News from Rohde & Schwarz

R&S Smart Instruments™ –
revolution in the lowest price class

Tried-and-tested spectrum monitoring software
now available in a completely updated version

Advanced communication technology
for global radio networks

2003/I
177

ROHDE&SCHWARZ

The R&S FS300 is a new, favourably priced spectrum analyzer – the first of the Family 300 – which is particularly notable for its extremely versatile applications in lab, service and production (pages 20 and 24).

43962

The RF Test System R&S TS8965 for the *Bluetooth* communication standard has been designed for use in development, prequalification and quality assurance (page 6).

The new Family 300 from Rohde&Schwarz and what is behind it … (page 24).

MOBILE RADIO

Trunked radio systems

Multi-Messaging Portal R&S MMP-500 for *ACCESSNET*®-T
Multi-messaging in realtime 4

Test systems

◁ RF Test System R&S TS8965
Flexible upgrading from base system to full-compliance test solution 6

Radiocommunication testers

Universal Radio Communication Tester R&S CMU200
Signalling and RF measurements for WCDMA 9
User-specific correction of frequency response and level response 12
Enhanced *Bluetooth*™ measurements 15

Radio Communication Tester R4870 (*Bluetooth*) from Advantest
RF and communication tests according to the *Bluetooth* SIG standard 17

GENERAL PURPOSE

Spectrum analyzers

Spectrum Analyzer R&S FS300
Favourably priced and universal for laboratory, service and production 20

Measuring instruments

◁ Family 300 – the strategy for the future 24

Test cells

Extreme Temperature Tester R&S E-Line
Shielded test cell for temperature tests in production 26

Providing a sound basis for the discussion about the effects of electromagnetic fields, especially those generated by mobile radio, requires comprehensive short-term and long-term measurements – and the Portable System for EMF Measurements R&S TS-EMF is the ideal tool for performing them (page 29).

Spectrum Monitoring Software R&S ARGUS – core of the software packages for the Spectrum Monitoring and Management System R&S ARGUS-IT and the Coverage Measurement System R&S ARGUS-FMTV – is now available in version 5 (page 46).

EMC / FIELD STRENGTH

Measurement systems

◁ Portable System for EMF Measurements R&S TS-EMF
Accurate measurements of electromagnetic fields caused by transmitter systems 29

BROADCASTING

Test transmitters

TV Test Transmitter R&S SFQ / R&S SFL
ISDB-T – Digital terrestrial broadcasting in Japan 32

Generators

MPEG2 Generators R&S DVG / R&S DVRG
Transport stream signal library for comprehensive tests in production 37

TV transmitters

DTV Exciter R&S SV702: Compact exciter for digital terrestrial TV 40

Transmitter network monitoring

R&S NetLink: Enhanced capabilities for management of broadcasting networks 42

RADIOMONITORING

Monitoring systems

Monitoring and coverage measurement systems: Expanded system devices line 44

Spectrum Monitoring Software R&S ARGUS
◁ The successful "classic" now available as version 5 46

RADIOCOMMUNICATIONS

Radio networks

Information & Communication System R&S PostMan II
Advanced communication technology for global radio networks 51

MISCELLANEOUS

Newsgrams 54

Published by Rohde & Schwarz GmbH & Co. KG · Mühldorfstrasse 15 · 81671 München
Support Center: Tel. (+49) 018 05 12 42 42 · E-mail: customersupport@rohde-schwarz.com
Fax (+49 89) 41 29-137 77 · Editor and layout: Ludwig Drexl, Redaktion – Technik (German)
English translation: Dept. 9UK7 · Photos: Rohde & Schwarz · Circulation (German, English and French) 90 000
approx. 4 times a year · ISSN 0028-9108 · Supply free of charge through your nearest Rohde & Schwarz representative · Printed in Germany by peschke druck, München · Reproduction of extracts permitted if source is stated and copy sent to Rohde & Schwarz München.

Multi-Messaging Portal R&S MMP-500 for *ACCESSNET*®-T

Multi-messaging in realtime

The Multi-Messaging Portal R&S MMP-500 connects the TETRA *ACCESSNET*®-T mobile radio systems to the Internet and thus to corporate networks as well. This provides mobile subscribers using professional radio with access to information, data applications and messaging services.

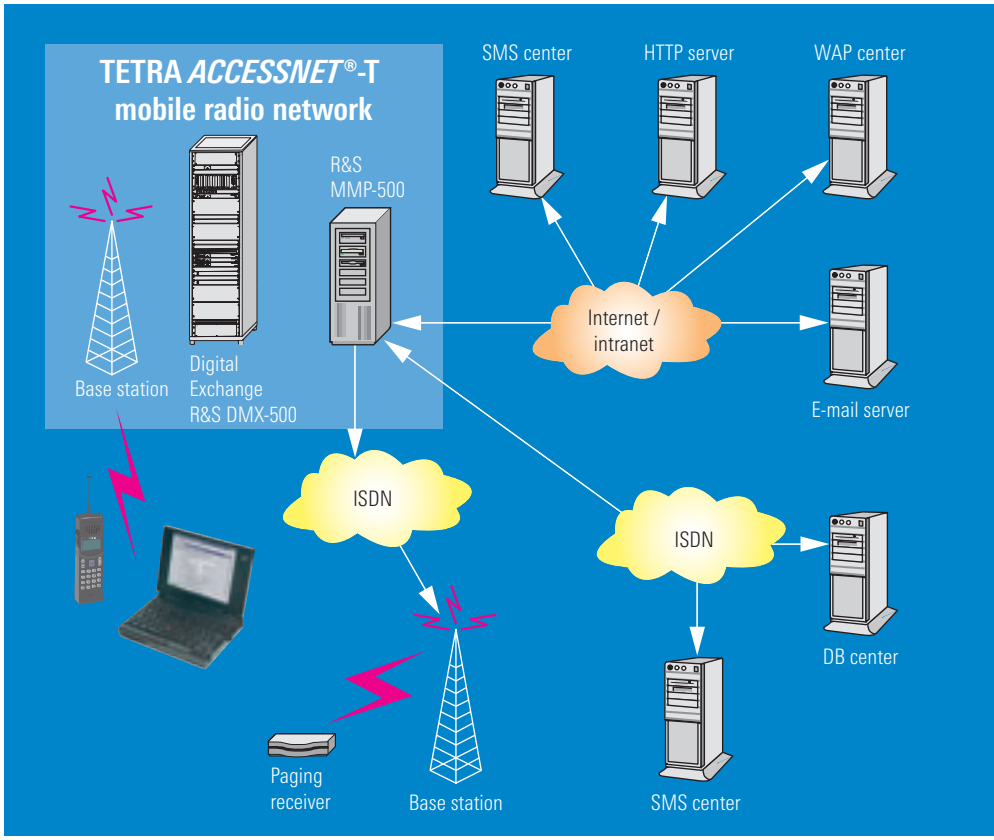


FIG 1 The Multi-Messaging Portal R&S MMP-500 connects *ACCESSNET*®-T trunked radio systems to the Internet and thus to all message- and data-oriented services.

FIG 2 The software for the Multi-Messaging Portal R&S MMP-500 is installed on a high-availability, PC-compatible processor.

Photo: R&S BICK Mobilfunk

New means of communication

By using the R&S MMP-500, operators of TETRA *ACCESSNET*®-T mobile radio networks provide closed user groups and individual subscribers with homogeneous access to both the Internet and the associated data and communication networks. The capacity and services of the portal can be scaled to a broad range of requirements.

The R&S MMP-500 opens up completely new means of communication to stationary and mobile corporate staff. Specifically, mobile employees can optimally be integrated into a company's communication network, including e-mail service.

The R&S MMP-500 is implemented as a gateway between an *ACCESSNET*®-T mobile radio network and the Internet, allowing access to all service centers that can be reached via the Internet (FIG 1). To allow the exchange of e-mail, short data service (SDS) and SMS, a Smart SDS Center has been integrated for storage and delivery when the TETRA subscriber is accessible.

The R&S MMP-500 is connected to a Digital Exchange R&S DMX-500 via the *ACCESSNET*®-T common application pro-

grammers interface (A-CAPI). Connections to external data services are established via commercial interfaces and protocols such as HTTP, POP, X.25 or IP, to name just a few. In addition, firewall functionality is an integral part of the R&S MMP-500.

Design of the R&S MMP-500

The R&S MMP-500 consists of a conventional high-availability, PC-compatible processor running under the Linux operating system and the MMP software package (FIG 2). It has a local subscriber database for parameterizing the subscriber administration data.

The transmission methods support both packet and circuit mode data. To ensure compatibility with GSM networks, the size of TETRA SDS messages can be limited to 160 characters.

Smart SDS Center

The short data service in an *ACCESSNET*®-T mobile radio network is normally a real-time service, i.e. the SDS message will be delivered without delay if the called subscriber is available. If the subscriber is not immediately available, the Smart SDS Center stores the message in the R&S MMP-500 and then delivers it automatically when the subscriber becomes available (FIG 3). The storage duration can be defined in the subscriber database.

Rejected deliveries (e-mail or SDS messages) are reported to the sender along with the reason. For example, if a TETRA subscriber sends a message to an unknown e-mail address, the subscriber is notified with a standard text via SDS.

If an e-mail is sent to an unknown TETRA subscriber in the R&S MMP-500 or if the subscriber's receive limit has been reached, the sender is informed accordingly. E-mail file attachments are usually disregarded.

Authorization of e-mail subscribers

A PIN process ensures that only e-mail subscribers with PIN authorization are allowed to send messages to TETRA subscribers. Access via non-existing e-mail identities is not possible, because the required PIN cannot be delivered in this case. This also prevents automatic, program-controlled sending of e-mail with intermediate changing of the e-mail identity (mail bombing).

Since the number of authorized e-mail subscribers and their messages within a period of days, weeks or months can be restricted, the TETRA system is not likely to be overburdened. Configuration mechanisms can also be used to block specific subscribers or entire domains from using the e-mail service.

Harald Haage; Max Zerbst

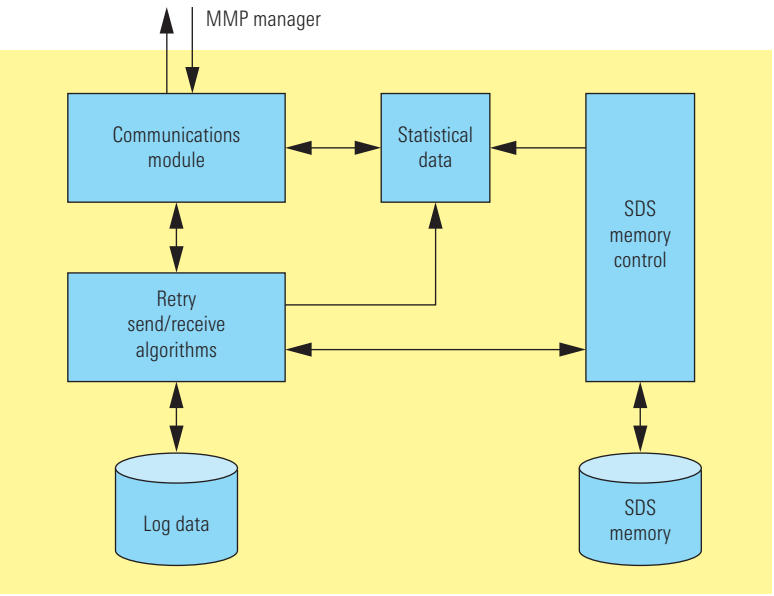


FIG 3
Function of the Smart SDS Center in the Multi-Messaging Portal R&S MMP-500.

FIG 1 Basic configuration of the RF Test System R&S TS8965.

Bluetooth™

RF Test System R&S TS8965

Flexible upgrading from base system to full-compliance test solution

The new modular RF Test System R&S TS8965 for the *Bluetooth* communication standard has been designed for use in development, prequalification and quality assurance. The system can also be upgraded to the tried-and-tested full-compliance Test System R&S TS8960.

Simple adaptation to requirements

The base system includes two measuring instruments, an RF unit and a controller (FIG 1). With this configuration, up to 12 or 16 test cases of the *Bluetooth** RF test specification can be performed. The base system can be upgraded to the validated full-compliance RF Test System R&S TS8960 [*] with the aid of five options.

