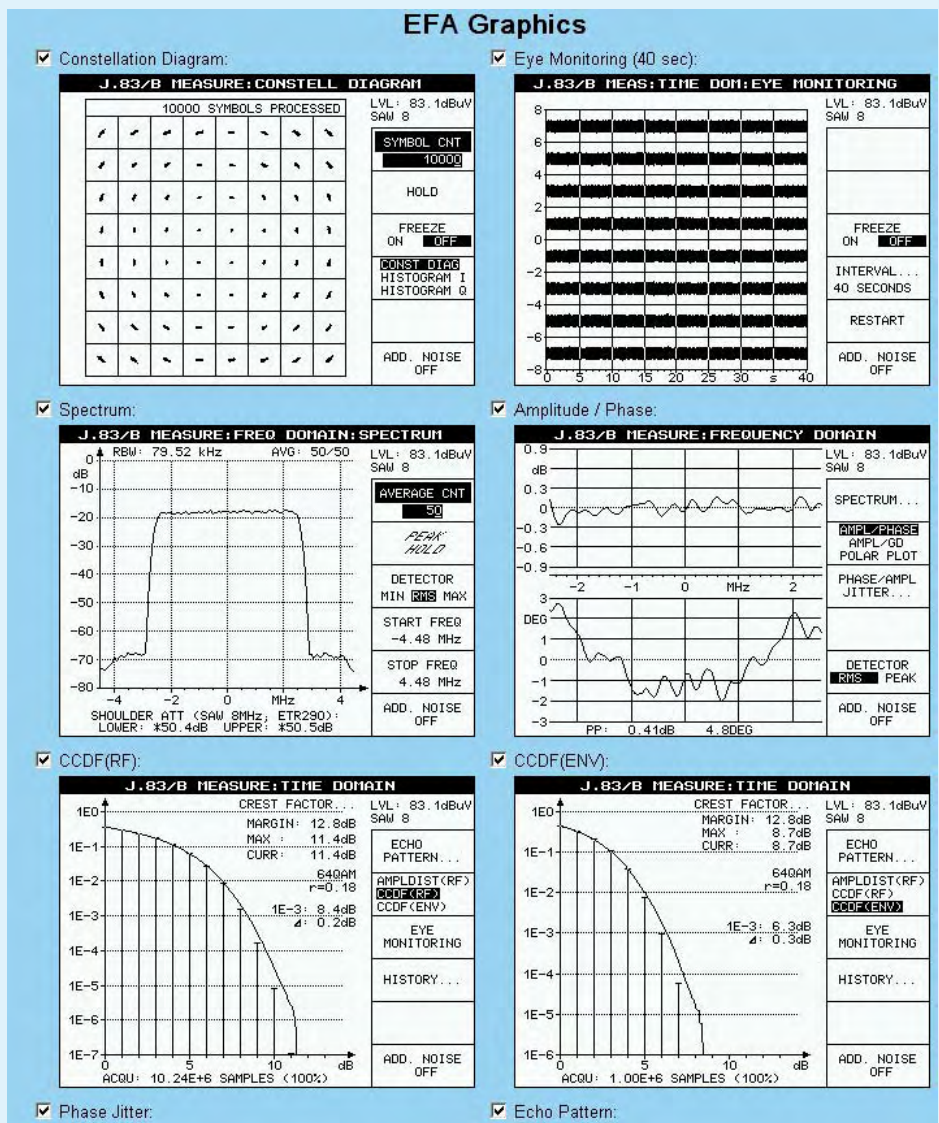


FIG 5 R&S®EFA TxCheck also outputs results in graphical form and saves the graphs.