This flexibility allows users performing *Bluetooth* measurements to first choose an economical solution that fits their budget and test requirements, and then to upgrade the system later. A main advantage of this new test system concept is that it uses the same measuring instruments and test methods as the full-compliance Test System R&S TS8960. Thus, if a DUT passes a test performed with the precompliance Test System R&S TS8965, it will most likely also pass the qualification tests in a test house.

* *Bluetooth* is a registered trademark of Bluetooth SIG, Inc., USA, and is licensed to Rohde&Schwarz.

Components of base system

The base configuration of the R&S TS 8965 includes a Spectrum Analyzer R&S FSP 3, the *Bluetooth* signalling unit, an RF unit (Signal Conditioning Unit R&S SCU) and a System Controller R&S PSM 12 (FIG 1). The SCU consists of a 4-way combiner, a directional coupler, two isolators and an attenuator.

The 12 test cases of the *Bluetooth* RF test specification that can be performed with the base system comprise the following measurements:

- Output power
- Power density
- Power control
- TX output spectrum
  - Frequency range
  - 20 dB bandwidth
  - Adjacent-channel power
- Modulation characteristics
- Initial carrier frequency tolerance
- Carrier frequency drift
- Sensitivity
  - Single slot
  - Multislot
- Maximum input level

The *Bluetooth* signalling unit includes a level control module permitting the required signalling and payload signal levels to be set by way of TCP/IP via the Ethernet interface. In the base configuration, this module also serves as a payload signal source for receiver test cases.

Gradual upgrade by options to full-compliance test system

With the aid of five options, the base system can be gradually adapted to increasing requirements (FIG 2 and 3).

Option 1 – Spurious emissions

When the base system is equipped with option 1, the test cases for spurious emissions can be performed in line with the ETS 300 328 and FCC Part 15.247(c) standards. The available frequency range depends on the model of the Spectrum Analyzer R&S FSP (3 / 7 / 12.75 GHz). Since the measurements are performed without bandstop and high-pass filters, spurious emissions in the vicinity of the carrier can only be measured to a limited extent.

Main characteristics of the RF Test System R&S TS 8965

- Compact, powerful and favourably priced
- Modular design: the base system can be upgraded in five steps to the full-compliance Test System R&S TS 8960
- Same measuring instruments, test methods and operating software (graphical user interface) as the R&S TS 8960
- Variable test case parameters

Option 2 – C/I performance

Option 2 includes the Vector Signal Generator R&S SMIQ 03 B and considerably extends the test system's function range. When receiver test cases are performed, the generator acts as a payload signal generator like in the R&S TS 8960. As a result, the "dirty transmitter" function of the vector signal generator can be used for sensitivity tests.

Available options

Option	Hardware	Function
1 – Spurious emissions	–	◆ Test of spurious emissions up to 3 / 7 / 12.75 GHz
2 – C/I performance	◆ Vector Signal Generator R&S SMIQ 03 B	◆ C/I performance test ◆ "Dirty transmitter" function for sensitivity tests ◆ Blocking test up to 3 GHz
3 – Blocking performance	◆ Microwave Signal Generator R&S SMR 20	◆ Blocking test up to 12.75 GHz ◆ Intermodulation test with option 2
4 – RF calibration	◆ Power Meter R&S NRVD ◆ Sensor R&S NRVD-Z1	◆ Path calibration (R&S SMIQ 03 B, e.g. from option 2, is required in addition)
5 – Upgrade to R&S TS 8960	◆ RF Switch Matrix R&S SSCU-BT ◆ Vector Signal Generator R&S SMIQ 03 B ◆ RF Attenuator R&S RSP ◆ Sensor R&S NRV-Z1	◆ All 16 validated test cases ◆ Automatic path calibration ◆ System selftest

FIG 2 Options for adapting the base system to increasing requirements.

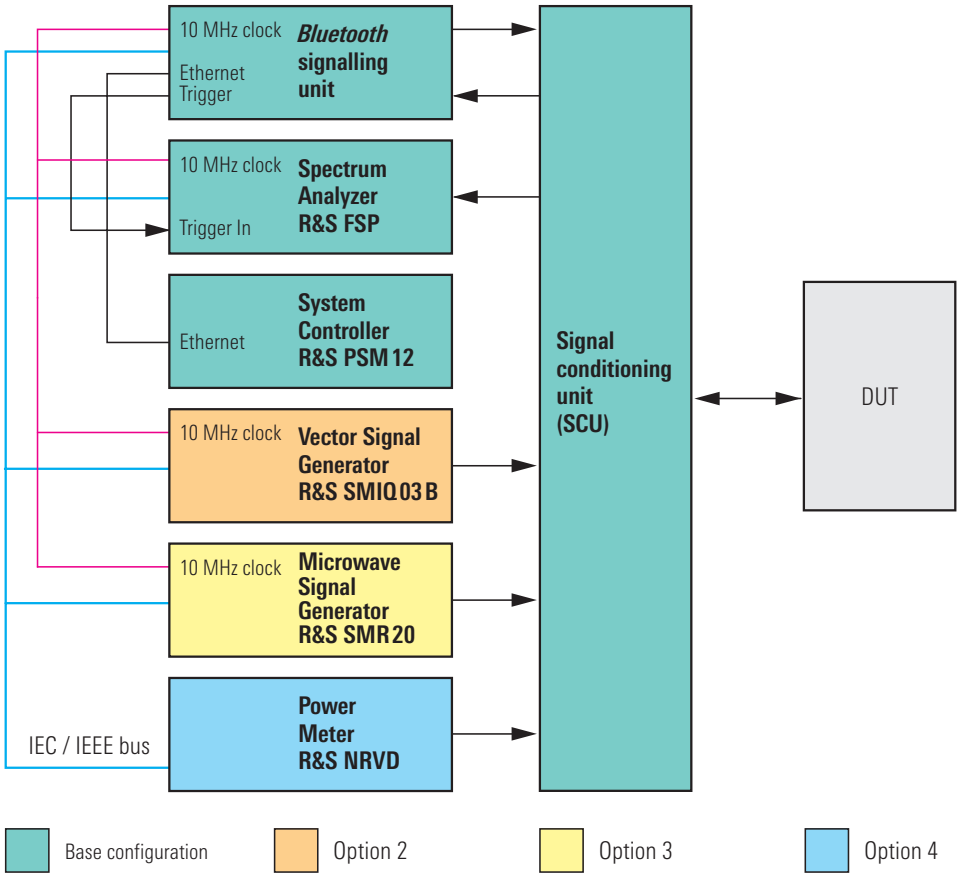


FIG 3 Options 2, 3 and 4 for the RF Test System R&S TS 8965.

Option 2 adds two test cases to those of the base configuration, the C/I performance test and the blocking test. When C/I performance tests are carried out, the *Bluetooth* signalling unit provides the payload signal and the R&S SMIQ 03 B a *Bluetooth* modulated RFI signal. With this option, the blocking test can only be performed up to 3 GHz because of the limited frequency range of the R&S SMIQ 03 B.

Option 3 – Blocking performance

If a blocking test up to 12.75 GHz is to be performed, as is prescribed by the test specification, the Microwave Signal Generator R&S SMR 20 of option 3 is required. If options 2 and 3, i.e. an R&S SMIQ 03 B and an R&S SMR 20, are available, the intermodulation test cases can also be performed.

Option 4 – RF calibration

The base configuration of the SCU is designed for 16 test cases so that it need not be updated when options are added. The SCU is calibrated prior to delivery. Calibration should be repeated once a year. This procedure ensures that measurements can be performed with an accuracy only slightly lower than that prescribed by the test specification.

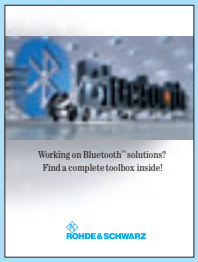
If a higher measurement accuracy is required, the RF calibration option can be used. The system can be calibrated by the user with the aid of the Power Meter R&S NRVD, Sensor R&S NRV-Z1 and the associated path calibration software. With this configuration, the measurement accuracy of the *Bluetooth* test specification can be attained with only a few restrictions which mainly concern signal quality (e.g. modulation accuracy) and signal stability.

Option 5 – Upgrade to full-compliance Test System R&S TS 8960

Option 5 upgrades the R&S TS 8965 to the R&S TS 8960. Based on a system equipped with options 1 to 4 (R&S SMIQ 03 B, R&S SMR 20, R&S NRVD), this upgrade kit comprises an RF Switch Matrix R&S SSCU-BT, another R&S SMIQ 03 B, an additional Sensor R&S NRV-Z1, the RF Attenuator R&S RSP, a comprehensive calibration and selftest software as well as 16 validated test cases. With this complete solution, all test cases can be performed in line with the test specification.

Wilfried Tiwald

More information and test systems for *Bluetooth* at www.rohde-schwarz.com (search term: Bluetooth)



Flyer *Bluetooth*: Main measuring instruments and systems from Rohde & Schwarz for measurements on *Bluetooth* devices.

REFERENCES

[*] RF Test System R&S TS 8960 – *Bluetooth*™ qualification in development and quality assurance. News from Rohde & Schwarz (2001) No. 172, pp 4–7

Other references:

- Bluetooth RF Test Specification 1.1, Revision 0.91, 2 July 2001
- Bluetooth Core Specification, Revision 1.1, 22 February 2001

Universal Radio Communication Tester R&S CMU 200

Signalling and RF measurements for WCDMA

Owing to the R&S CMU 200, Rohde & Schwarz was intrinsically involved in the development of the WCDMA standard right from the beginning. The fast and accurate radio tester now also masters signalling with combined RF measurements for WCDMA.

43238/16n

The trend toward higher data rates continues

The delays with UMTS are a controversial topic currently debated among the public. Time and again, the high financial burden, resulting for example from the steep license costs and the necessarily complex technology, is quoted as an impediment. While some operators are reporting delays in the network start, various established standards such GSM or its follow-on development GPRS are already offering data-intensive services such as multimedia message service (MMS). The WCDMA technology used in UMTS will promote these fast applications and open up new possibilities.

More articles on the R&S CMU 200: see page 12 and page 15.

With its Universal Radio Communication Tester R&S CMU 200, Rohde & Schwarz contributed step by step to the technical development of the WCDMA standard – ranging from the first module developments to testing in trial networks. At the beginning, T&M technology ensured the transmitter characteristics [1], followed by the WCDMA generator functionality [2], which simulates the physical channels of a WCDMA cell and provides a means of checking the DUT receiver for different synchronization and decoding capabilities up to BER and BLER evaluation.

The R&S CMU-K67, -K68 and -K69 WCDMA signalling options are new on the market. As with real field operation, the R&S CMU 200 controls the DUT exclusively via the radio interface. Specific basic functions, such as incoming or outgoing calls, can be easily tested. Moreover, it is possible to put the mobile phone in a mode that permits conclusive and detailed RF measurements. In this case, it is not the network, but the software in the radio tester that controls the integrated UMTS protocol and the associated RRC, RLC, MAC and PHY layers. Owing to multipurpose parameters, the general analysis conditions can be flexibly configured via the display or the remote-control interface of the R&S CMU 200. FIG 1 shows an excerpt of the checkable default functions of a phone.

Transmitter measurements

T&M technology and the high accuracy of the WCDMA transmitter measurements have already been detailed in [1]; a concise overview is given below:

- **Power evaluation**
  Max / min / off power, inner loop power control
- **Modulation quality**
  Error vector magnitude, magnitude error, phase error, IQ offset, IQ imbalance, waveform quality
- **Code domain power**
- **Spectral evaluation** (FIG 2)
  Adjacent channel leakage power ratio, spectrum emission mask, occupied frequency bandwidth

Receiver measurements

With receiver measurements, the DUT has to demodulate and descramble the downlink (DL) signal generated

by the tester and decode the information bits. This process must then be mirrored for the uplink (UL) signal so that the information the DUT contains is returned to the tester. For this purpose, the R&S CMU 200 switches the phone to loopback mode by using a command defined in layer 3, and compares the data received with the data previously transmitted. The specifications according to 3GPP 34.109 define a specific test mode and test loop for these purposes, which are mandatory for 3GPP phones.

Moreover, 3GPP TS34.121 defines reference measurement channels (RMC) for RF measurements. They are configured by the tester after the successful call setup via signalling on the dedicated radio link; a useful scenario for BER tests is thus generated. The R&S CMU 200 supports the receiver measurements for different data rates.

Test function	Test method	Functions checked
Call to telephone	MTC (mobile terminated call)	◆ Telephone synchronization to the base station signal in the time and frequency domain ◆ Decoding of signalled system information at the telephone end ◆ Call setup via information exchange with standard signalling protocol on the RRC, RLC, MAC, PHY layers ◆ Basic telephone test such as ringing tone, display information, etc
Call from phone to R&S CMU 200	MOC (mobile originated call)	◆ Same as for MTC ◆ Telephone keyboard via displayed call number in the R&S CMU 200
Replacing at the phone end	MIR (mobile initiated release)	◆ Standard disconnect
Replacing at the base station end	NIR (network initiated release)	◆ Standard disconnect
Immunity of connection	Temporary switchoff of the tester signal, comparable to shadow effects in the field, etc	◆ Immunity or sensitivity of the phone regarding synchronization interference
Speech intelligibility	Echo test on speech channel	–

FIG 1 Excerpt of the checkable basic functions of a telephone.

In compliance with the 3GPP specification, the BER measurement should not be performed at the lowest physical layer, but at the transport block layer, i.e. at the interface between layer 1 and layer 2. The evaluation of the receiver quality thus not only includes the characteristics of the RF modules on the air interface, but also the quality of the baseband error correction implemented in the DUT. This test philosophy comes very close to the real operating conditions.

Bit error rate (BER)

The BER is calculated from the bit errors in the data fields of the transport data blocks that are usually used for information bits of a dedicated link:
BER = bit error / (total number of information bits received by the tester in the loopback) × 100 %.

Block error rate (BLER)

If cyclic redundancy check (CRC) errors are detected in the decoded transport blocks or checksums, the entire block is marked as faulty. The DUT must therefore forward its CRC – decoded in the downlink – via the uplink to the tester. FIG 3 illustrates the flow of the transport block data and the CRC checksum from the tester to the DUT (DL) and back (UL).

Interaction of signalling and T&M technology

In addition to the conventional transmitter and receiver measurements, CDMA systems also offer combined signalling and measurement functions which require synchronized interaction of these two units in the radio tester. The TPC stimulation and inner loop power (ILP) measurement detailed below illustrate this interaction.

Fast power control is crucial in CDMA radio networks to ensure optimum connections (e.g. for speech or data transmission) while keeping the use of resources to a minimum – under varying propagation conditions.

Operation, display means and remote-control command set for measurement and WCDMA signalling menus correspond to the other R&S CMU 200 standards. Users already familiar with this tester master these quickly and can easily adjust existing remote-control scripts of other function groups to match WCDMA applications.

The 3GPP specifications classify the physical layer into frames (10 ms each) and slots (15 timeslots per frame). For each timeslot (667 µs), two transmit power control (TPC) bits are reserved in the physical layer on the dedicated physical control channel (DPCCH) of the downlink signal. The significance of these bits is to cause spontaneous power variation (approx. 300 µs later) at the beginning of the next uplink timeslot. The magnitude of the reference power variation (1 dB, 2 dB or 3 dB), in turn, is a parameter signalled by the higher layers when a dedicated connection (radio bearer setup) is established; it must be decoded correctly by the DUT.

FIG 4 shows how a mobile phone responds to the stimulation for power increase by means of a DL TPC sequence of ten "1" bits and subsequently ten "0" bits (attenuation of power). The output power of the mobile phone follows these commands. In addition to the power variation per step – the reference value is 1 dB in the above example – the integration of ten subsequent steps is rated against a minimum and a maximum value, as stipulated by the 3GPP specifications.

The R&S CMU 200 users will embrace the different means for evaluating the quality of mobile phones by using technical data as well as the subjective capability of this tester to evaluate the DUTs. For example, the user can now establish a speech connection between the R&S CMU 200 and the mobile phone. If the user speaks into the microphone of the mobile phone, this signal is transmitted via the speech channel to the tester, where it is decoded and returned as an echo at a delay, and is then output at the loudspeaker of the telephone.

FIG 2
Graphical menu with modulation evaluation.

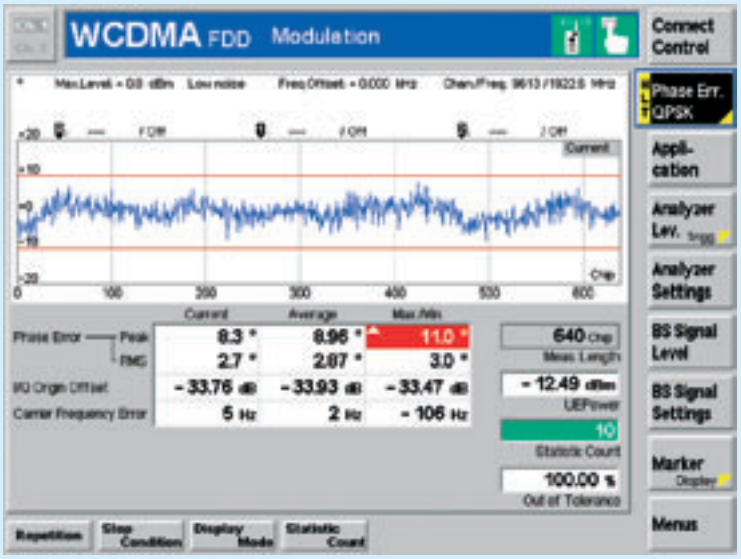


FIG 3
Layer1 (L1) receive and transmit path with loop in DUT for e.g. RMC at 12.2 kbit/s.

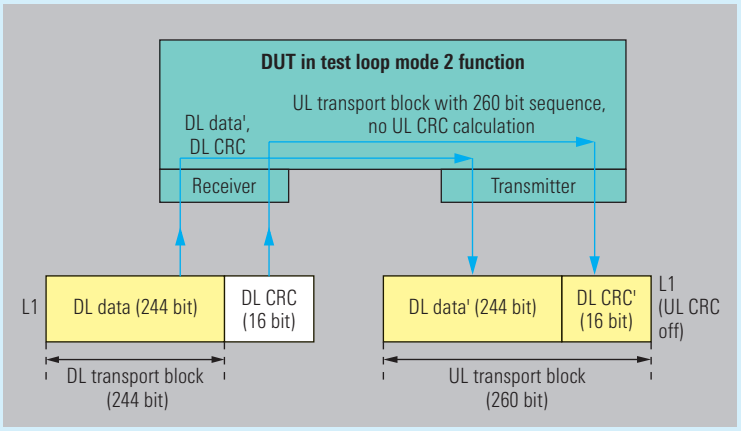
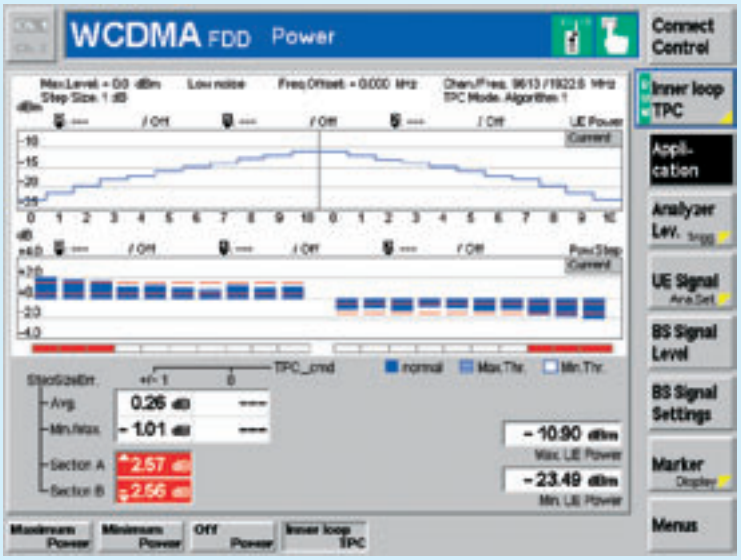


FIG 4
DUT reaction to the stimulation by a DL TPC sequence of ten "1" bits (power increase) and, subsequently, ten "0" bits (power attenuation).



High measurement speed and flexibility

Since the R&S CMU 200 was also designed for production-related applications, Rohde & Schwarz paid particular attention to high measurement speed and accuracy right from the start of the tester development. Users involved in the hardware or software development of a WCDMA telephone can generate a large number of test setups by means of the flexible parameterization of the measurement and signalling functions. Right now, with UMTS still on its marks, users benefit from the joint platform components of the Protocol Tester R&S CRTU-W and the R&S CMU 200. The protocol tester is thus able to integrate possible changes in the 3GPP standard into the signalling unit of the radio tester, keeping time delay to a minimum.

If the R&S CMU 200 is fitted with the optional IQ/IF Interface R&S CMU-B17 [3], it is possible to couple or decouple directly at the baseband or in the IF of the DUTs, enabling the testing of pure baseband or RF module characteristics.

Summary

The R&S CMU 200 as a multimode tester is able to test in a single test sequence DUTs that can contain modules for WCDMA, GSM and *Bluetooth*. Since practical UMTS applications are still in their infancy, other versatile test functions, also between the different cellular standards, will be developed on this basis.

Pirmin Seebacher

REFERENCES R&S CMU 200
[1] First WCDMA measurement functions. News from Rohde & Schwarz (2001) No. 171, pp 13–15
[2] WCDMA generator for fast testing of 3G mobile radios. News from Rohde & Schwarz (2002) No. 173, pp 9–11
[3] Optional IQ and IF interfaces for new applications. News from Rohde & Schwarz (2002) No. 175, pp 12–14

The seemingly inconspicuous functions of a mobile radio tester are often the ones that contribute to a productivity increase in production. This also applies to the user-specific correction of frequency response and level response in the R&S CMU 200, which offers quite a few advantages in mobile phone production.

Universal Radio Communication Tester R&S CMU 200

User-specific correction of frequency response and level response

Why such a correction?

You may ask yourself why a user-specific correction of frequency response and level response is required if a professional mobile tester can reliably be expected to perform precise measurements across the entire frequency range. At first glance, this is, of course, true. However, once the instrument is integrated into a test system in a production line, the situation is different. The total measurement error includes not only inaccuracies of the radio tester, but also errors in the test setup such as the frequency response of cabling and any power divider that may be used. To compensate for these wiring losses, "external attenuation" may be entered in the mobile radio testers, often also separately for several frequency bands. Even so, this type of correction is frequently insufficient, e.g. when using an antenna coupler for coupling the DUT, since notable level changes in these instruments can often be detected even across individual radio channels.

Such frequency responses are usually measured and stored as correction

User-specific correction of frequency response and level response: a snap with the R&S CMU200

The user-specific correction of frequency response and level response of the Universal Radio Communication Tester R&S CMU200 is designed to be versatile (FIG 1, 2). Separate correction tables can be compiled for each RF input and RF output. The user is free to decide on the number of frequency and level points to be set up. The tester linearly interpolates the level correction to be used between the frequency points. The correction tables (FIG 3) are easy to compile on any PC by means of a normal text editor, or automatically by a measurement program, and are then loaded into the mobile radio tester via the IEC/IEEE bus, RS-232-C interface or PCMCIA card, where they can be activated or deactivated at any time.

FIG 1
Instead of the DUT, a power meter or a signal generator is connected to determine the correction values, and the required correction points are measured. A correction table is then compiled from the measurement results. A separate table can be generated for each RF input and output on the R&S CMU200.