R&S®EFA TxCheck software, more information and data sheets on the TV Test Receiver R&S®EFA at [www.rohde-schwarz.com](http://www.rohde-schwarz.com) (search terms: EFA/TxCheck)



## Air traffic control (ATC) system for Kabul airport

**R&S Systems GmbH, a wholly-owned subsidiary of Rohde&Schwarz, supplied an air traffic control system for Afghanistan's Kabul International Airport on behalf of the NATO Consultation, Command and Control Agency NC3A in Brussels. Despite the extremely short implementation schedule, the project was completed on time.**



**FIG 1 Tower building at Kabul airport: Communications technology from Rohde&Schwarz ensures air safety.**

### R&S Systems GmbH

R&S Systems GmbH, with headquarters at the Rohde&Schwarz Cologne Service Center, was founded on June 1, 2003 as a wholly-owned subsidiary of Rohde&Schwarz. The company provides system services within and beyond the Rohde&Schwarz business fields – from system integration to the delivery, assembly and commissioning of turnkey T&M and communications equipment for customers around the world.

In mid-April 2004, the NATO procurement department NC3A commissioned the Rohde&Schwarz subsidiary R&S Systems GmbH to equip the international airport in Kabul (FIG 1) with an air traffic control system. The schedule was tight: The air traffic control system needed to be ready for use by June 1, 2004. Based on the findings collected during a site survey and the experience gathered in previous ATC projects, R&S Systems GmbH worked out a basic concept. The resulting proposal for a flexible and easy-to-operate ATC system providing for various expansion options met with NATO approval.

In compliance with NATO requirements, eight VHF and four UHF transceivers of the R&S®Series 200 as well as the R&S®HK012 and R&S®HK014 antenna systems were installed within a period of two months (FIGs 2 and 3). The delivery also included a digital voice recording and replay system, operator consoles, an uninterruptible power supply as well as an aeronautical fixed telecommunication network (AFTN) terminal and a signal light gun. The system was handed over to ISAF and NATO on schedule in May 2004.



**FIG 2** The R&S®HK012 and R&S®HK014 antenna systems at Kabul airport.

**FIG 3** Equipment room with ATC system components.



▶ In a second phase, NATO placed an order in August 2005 for a modern VHF / UHF ATC Direction Finder R&S®PA120 featuring ground radio suppression, a second (redundant) voice recording system, a digital time clock system and robust and portable R&S®M3TR radio systems for the VHF and UHF bands.

As another requirement, NATO stipulated that essential ATC functionality would have to be maintained even in the event the tower had to be evacuated. The robust R&S®M3TR radio systems provide the operator with the required VHF and UHF frequencies and thus ensure that radio contact with aircraft will be maintained – under any conditions that may prevail within the mission environment and independent of external power supplies for several days at a time.

R&S Systems GmbH also provided support beyond the actual scope of the project during this phase, assisting NATO / ISAF in planning and implementing the infrastructure at Kabul International Airport. Compliance with NATO security requirements both with respect to civil and military aspects was an issue of priority.

In phase III, which followed in early 2006, automatic filters for main/standby operation as well as an airport terminal information service (ATIS) system were added to the radio system. Expansion of the system posed no problems due to the modular system concept. With phase III completed, the ATC system meets all current requirements and ensures that air traffic control at Kabul airport is performed in accordance with International Civil Aviation Organization (ICAO) rules using state-of-the-art equipment. Later expansion of the airport for civil use will also be possible without any problem.

R&S Systems GmbH successfully met the customer requirements specific to this project due to its many years of experience in the field of ATC and its very flexible handling of the project. NATO gave the project high marks for being dealt with in an extremely positive manner. A further order will involve the creation of operating instructions tailored to the requirements of frequently changing crews at the site of operation and thus ensuring smooth handover of the ATC system to the next crew.