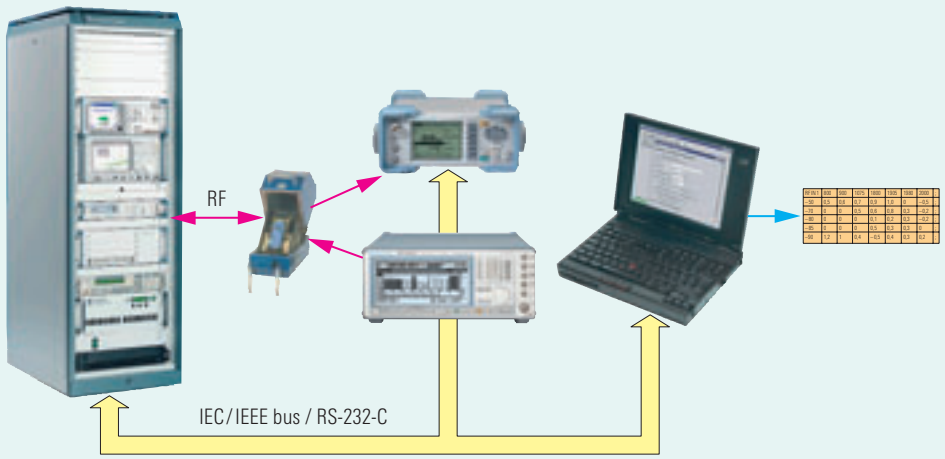


FIG 2
Once the correction values have been recorded, the correction tables are loaded in the R&S CMU200 and activated. The mobile radio tester now corrects all measurement results and all transmit levels according to the table.

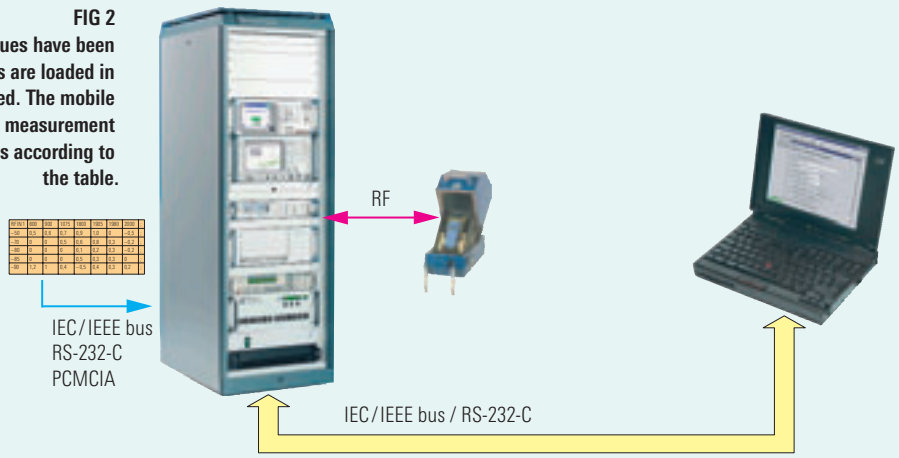


FIG 3
The first column in the correction table designates the RF input or output that is to be corrected. The frequency points are on the horizontal axis, the level points on the vertical axis. The other table entries are the correction values. A semicolon indicates the end of a table line. During operation, the correction value is linearly interpolated between the individual frequency points; there is no interpolation between the level points. The frequency and level points are user-definable. A correction table can contain a total of 120 values.

RF IN 1	800	900	1075	1800	1905	1980	2000	;
–50	0.5	0.6	0.7	0.9	1.0	0	–0.5	;
–70	0	0	0.5	0.6	0.8	0.3	–0.2	;
–80	0	0	0	0.1	0.2	0.3	–0.2	;
–85	0	0	0	0.5	0.3	0.3	0	;
–90	1.2	1	0.4	–0.5	0.4	0.3	0.2	;

values in a database outside the radio tester. During the subsequent measurement, the test program (i.e. not the tester) corrects the obtained results by means of the correction values. However, such methods do not use the capabilities of modern mobile radio testers, which provide not only numerical measurement values, but are also able to evaluate the measurement results by using the limit values and tolerance schemes specified by the standardization bodies.

For example, the R&S CMU200 fully automatically checks a GSM burst within only a few milliseconds by using the power ramp tolerance mask defined in the specifications, and outputs the measurement result as PASS or FAIL information. For this rather complex measurement, the R&S CMU200 first evaluates the data content of the burst which determines the time position of the tolerance mask across the burst. It then determines the average transmit power in the burst across the useful part and the modulation (GMSK or 8PSK). Based on these two measurement results, it decides on the suitable tolerance mask and positions it correctly across the burst. It must then clip the tolerance mask at a specific absolute level. Only now can the R&S CMU200 determine if the measured burst fully complies with the tolerance mask.

Still, the results thus obtained can only be used if the level measured by the tester is identical with the actual level, i.e. if the attenuation errors of the entire test system in the R&S CMU200 are known as well. This clearly shows the shortcomings of a subsequent correction of the measured value in the test program: The capabilities of the tester to make PASS/FAIL decisions in a split second cannot be used; the external measurement program must perform them, which is very time-consuming. If, however, the frequency response and level response of the test setup are taken into account in the mobile radio tester, its automatic PASS/FAIL decisions are also correct and can be used in the measurement program.

Improved measurement accuracy

Every T&M device must be calibrated periodically because this is the only way to continuously ensure the measurement accuracy specified in the data sheet. The data sheets therefore usually mention a prescribed calibration interval. If users want to improve the measurement accuracy within the calibration interval, they can check the measurement accuracy in between these comprehensive calibration actions, store the determined correction values in a database and have them automatically considered at a later time in the measurement results. But the above remarks about the shortcomings of calculating the results in the external measurement program apply also in this case. Plus, there is the obligatory administrative effort. The measurement program must determine the serial number of the tester and use it to search for the corresponding correction values in the database. The effort is particularly high if you do not want to control the tester via a program, but manually: there is no alternative to correcting each displayed measured value by using a pocket calculator.

The user-specific correction of frequency response and level response in the tester helps to easily circumvent all of the above problems: Simply store the determined correction values in the test setup, which will then consider them automatically.

Setup times are reduced

The user-specific correction of frequency and level response also reduces setup times, for example if you regularly measure all mobile radio testers available in a specific production on a reference measurement system and then store the correction values thus determined in the mobile radio tester. If a production system has to be modified (e.g. if a mobile radio tester needs recalibration at the end of a calibration interval), the mobile radio testers can be exchanged at random. The production system is immediately ready for use without requiring complex measurements since every mobile radio tester already comes with the required correction values.

Summary

It is not necessarily the big features that ensure innovation in a mobile radio tester. The sum of numerous small characteristics can just as easily make it a top-ranking mobile radio tester. This may be part of the secret behind the huge success of the Universal Radio Communication Tester R&S CMU200, which has advanced to one of the most innovative products in mobile radio measurement.

Rudolf Schindlmeier

More information and data sheet at www.rohde-schwarz.com (search term: CMU200)

Enhanced *Bluetooth*™ measurements

The R&S CMU 200 is the only tester on the market that offers *Bluetooth* and all important mobile radio standards in a single instrument. Over the past two years, it has excelled worldwide in the research, development and production of *Bluetooth* products. Software version 3.08 significantly enhanced the *Bluetooth* functionality.

The innovations in detail

Link setup in normal mode (without test mode)

The previous software versions only allowed link setup that was immediately followed by activation of the *Bluetooth* test mode. This is still possible with the "connect test mode" key. But the new software also enables the setup of a *Bluetooth* asynchronous connection-less (ACL) link without test mode activation. This mode permits the measurement of the power and frequency accuracy of every DUT, regardless whether the DUT has been locally enabled for the test mode. If a normal ACL link is used, the R&S CMU 200 can switch the DUT to audio, hold and sniff mode.

Audio mode

In audio mode, the R&S CMU 200 sets up a synchronous link to the DUT. All instruments supplied to date come with integrated hardware for the *Bluetooth* audio codec so that audio functionality can now be retrofitted free of charge via a simple software update. External audio generators and analyzers can be connected by means of one analog input and output each. However, the R&S CMU-B41 audio option is a much more convenient alternative since it effortlessly enables basic audio measurements on *Bluetooth* DUTs by means of the *Bluetooth* audio codec (FIG 1 and 2).

Hold and sniff mode

Power consumption of a *Bluetooth* chipset is considerably reduced in these two modes, making them particularly important in all battery-powered *Bluetooth* devices. The R&S CMU 200 can switch the DUT to both modes, thus allowing the reduced power consumption to be checked by means of external test equipment.

Power control

In this mode, the mobile radio tester can send the link manager protocol (LMP) commands for power up and power down to the DUT. The user has two keys for manual power control. After each keystroke, the R&S CMU 200 displays in a measurement window the difference level as compared to each previous power level. In compliance with the *Bluetooth* specification, all difference values must be in the 2 dB to 8 dB range. When the maximum or minimum power level has been reached, the DUT sends

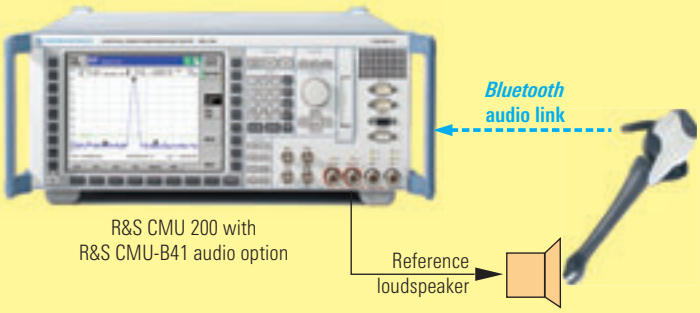


FIG 1 Measurement of the audio characteristics of a *Bluetooth* headset (microphone and earphone) by using the R&S CMU-B41 audio option.

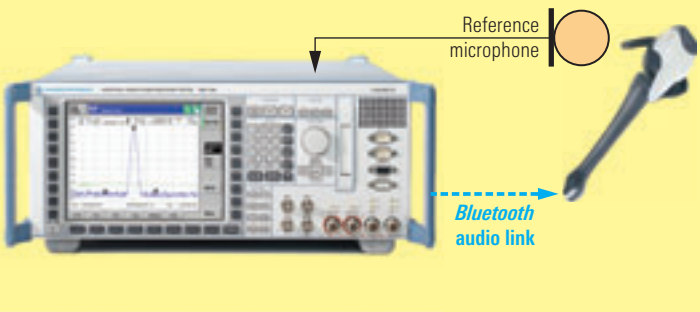


FIG 2 Function test of a *Bluetooth* headset by means of the echo test.

a message which is displayed by the R&S CMU 200 (FIG 3).

Enhanced modulation measurements

In compliance with the *Bluetooth* RF test specification, a minimum of 99.9% of all measured bits must have a frequency deviation of at least 115 kHz. The R&S CMU 200 displays the measurement result in an additional window in the modulation display.

Channel display in frequency-hopping mode

If "on limit failure" is set as a stop condition in frequency-hopping measurements, the R&S CMU 200 automatically stops the measurement at the RF channel where one of the measured values exceeds the settable limit values, and displays the channel number.

Dirty transmitter parameters

The *Bluetooth* RF test specification stipulates a "dirty transmitter" for measuring the receiver sensitivity; its two major parameters, modulation index and frequency accuracy, can be continuously adjusted on the R&S CMU 200, and set in any combinations. Even during link setup (inquiry, connect), the R&S CMU 200 uses the dirty transmitter settings, thus enabling a wide variety of tests that exceed the test specifications requirements by far.

Control commands to the DUT

The R&S CMU 200 can send user-specific control commands in the form of any bytes via the ACL link to the DUT. This application, which comes in useful in production, allows the control of specific functions of the DUT via the RF interface, e.g. switching a headset LED on and off.

Complementary software

R&S CMUGo

Windows™ Software R&S CMUGo is available free of charge and allows easy configuration of test sequences to remote-control the R&S CMU 200. A wide variety of modules (DLLs) are available for *Bluetooth*, supporting measurements in compliance with the *Bluetooth* RF test specification for example. The software also offers automatic measurement of all available parameters on all 79 *Bluetooth* channels. It generates graphics that show the measurement results for all channels. Thus, the user can see at a glance if the DUT exhibits homogeneous behaviour across the entire frequency range. R&S CMUGo is also very convenient for users who want to create user-specific remote-control scripts, since all remote-control commands used by the software can be easily copied to other applications.

R&S DUT Control

The R&S CMU 200 can switch a DUT to test mode only if it is locally enabled for this test mode. Previously, each DUT required specific software which could be easy or not so easy to operate. Rohde & Schwarz now provides all users of the R&S CMU 200 free of charge with the Windows™ Application R&S DUT Control which very easily controls a DUT via its standardized host controller interface (HCI).

Dieter Mahnken

More information and data sheet at www.rohde-schwarz.com (search term: CMU 200)

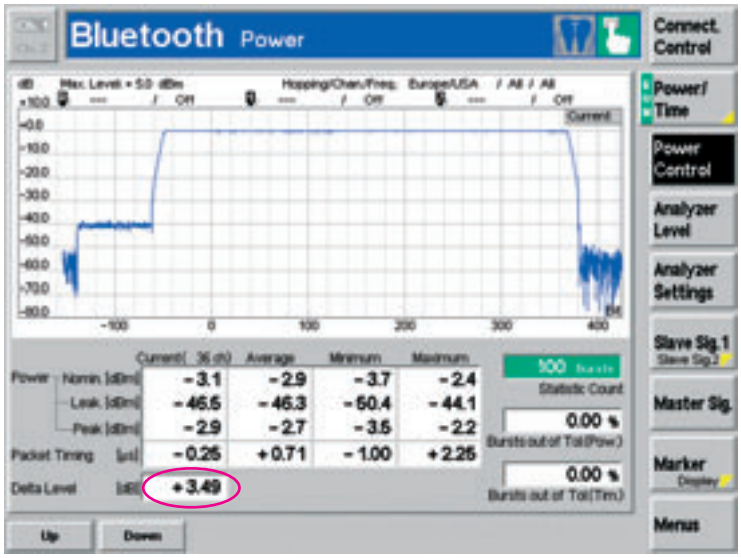
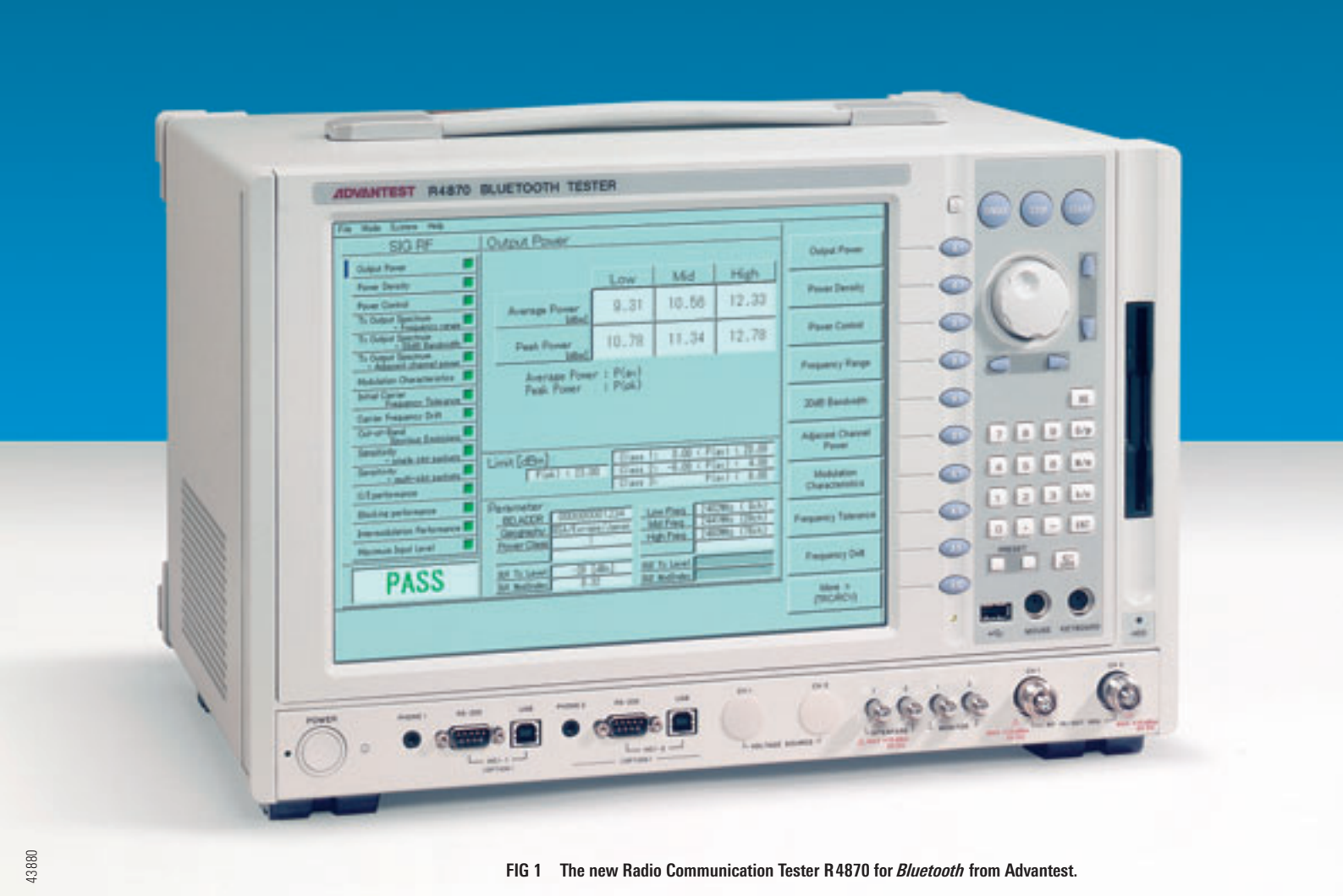


FIG 3 Power control of the *Bluetooth* DUT by using the up and down keys. The R&S CMU 200 displays the difference level as compared to each previous power level in a separate measurement window.



43880

FIG 1 The new Radio Communication Tester R 4870 for *Bluetooth* from Advantest.

Bluetooth™

Radio Communication Tester R 4870 (*Bluetooth*) from Advantest

RF and communication tests according to the *Bluetooth* SIG standard

The growth forecasts for the *Bluetooth* market are promising, and the demand for automated and high-speed measurement instruments is growing. Advantest is taking this into account with its new Tester R 4870, which makes it possible to perform both RF measurements and communication tests according to the SIG standard.

Bluetooth is booming

The *Bluetooth* market promises enormous growth: In 2006, the number of supplied *Bluetooth* modules is expected to surpass the one-billion mark. The high pressure on prices for chips and modules is increasing the need for fast, automated test solutions in production and integration, for example. Advantest aims to fulfil this need with its new Radio Communication Tester R 4870 (FIG 1), which enables both RF measurements and communication tests (known as Blue Unit test cases) according to the SIG standard.

RF measurements

The R 4870 can be used to implement various RF test cases as described in the SIG standard, version 1.1 [1], including the test of the output power or the modulation characteristics of the *Bluetooth* signal (FIG 2). For this purpose, the R 4870 first puts the DUT into the transmitter test mode via the *HCI* interface supported by the tester, for example. The parameters described in the standard for each test case are already stored as defaults, so the user need only select the test cases to be measured and start the measurement. The results are displayed both numerically and as a

PASS/FAIL statement. In the lower central part of the screen, the R4870 indicates important parameters, such as the *BD* address, the type of data packet (*DH1*, *DH3, DH5*), the output power, the frequency channels to be measured, etc (FIG 3).

In addition, the R4870 supports receiver RF test cases such as sensitivity measurements. For this purpose, it generates a "dirty transmitter" signal, as is defined in the standard (box at the bottom of page 19). Using this signal, the bit error rate can be measured under realistic conditions.

Measurements on the R4870 are normally made at the press of a button using the defaults; however, it is of course also possible to change the test parameters, in order to configure test routines flexibly and simulate extreme situations. The instrument's user interface is based on Windows™ NT. Its touch screen makes operation easier, and it has ports for a mouse and keyboard.

SIG standard number	Test cases	Basic unit R4870	Test system
TRM/CA/01/C	Output Power	✓	✓
TRM/CA/02/C	Power Density	–	✓
TRM/CA/03/C	Power Control	–	✓
TRM/CA/04/C	TX Output Spectrum (Frequency Range)	–	✓
TRM/CA/05/C	TX Output Spectrum (20 dB Bandwidth)	–	✓
TRM/CA/06/C	TX Output Spectrum (Adjacent Channel Power)	–	✓
TRM/CA/07/C	Modulation Characteristics	✓	✓
TRM/CA/08/C	Initial Carrier Frequency Tolerance	✓	✓
TRM/CA/09/C	Carrier Frequency Drift	✓	✓
TRC/CA/01/C	Out-of-Band Spurious Emissions	–	✓
RCV/CA/01/C	Sensitivity (single-slot packets)	✓	✓
RCV/CA/02/C	Sensitivity (multislot packets)	✓	✓
RCV/CA/03/C	C/I Performance	–	✓
RCV/CA/04/C	Blocking Performance	–	✓
RCV/CA/05/C	Intermodulation Performance	–	✓
RCV/CA/06/C	Maximum Input Level	✓	✓
	Signalling	✓	✓

FIG 2 Test cases to the SIG standard version 1.1.

All test cases listed in FIG 2 cannot be covered by an RF tester alone. Measuring the out-of-band spurious emissions (TRC/CA/01/C) requires a spectrum analyzer that covers the frequency range up to 12.5 GHz, and measuring the intermodulation characteristics (RCV/CA/05/C) requires two additional signal generators. In the near future, it will therefore be possible to link the R4870 to other instruments to form a prequalification test system that can cover all the RF test cases specified by the standard. Manufacturers of

FIG 3 Result of an output power measurement in the lower, center and upper frequency channel.

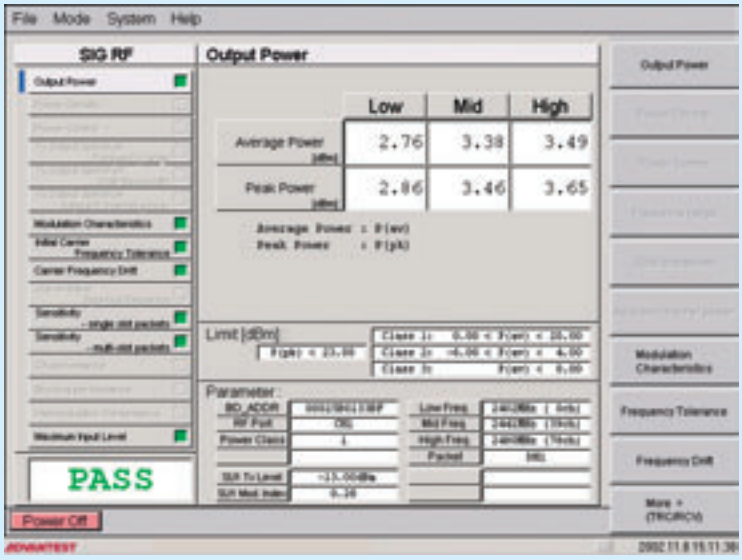
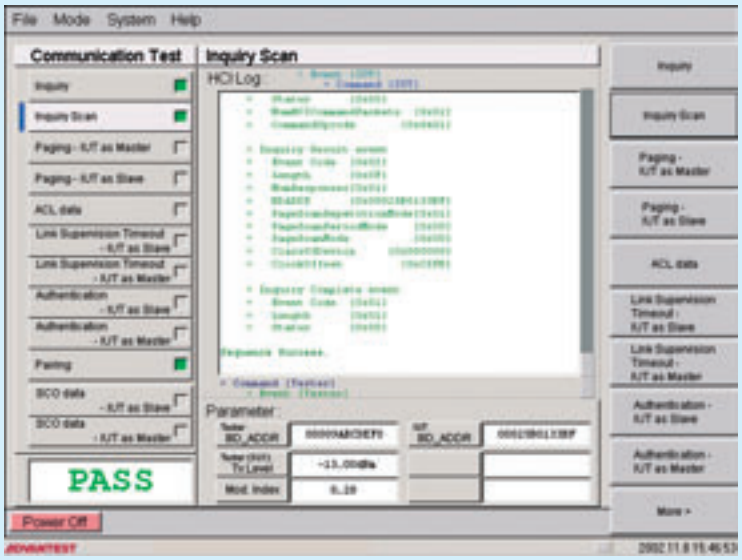


FIG 4 Result of an inquiry scan measurement.