Arnd Gresch

### Example of a single-source, turnkey ATC system

#### Hardware

- ◆ Radiocommunications system
- ◆ ATC direction finder
- ◆ Voice communications system
- ◆ Voice recording with independent replay system
- ◆ Meteorological equipment
- ◆ GPS time synchronization and display system
- ◆ Distress radio
- ◆ ATC consoles
- ◆ Uninterruptible power supply
- ◆ ATIS system
- ◆ AFTN terminal
- ◆ Signal light gun
- ◆ Optical precision approach system
- ◆ Equipment for maintenance and repair

#### Services provided by R&S Systems GmbH

- ◆ Site survey / on-site consulting
- ◆ System planning / implementation
- ◆ Handover
- ◆ After-sales support
- ◆ Training
- ◆ Maintenance and repair

Friedrich Schwarz retires from day-to-day operations –  
Michael Vohrer new President and CEO



Friedrich Schwarz



Michael Vohrer

**After 35 years as a President of Rohde & Schwarz GmbH & Co. KG, Friedrich Schwarz (66) retired from day-to-day operations at the end of 2005. During the last ten years, he was the Chairman of the Executive Board (President and CEO). His successor in this role is Michael Vohrer (58). Vohrer joined the company 30 years ago, and he has been a member of the Executive Board since 2003. This demonstrates the company's commitment to continuity. The three-member Executive Board also includes Manfred Fleischmann (53) and Christian Leicher (36).**

Under the leadership of Schwarz, Rohde & Schwarz evolved into a company group with an international presence. The independent, family-owned electronics enterprise today has offices and representatives in more than 70 countries. Over 90 percent of the addressed market is served by Rohde & Schwarz subsidiaries. Schwarz, son of one of the company's founders, furthermore made Rohde & Schwarz one of the world's most important players in the fields of test and measurement for wireless communications and electronics, secure radiocommunications, broadcasting and radiomonitoring. At the beginning of this year, he handed the reins over to Michael Vohrer. Friedrich Schwarz will, however, stay in close contact and keep an eye on the company's progress and will assist the Executive Board as an advisor, especially in strategic matters and corporate culture.

Prior to joining the Executive Board, Vohrer headed the Test and Measurement Division and significantly expanded the company's share in this segment of the world market.

Fleischmann and Leicher have been members of the Executive Board since January 2005. Leicher, grandson of one of the company founders and representative of the shareholders, left Sony Ericsson at the beginning of 2005 to join Rohde & Schwarz. Fleischmann has been with Rohde & Schwarz since 1985. He was Head of Quality Assurance and then Head of the Production and Materials Management Division. In 2001, he assumed responsibility for all production activities, and in 2005, he joined the Executive Board.

24-hour service around the world:  
Rohde & Schwarz Customer Support

Rohde & Schwarz now provides qualified round-the-clock phone and e-mail support to its customers around the world. The three customer support centers were synchronized so that one of them will always be available to answer your questions. All questions directed to the support centers are checked against a central database, in which all previous questions are stored. The database already contains over 94 000 answers relating to all Rohde & Schwarz equipment, and up to 150 new answers are added every day. The staff at each support center also informs the sales office in charge, which can then directly answer any further questions the customer may have. Contact our support centers at:

#### Customer Support Europe

+49 18 05 12 42 42  
customersupport@rohde-schwarz.com

#### Customer Support America

1-888-TESTRSA (1-888-837-8772) selection 2  
customer.support@rsa.rohde-schwarz.com

#### Customer Support Asia/Pacific

+65 65 1304 88 (Singapore)  
customersupport.asia@rohde-schwarz.com

#### Among Germany's most attractive employers

For the third year in a row, Rohde & Schwarz was ranked among the very best companies to work at in Germany. In the category of companies with more than 5000 employees, Rohde & Schwarz took third place, surpassed only by SAP in 1st place and Dow Chemical in 2nd place. The results are based on a representative survey of the companies' employees and a human resources culture audit. The competition is held annually by the psychonomics AG research and consulting institute in cooperation with the German business journal CAPITAL.

#### R&S®ZVT8 network analyzer wins "Best in Test" 2006

The editors of the US trade journal Test & Measurement World have chosen the Multiport Vector Network Analyzer R&S®ZVT8 as the winner in the "RF & Wireless Test" category. The prize

is awarded annually to especially innovative or user-oriented products. Companies and users were allowed to nominate products launched between November 2004 and October 2005 in 12 different categories. The editors were particularly impressed by the R&S®ZVT8's true multiport architecture, which allows it to achieve very short measurement times while maintaining high measurement accuracy and a wide dynamic range.