Bluetooth modules can then perform prequalifying measurements during the development phase in order to later obtain the qualification of their modules from an independent test house without having to make costly and time-consuming changes.

Communication measurements

The Blue Unit test cases describe tests for checking the interoperability between *Bluetooth* modules. They monitor communication via the HCI interface and can also be used as a quick alternative to RF measurements, i.e. as a type of Go/NoGo test to ensure minimal interoperability between two modules.

The R 4870 covers all Blue Unit test cases described in the standard [2]. For this purpose, the tester contains a Blue Unit, which can act both as master and slave. The radio communication tester is connected with the DUT via the *HCI* interface; the results are available as PASS/FAIL statements or as records in the form of *HCI* commands (FIG 4).

Summary

Due to the steadily declining prices of *Bluetooth* chips, it is necessary to perform high-speed tests providing results in the form of a PASS/FAIL statement in the production of *Bluetooth* modules or their integration into headsets, mobile telephones, PCs or modems. The R 4870 from Advantest makes it possible to measure the RF test cases described in the SIG standard at the press of a button. The tester can also be used to perform Blue Unit test cases, which are a quick means of obtaining information about a module's communication capacity. Users can choose between either test method or perform both, of course. If, for example, one of the Blue Unit tests ends with FAIL, the cause can be determined by means of RF measurements.

Furthermore, in the future it will be possible to optionally expand the R 4870 into a small test system that covers all RF test cases and that can be used for making all prequalifying measurements.

Patricio Dueñas

More information and data sheet at www.rohde-schwarz.com (search term: R 4870)

REFERENCES

[1] Test Specification RF 1.1, Revision 0.91, Bluetooth Test & Interoperability Working Group

[2] Test Specification Blue Unit Test Cases (Draft), Revision 1.1, Hans Andersson (Ericsson Technology Licensing AB)

Abbreviations

SIG	Special Interest Group
BD address	Bluetooth device address
DH1, DH3, DH5	Data packets having a length of 1, 3 or 5 slots
HCI	Host controller interface

Parameter set	Carrier frequency offset (kHz)	Modulation index
1	75	0.28
2	14	0.30
3	–2	0.29
4	1	0.32
5	39	0.33
6	0	0.34
7	–42	0.29
8	74	0.31
9	–19	0.28
10	75	0.35

FIG 5 Parameter sets of the "dirty transmitter" signal.

Dirty transmitter

The *Bluetooth* RF standard [1] describes two variants of sensitivity measurements under RCV/CA/01/C (with *DH1* packets) and RCV/CA/02/C (with *DH5* or *DH3* packets). In both cases the DUT is put into the test mode. The radio communication tester sends a signal to the DUT, and then the received signal is sent back to the DUT at maximum power (loopback test mode). The radio communication tester subsequently measures the bit error rate. For this purpose, however, a "dirty transmitter" signal should be used instead of an ideal transmit signal. The configuration of this signal is defined in the standard, in a table listing the various parameter sets (FIG 5). Each set specifies a particular shift of the carrier frequency and a different modulation index of the signal. In the first 20 ms the signal is transmitted using the parameters of set 1, in the next 20 ms using the parameters of set 2, etc. After parameter set 10, transmission continues with set 1 again.

Spectrum Analyzer R&S FS300

Favourably priced and universal for laboratory, service and production

The R&S FS300 is a new, favourably priced spectrum analyzer – the first model of the Family 300 – which is particularly notable for its versatile applications in lab, service and production.

New standards in the lowest price class

After introducing the Handheld Spectrum Analyzer R&S FSH3 [*], Rohde&Schwarz has now added the Spectrum Analyzer R&S FS300 to its range of analyzers in the lower price class. The R&S FS300 is the first model of the Family 300 that is based on a completely new platform concept and marketed under the R&S Smart Instruments™ label (for details refer to page 24). Anyone who considered the price for a professional bench model too high will find in the new spectrum analyzer all the characteristics previously available only with higher-priced instruments.

Highly integrated circuits for optimum measurement characteristics

The innovative frequency processing concept and the highly integrated circuits are two reasons for the high quality of the analyzer despite its favourable price (from 4990 € in the EU). All resolution and video bandwidths of the R&S FS300 are digital and therefore not affected by aging or temperature. To ensure superior frequency accuracy, Rohde&Schwarz has developed highly integrated circuits (ASICs) that control crystal-accurate frequency processing in the unit.

This combination of tried-and-tested and latest technology ensures that measured signals are displayed with an accuracy, speed and dynamic range previously unrivalled in this price class. The level measurement uncertainty of <1.5 dB, for instance, is below that of comparable spectrum analyzers of other makes. The frequency response, which influences the level measurement uncertainty, is corrected in the entire frequency range by calibration data stored in the instrument.

With a noise figure of typically 29 dB and a third-order intercept point of +5 dBm, the R&S FS300 easily compares with spectrum analyzers of higher classes (FIG 2) with respect to dynamic characteristics. These values of course apply to the full specified frequency range and are typically even below it. This makes the instrument suitable for all kinds of applications in wireless communication through to analysis of LF signals in the low kHz range.

The phase noise with a verified value of –90 dBc (1 Hz) at 10 kHz from the carrier is comparable to that of much more expensive instruments. The specified value applies in the range 9 kHz to 3 GHz, which is not always the case with other products. The entire frequency range is therefore available to the user without any restrictions regarding dynamic range or accuracy.

Digital resolution bandwidths

Another major requirement for accurate measurements of different signals is adjustable resolution bandwidths. The digital filters can be set in 1/2/3/5 sequences between 200 Hz and 1 MHz. This brings a few advantages over analog filters: The error caused by bandwidth switching is negligible and the shape factor (ratio of 60 dB to 3 dB bandwidth) of typically 3.6 is extremely low. The low shape factor yields very high frequency selectivity when sweep times are relatively short (FIG 3). Analog filters have values between 12 and 15.

The video bandwidths of the R&S FS300 are also digital and can be set in 1/2/3/5 sequences between 10 Hz and 1 MHz.

Input levels of up to +33 dBm

The input is highly resistive to overdrive and can even handle the signal levels of up to +33 dBm that are emitted by mobile phones with 2 W output power. A detector recognizes levels above 13 dBm and automatically switches on a 20 dB input attenuator to prevent overloading of subsequent circuits. This function is integrated in the electronic attenuator which is adjustable between 0 dB and 70 dB in 2 dB steps. The dynamic range can thus be optimally matched to the actual measurement situation – a capability which is not standard in this price class.

High picture refresh rate

Owing to the high refresh rate of approx. 10 pictures/second and the short sweep times, changes in the measurement signal are immediately displayed on the R&S FS300. A sweep time of only 60 ms is achieved when the full frequency range is displayed. In the time domain (span = 0 Hz), the minimum value is as low as 100 µs. The time-consuming level adjustments that often must be performed in service shops can thus be carried out quickly and efficiently.

Two markers can be positioned on the displayed traces for absolute or relative level and frequency measurements. One of the markers can also be used as a noise marker so that a measured value in dBm (1 Hz) can be obtained. Two traces at a time are displayed on the R&S FS300, where one of them can be active. For comparison measurements, the two traces can be subtracted and only the difference is displayed as the measurement result.

In the time domain, another evaluation function is available in addition to the markers for measuring the average power of a TDMA carrier signal.

Comprehensive trigger capabilities

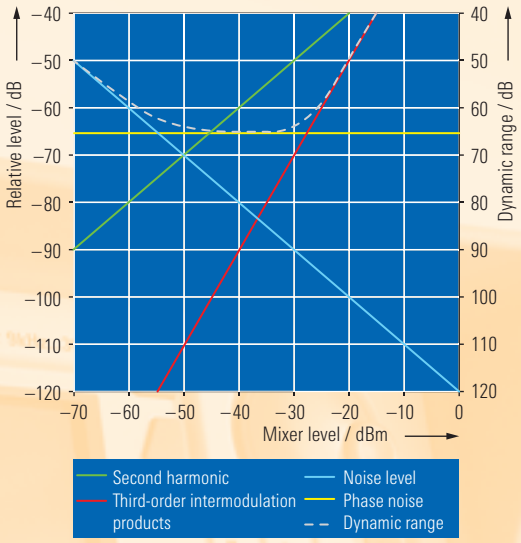
Signal measurements requiring a time reference are often a great challenge for the person performing the test. Even if only the time characteristic of mobile radio signals is to be measured or the effect of interference relative to the supply network – useful measurements cannot be performed without synchronization. The R&S FS300 offers a great variety of trigger capabilities for practically all conceivable application ranges.

Remote control from a PC

The R&S FS300 is supplied with a driver for Windows™ 2000 or XP as standard, which can be integrated in all common software development environments.

FIG 1 Convenient: The R&S FS300 can be connected to a PC even during operation – one of the many benefits of USB.

FIG 2 Dynamic range of the R&S FS300 with 300 Hz resolution bandwidth.



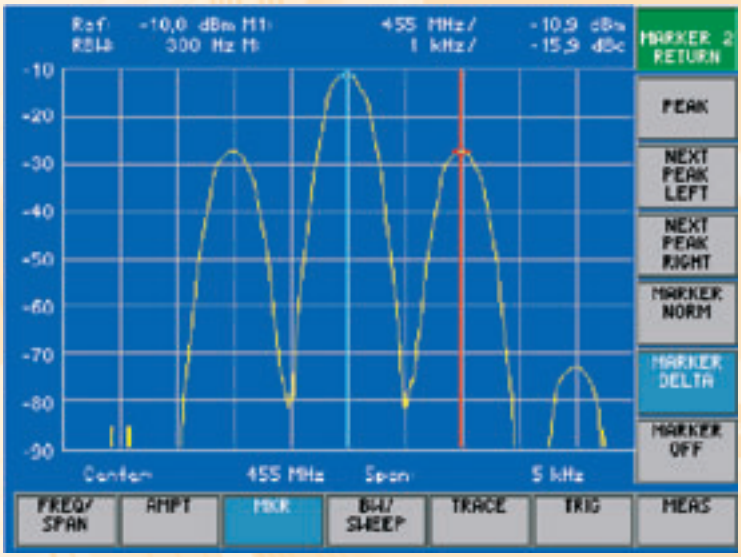


FIG 3 Modulation sidebands near the carrier are clearly displayed because of narrow resolution bandwidths.

Condensed data of the R&S FS300

Frequency range	9 kHz to 3 GHz
Resolution bandwidths	200 Hz to 1 MHz (in 1/2/3/5 sequences)
Video bandwidths	10 Hz to 1 MHz (in 1/2/3/5 sequences)
Displayed average noise level	<–110 dBm, typ. –120 dBm (300 Hz)
Intermodulation-free range	<–70 dBc at –30 dBm input level
SSB phase noise, 10 kHz offset	<–90 dBc (1 Hz)
Markers	normal, delta, noise
Level measurement uncertainty	<1.5 dB

More information and data sheet at www.rohde-schwarz.com (search term: FS300)

REFERENCES

[*] Handheld Spectrum Analyzer R&S FSH3 – New mobility in spectrum analysis. News from Rohde&Schwarz (2002) No. 175, pp 20–25

Commands are simple in structure and permit fast programming of the spectrum analyzer. Since the analyzer is connected to the PC via the USB interface, additional hardware – as required for the IEC/IEEE bus – is not needed in this case (FIG 1 and blue box on right).

A PC software package is available as an option for the spectrum analyzer. It adds evaluation and documentation capabilities to the applications. The software can be installed on all controllers using a USB interface and Windows™ 2000 / XP. The analyzer can be remote-controlled even by untrained users via straightforward menus by means of a few mouse clicks.

Remote-control via the PC clearly increases the measurement speed: The spectrum analyzer transfers 900 test points to the PC with each sweep and displays them with a refresh rate of 10 pictures/second.

Summary

The favourably priced Spectrum Analyzer R&S FS300 sets new standards in the lowest price class not only because of its excellent RF characteristics. In addition to its internal capabilities, the instrument is of compact design and equipped with a TFT colour display. Operation is easy, which is beneficial if the instrument is used infrequently. Nonetheless, the instrument provides all the main functions of a modern spectrum analyzer.

Since USB is used as the internal bus, the spheres of measuring instruments and PCs approach each other, yet remain free of the disadvantages of the other. The result is lower costs, making the world of spectrum analyzers accessible at an entry price of 4990 € (in the EU).

Robert Obertreis

USB in measurements: persuasive advantages

The universal serial bus USB was developed to simplify operation if the user wants to control several units from a PC. When USB interfaces are used, there is no need for additional hardware, manual allocation of system resources, individual configuration of instruments or restarting of the computer when the configuration is changed. In the PC world, the use of USB is now standard and many instruments are equipped with appropriate connectors (printer, mouse, modem, etc).

In most measuring instruments, the IEC/IEEE bus (general purpose interface bus GPIB) is used as standard although there was a trend in the last few years to replace this technology by Ethernet or, in the lower price classes, by RS-232-C interfaces. For reasons of compatibility, many measuring instruments are equipped with several interfaces, which, however, involves higher costs and additional software management.

Rohde&Schwarz opens up new avenues with the Family 300 instruments by using the standard USB interface on this state-of-the-art instrument platform (FIG 4). USB's great advantage is the low cost and an unlimited compatibility with the PC world. With USB, up to 127 instruments can be connected to a system and automatically identified by the software. Instruments in operation can be connected or disconnected without restarting the system.

USB also supports fast, deterministic data exchange with a specified transmission bandwidth of up to 12 Mbit/s. USB will surely establish itself as the bus system of the future alongside Ethernet.

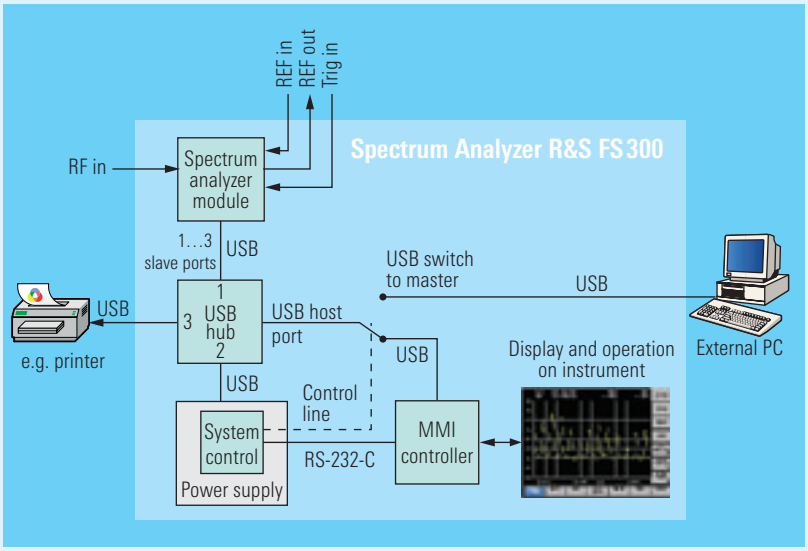


FIG 4 Internal and external communication of the R&S FS300 via USB.

Family 300 – the strategy for the future

R&S Smart Instruments™

A number of Rohde & Schwarz products of the lower price class, which are notable for their excellent price/performance ratio and compact design, will in future be marketed under the R&S Smart Instruments™ label. Owing to innovative technical solutions, these products offer a level of performance that was previously available only with instruments of higher price classes. Another new feature of R&S Smart Instruments™ is that they can be purchased not only from local Rohde & Schwarz representatives but also directly on the Internet or via selected distributors.

The Handheld Spectrum Analyzer R&S FSH3 for mobile applications introduced in News from Rohde & Schwarz, No. 175, was the first product from the series of R&S Smart Instruments™. The next unit is the Spectrum Analyzer R&S FS300, a bench model (page 20) , which will soon be followed by other members of Family 300, one of them a signal generator (FIG 5).

Further information at www.smart.rohde-schwarz.com

Ambitious goals …

Rohde & Schwarz aimed high with its Family 300: To develop a hardware and software platform that can be manufactured in large numbers at low cost and that offers excellent performance and versatility for a great number of applications. The implementation of highly diverse measuring instruments for mobile and network-independent use, for laboratory purposes or for integration into systems should not be a problem either. The new instrument generation should also be able to communicate with a PC and other peripherals.

… attained with Rohde & Schwarz precision

To meet all these requirements within the budget, Rohde & Schwarz developed a completely new and uniform concept, taking the successful platform strategy used in car production as a model. It was worth the effort: The modular design of the Family 300 instruments and the use of uniform components enable cost-efficient production of a wide variety of high-quality instruments. And all that at a low price that could not be achieved in the past. The main characteristics of the new generation are:

- **Identical housing** All instruments based on the Family 300 concept have an almost identical face, a 5.4-inch VGA TFT display, front-panel control elements, protective guards and a handle that can be adjusted to different positions. Only the connectors at the front and rear panel vary depending on the instrument type.
- **Uniform operating concept** Operation of all instruments is very similar and based on the high-end units from Rohde & Schwarz. Most operations are menu-controlled so that no device-specific keys are needed. Only the four unit keys have different labels.
- **Modular design** Despite the small dimensions, each unit comprises up to five slots for measurement modules. In the Spectrum Analyzer R&S FS300, only two slots are occupied. This allows enough room for the development of other measuring instruments.
- **USB interfaces** The USB host interface provided as standard links the instruments to the PC world. The bus ensures high data transmission rates at low cost (see box on page 23). Other peripherals (e.g. a printer) can be addressed via another USB interface.

Powerful design for versatile applications

The sturdy exterior housing protects the modules against shock and other mechanical stress. In addition, each model is individually encapsulated. Since the instruments do not contain a hard disk, they can also be used, for instance, in vehicles without any loss

in reliability. Another advantage of the spectrum analyzer is its low power consumption of no more than 35 W. The heat produced in the instrument is dissipated to the outside by a sophisticated fan system so that the modules always keep a "cool head".

Users particularly appreciate the bright 5.4-inch TFT colour display which can also be used in vehicles, for instance. The brightness of the display enables you to read measurement results easily even under adverse lighting conditions.

This great versatility makes the new measuring instruments ideal for a large number of applications:

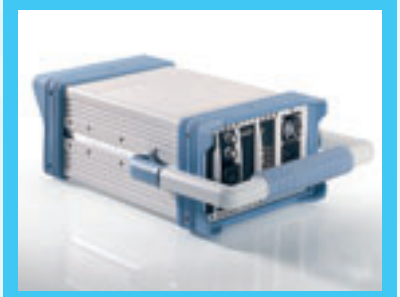
- **In the lab** With the aid of the adjustable handle, the instrument can be set up at almost any angle on the lab bench. To make optimum use of available space, several instruments can be stacked.

- **Mobile use** Despite the sturdy mechanical construction of the housing, the instruments are small, of low weight and can be easily carried to any site by means of the handle.

- **Rackmounting** Family 300 instruments occupy only half the width of a 19-inch frame, i.e. two instruments can be inserted next to each other. They take up three height units and have a seated depth of approx. 300 mm.

Robert Obertreis

FIG 5
The new Signal Generator R&S SM300 (right) is another member of the Family 300 and will be available soon. It has the same "face" as the Spectrum Analyzer R&S FS300.



Extreme Temperature Tester R&S E-Line

Shielded test cell for temperature tests in production

Mobile radio and automotive are two fields where individual components must function properly even at extreme temperatures. As a combined shielded enclosure, climatic chamber and multiplexer that can be program-controlled to test up to 12 DUTs in a wide temperature range, the Extreme Temperature Tester R&S E-Line provides the optimum measurement environment for functional checks of components with a radio interface.

FIG 1 Extreme Temperature Tester R&S E-Line.

Greater test capacity

The Extreme Temperature Tester R&S E-Line (FIG 1) was developed for quality assurance purposes such as random sample tests in the production of mobile communication equipment. The tests can be performed at temperatures ranging from –40 °C to +80 °C. The tester can be linked to an existing test system, offering significant advantages:

- If a test system could previously handle only one or two DUTs, being expanded by the R&S E-Line enables it to simultaneously test up to 12 DUTs that may even comply with different standards.
- Test times are drastically reduced because the time-consuming temperature cycles for the 12 DUTs are performed just once.

The R&S E-Line is used for testing equipment or components wherever the following requirements must be fulfilled:

- Tests at extreme temperatures
- Tests in shielded environments (e.g. to exclude external influence when testing the air interface, in particular when measuring maximum input sensitivity)
- Simultaneous testing of several DUTs
- Tests with high reproducibility

System concept: a perfect combination

The R&S E-Line primarily consists of a shielded enclosure, climatic chamber and mulitplexer. FIG 2 shows the basic interconnection between an external test system and the extreme temperature tester.

Shielding is necessary to exclude any environmental influences on the DUTs. Up to 3 GHz, the R&S E-Line exhibits a minimum shielding effectiveness of 60 dB, allowing communication testing via the air interface, especially for mobile phones.

The climatic chamber features a temperature range of –40 °C to +80 °C, meeting the requirements in the mobile radio and automotive field.

The multiplexer switches the signal paths of the external test system to the DUTs. Different types of multiplexers are used for RF/AF signals, DC supply or high-speed data lines. The external test system provides all measurement functions; it can be from Rohde&Schwarz or it can be an existing customized test system.

Depending on the test requirements, the Universal Radio Communication Tester R&S CMU 200 and a spectrum analyzer from the R&S FSx family from Rohde&Schwarz are typically used in mobile radio applications.

The controller in the Extreme Temperature Tester R&S E-Line controls the entire test sequence, and thus the test system. It can perform the following tasks:

- Control of
  - climatic chamber
  - multiplexer
  - pneumatics for the cell door
- Communication with the external test system
- Control/monitoring of the DUTs

DUT adaptation across 12 universal interfaces

The extendable DUT platform offers universal interfaces to connect up to 12 fixtures, and is thus configurable for a variety of DUTs. If a DUT must be quickly replaced, two platforms can be used (one for the ongoing test, the second to attach DUTs for the next test).

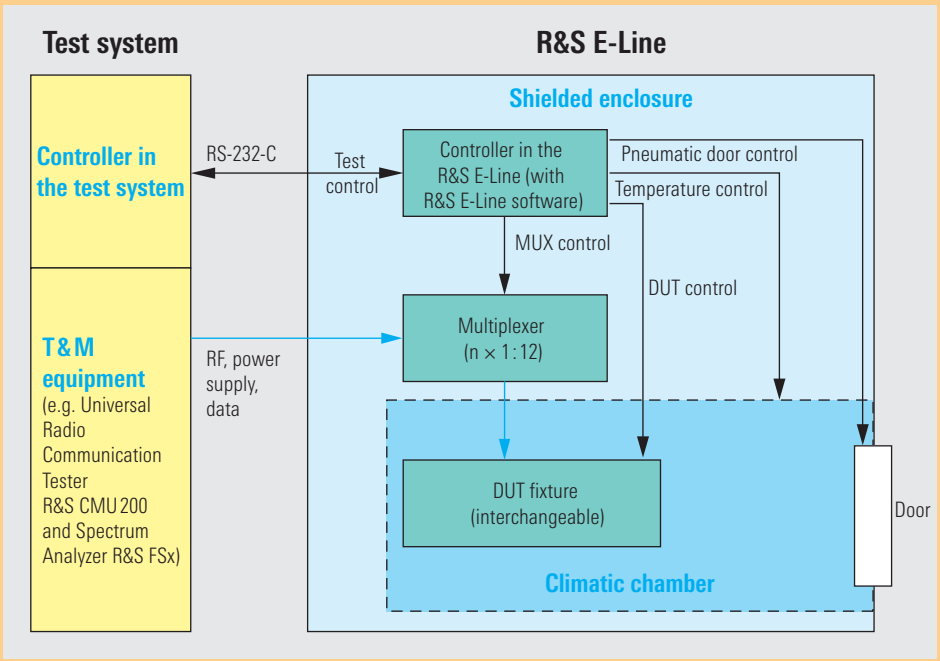
A connecting system links the DUT platform to the instrumentation. When the pneumatically operated door is opened, the DUT platform is disconnected from the connecting system, and is then easy to replace. This connecting system allows fixed laying of the fixture cabling, increasing the test system's reliability.