#### Environmental award for Rohde & Schwarz

Rohde & Schwarz has received an award from the ÖKO-PROFIT environmental protection program initiated by the city of Munich. In this program, companies headquartered in Munich work with external consultants to develop practical measures for reducing the burden on the environment and conserving resources. Last year, Rohde & Schwarz achieved the greatest reduction.



## ACCESSNET®-T – a success story

R&S BICK Mobilfunk brings TETRA to the Panama Canal

**R&S BICK Mobilfunk has set up the first digital radio network in Panama. The Panama Canal Authority (ACP), the operating company of the Panama government, will use the secure and stable TETRA network to operate, maintain and protect the canal.**

Almost 14 000 vessels transit the artificial waterway between the Atlantic and the Pacific each year. The TETRA system, therefore, must meet high security requirements especially in emergency situations. R&S BICK Mobilfunk was awarded the contract for the system last year following a public invitation to tender issued by the Datatel company of Panama. The ACP staff maintains vessel service on the Panama canal round the clock. Stable and, above all, fail-safe radio coverage is the key to ensuring smooth operation and responding quickly in the event of malfunctions or emergencies. For the TETRA network, R&S BICK Mobilfunk supplied exchanges and base stations of its ACCESSNET®-T prod-

uct series 600, which features redundancy of all infrastructure elements. In addition, the entire network management system, the antennas and the connecting network were designed with redundancy. The ACCESSNET®-T system was enhanced by applications that allow alarm messages to be rapidly forwarded to the staff in charge. An integrated multimessaging portal transfers the messages to the customer's corporate network and distributes them as short data service (SDS) via e-mail. An IP access point (IAP) was also installed. This fully IP-based application allows packet data to be exchanged between the ACCESSNET®-T TETRA system and the user's web server. In the future, the TETRA system will transmit alarms, e.g. to signal a malfunction or the need for servicing, also to other external communications systems such as GSM networks or the Internet. R&S BICK Mobilfunk handed the system over to the ACP at the end of January 2006.

ACCESSNET®-T will enhance safety at Moscow Metro

**ICS New Systems, an official systems partner of Rohde & Schwarz, has been awarded the contract for supplying Moscow's underground railway (Metro) with a digital TETRA radio system. Moscow's seven Metro lines and their public emergency call system will thus be able to rely on a secure and modern communications system.**

The order includes two ACCESSNET®-T DMX-521 switches (digital mobile exchanges), twelve DOB-550 base stations for two carrier signals each, and a network management system. Another special feature is the redundancy concept, which will make the system more failsafe. ICS New Systems has a major role in designing the system and will also install the radio system to be supplied by R&S BICK Mobilfunk.

ACCESSNET®-T now also provides secure communications in Hamburg and Leipzig

**Udo Nagel, city commissioner in Hamburg, placed the city's digital World Cup network into operation during a press conference held February 16, 2006. The network provides key locations in the city with a tap-proof and extremely reliable radiocommunications system, thus enhancing public safety.**

In addition to Hamburg, R&S BICK Mobilfunk will also set up its ACCESSNET®-T TETRA system in the city of Leipzig. Like their Hamburg counterparts, the Leipzig police will thus be able to use the network for secure, confidential communications during the World Cup.

TETRA system in operation during the 3rd West Asian Games

**Just a few months after the order was placed, the expanded ACCESSNET®-T mobile radio system from R&S BICK Mobilfunk has been successfully launched in Qatar: In accordance with the contract, the city of Doha was supplied with TETRA mobile radio equipment for the 3rd West Asian Games in December 2005.**

At the end of July 2005, R&S BICK Mobilfunk was commissioned by Qtel (Qatar Telecom) to expand the existing TETRA network. The order included delivering 15 additional indoor and outdoor base stations plus another ACCESSNET®-T exchange and putting them into operation. The West Asian Games are a large-scale sporting event with over 1200 athletes from 13 countries and regions across West Asia held every four years.

Together with its local partner, Consolidated Gulf Company (CGC), R&S BICK Mobilfunk is currently setting up a nationwide digital radio network for the Asian Games, also held in Qatar. From July 2006, companies as well as rescue services and security forces in Qatar will be able to communicate with one another over the public network commissioned by the operator, Qtel (Qatar Telecom). The job for which this order was placed is already part of the third expansion phase. The Asian Games are the second-largest sports event in the world, surpassed only by the Summer Olympic Games.



How ten years have flown

**ROHDE & SCHWARZ India Pvt. Ltd. celebrated its tenth anniversary in autumn last year**

Rohde & Schwarz's engagement in India goes back to the 1950s, when Dr Rohde made the acquaintance of Dr G. R. Toshniwal of M/s Toshniwal Brothers while flying on the same plane. The two companies soon began working together, and M/s Toshniwal Brothers subsequently became Rohde & Schwarz's representative in India. The first office with a staff of eight was set up in 1987 in New Delhi. In 1995, Friedrich Schwarz inaugurated ROHDE & SCHWARZ India Pvt. Ltd., a wholly-owned Rohde & Schwarz subsidiary, which now has offices in New Delhi, Bangalore, Hyderabad and Mumbai.

**Chinese regulatory authority awards contract to Rohde & Schwarz**

**Radio resource management (RRM) is important for network operators and mobile phone manufacturers in order to optimize their service quality. When a mobile phone travels from one base station to another, it must detect the best cell and register with it as fast as possible. RRM tests are performed to determine whether the mobile phone functions in accordance with specifications in this situation; this is the only way to ensure that data can be transmitted smoothly by as many mobile phone subscribers as possible.**

After opening an invitation for tenders in summer 2005, the China Academy of Telecommunication Research (CATR) was so impressed by the R&S®CRTU-RRM system from Rohde & Schwarz that it selected this solution for RRM certifica-



The staff of ROHDE & SCHWARZ India Pvt. Ltd.



tion. Rohde & Schwarz is providing the Chinese regulatory authority with a complete system for which the most test cases defined in Specification 34.121 Chapter 8 are validated worldwide.

MTNet, a CATR laboratory, had already ordered the R&S®TS8950-W test system from Rohde & Schwarz in 2003. The latest transaction with CATR – through its MTNet and CCTL labs – further strengthens Rohde & Schwarz's position on the Chinese mobile radio market.

**Promoting tomorrow's workforce also in Asia**

**The Rohde & Schwarz Singapore subsidiary is investing in tomorrow's workforce. At the end of 2005, the Rohde & Schwarz test center at Nanyang Polytechnic was put into operation. This marks the company's first presence at an Asian educational institution.**

Chang Yew Meng, head of the test center, and Lim Boon Huat, Managing Director of Rohde & Schwarz Systems and Communications Asia, signed the agreement of cooperation. Nanyang Polytechnic (NYP), with 40 000 students, is an edu-

cational leader in Singapore. It is renowned for its high level of expertise in wireless communications. Rohde & Schwarz plans to develop T&M solutions for customers in the Asia Pacific region in collaboration with the test center at NYP. The center relies on the scientific expertise of NYP in design engineering, embedded and IC design, wireless technologies and software development. Students have the opportunity to complete their dissertations using equipment from Rohde & Schwarz. The presence of Rohde & Schwarz at NYP will also strengthen its position in the wireless community, which is promoted by the government.

Chang Yew Meng, head of the test center (left), and Lim Boon Huat, Managing Director of Rohde & Schwarz Systems and Communications Asia, signed the agreement of cooperation.



Training facilities at Rohde & Schwarz test center at Nanyang Polytechnic.





**ROHDE & SCHWARZ**

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