R&S E-Line control software

The modular R&S E-Line software controls the test sequence. The user interface is implemented as a LabWindows/CVI application and displays the current status of the DUTs, giving an overview of the current system parameters (FIG 3).

The major parameters in the R&S E-Line software are configured via simple text files. The software runs as a sequence under TestStand from National Instruments. FIG 4 shows the software structure.

FIG 2 Block diagram of a test system with the Extreme Temperature Tester R&S E-Line.



The control software allows test cell operation in the following two configurations:

With an external test system (FIG 2)

The controller in the extreme temperature tester controls the test sequence (master) as well as the controller in the external test system (slave) via a specified interface (trigger "Measurement" or "Read Go/Nogo result"). The customized test program in this case is independent of the R&S E-Line control software.

As an independent test system

Test equipment with IEC/IEEE bus interfaces is operated directly at the test cell controller if the applications are simple. The control software is expanded by a DUT-specific test sequence under TestStand (FIG 4). Basically, all instruments contained in the Generic Test Software Library GTSL from Rohde&Schwarz can be integrated. This library can be expanded to include other instruments.

More information and data sheet at www.rohde-schwarz.com (search term: E-Line)

Summary

The R&S E-Line is a universal test cell for the simultaneous testing of several DUTs at extreme temperatures in a shielded environment. The open software concept allows integration of an existing test system or configuration of a customized test system.

A variety of DUTs can be adapted via standardized and exchangeable interfaces. Customized versions (e.g. expanded temperature range, different DUT configuration) are available upon request.

Bernhard Rohowsky; Xaver Sutter

FIG 3 User interface of the R&S E-Line control software.

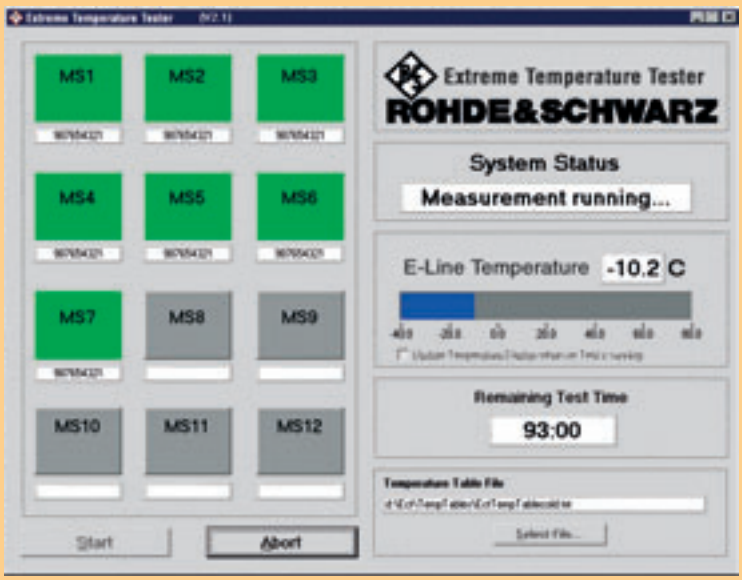
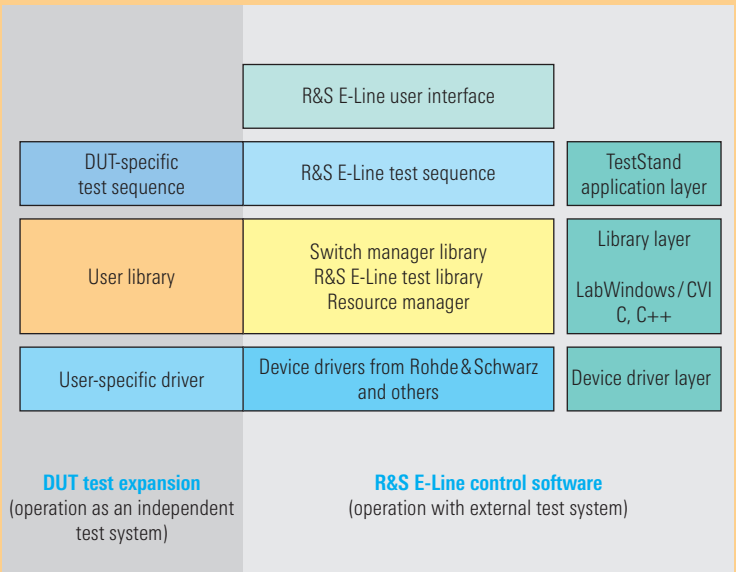


FIG 4 Structure of the R&S E-Line control software.



Portable System for EMF Measurements R&S TS-EMF

Accurate measurements of electromagnetic fields caused by transmitter systems

The effects of electromagnetic fields (EMFs) are widely discussed in public at present, particularly in connection with the advancing implementation of mobile radio networks. The Portable System for EMF Measurements R&S TS-EMF with software R&S RFEX permits electromagnetic fields to be accurately measured and statistically evaluated especially in densely populated areas.

43944/1

FIG 1 The Portable System for EMF Measurements R&S TS-EMF fits in a carrying bag.

Accurate measurements and statistical evaluation

Providing a sound basis for the discussion about the effects of mobile radio networks requires not only comprehensive short-term and long-term measurements of electromagnetic fields to be performed on site (e.g. when new systems are installed) but also statistical data to be obtained by means of broad-area measurement sequences [1].

Two methods have been available up to now for measuring the effects of electromagnetic fields on the environment (EMCE), a broadband measurement with the aid of an isotropic sensor and a frequency-selective measurement using a dipole or directional antenna. The new

Portable System for EMF Measurements R&S TS-EMF from Rohde & Schwarz (FIG 1) combines the advantages of both: Frequency-selective measurements of electromagnetic fields are performed with an isotropic sensor in the frequency range 80 MHz to 2.5 GHz.

In conjunction with software R&S RFEX, which has been specially designed for environmental electromagnetic compatibility applications, the system can be used for accurate measurements and statistical evaluation of electromagnetic fields particularly in densely populated areas. With the aid of this software, critical locations such as schools can be monitored over an extended period of time (days or weeks).

With the R&S TS-EMF, electromagnetic fields caused by radiocommunication services such as GSM, CDMA, UMTS, DECT, *Bluetooth*™ or W-LAN, or by sound and TV broadcasting can be measured.

All in one bag

The measuring system consists of a Handheld Spectrum Analyzer R&S FSH3 [2] and an isotropic sensor, both stowed in the supplied carrying bag, as well as system software R&S RFEX. The system offers a variety of advantages:

- Emissions can be assigned to discrete frequencies and analyzed
- Reference to (frequency-dependent) limit values
- High sensitivity and wide dynamic range
- Simple measurement procedure

Various field-strength parameters can be determined with the test system:

- Instantaneous value
- Mean value over time
- Peak and average value
- Maximum value, calculated from basic channel (BBCH with GSM) and maximum channel number

Isotropic sensor simplifies measurements

The sensor comprises three orthogonally arranged passive monopoles which are selectable by means of an integrated PIN diode switch. The software calculates the equivalent isotropic field strength from the three measured values with the aid of an evaluation algorithm.

To obtain optimum isotropic characteristics, the monopoles are symmetrical to the sensor handle. They are covered by a radome made of polystyrene for protection against weather effects or mechanical damage.

The isotropic radiation pattern of the sensor considerably simplifies measurements since they need not be carried out with different polarizations and in different directions. Particularly when long-term measurements with a stationary sensor are to be performed, reliable and frequency-selective field-strength measurements can be conducted independently of direction and polarization. Even locating maximum field strength in spaces such as rooms merely requires scanning the room with the sensor in hand. The sensor can also be mounted on a tripod for long-term measurements.

The passive sensor offers considerably higher sensitivity and a wider dynamic range than active, broadband field-strength sensors. The maximum field strength of 100 V/m allows measurements in the vicinity of emitters with sufficient spacing from limit values. The minimum sensitivity of typically 1 mV/m also permits reliable measurements of low field strengths, as occur further away from the field-strength source.

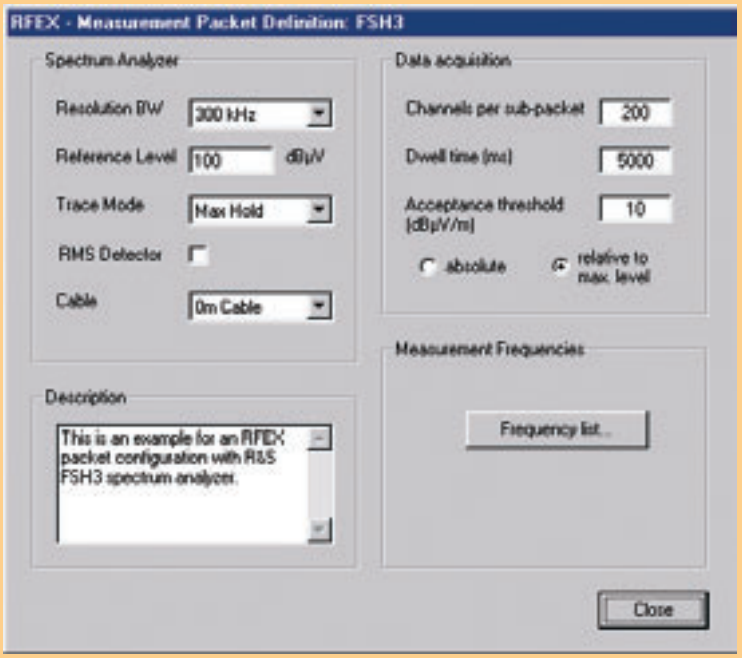


FIG 2
Menu of system software R&S RFEX for selecting measurement packets.

Highly specialized software

The R&S RFEX software package has been specially configured for the detection and evaluation of electromagnetic fields. Using remote control, the required functions of the Spectrum Analyzer R&S FSH3 can be activated via RS-232-C and switchover between the sensor antennas carried out via USB interfaces. Predefined measurement packets optimized for the signals to be measured are available for the most common emitters so that measurement errors caused by incorrect setting (e.g. integration time for pulsed signals too short) can be avoided. This makes the system ideal even for non-experienced users. The measurement packets can be edited and new ones can be created.

A great variety of functions can be performed via simple menus:

- Use of predefined measurement packets (FIG 2)
- Setting of instrument parameters
- Short-term measurements (minutes) or long-term measurements (hours or days), FIG 3
- Averaging over time
- Automatic switchover of sensor elements, sensor correction and calculation of isotropic field strength
- Automatic correction of cable loss
- Data reduction (sum value with average and peak value indication)
- Display referenced to limit value
- Result display in table or graphical format
- Export of measurement results for further processing, e.g. in Word or Excel for Windows™

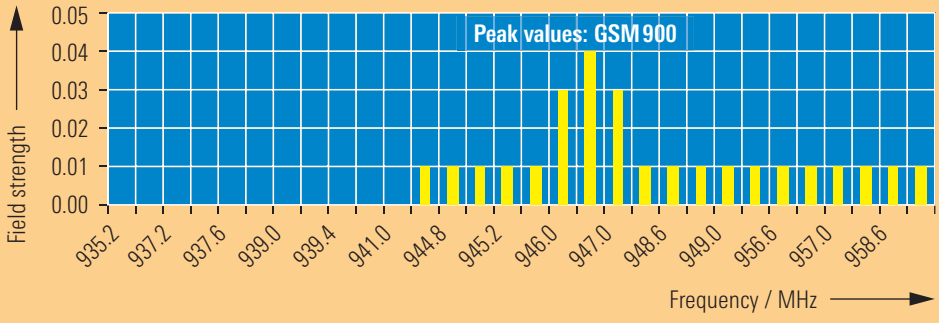
Summary

The Portable System for EMF Measurements R&S TS-EMF is ideal for fast overall measurements as well as for accurate measurements and statistical evaluation of electromagnetic fields in the frequency range 80 MHz to 2.5 GHz.

The advantage of the favourably priced system over conventional measurement methods is that frequency-selective measurements are performed with the aid of an isotropic sensor. The supplied R&S RFEX software package simplifies measurements by providing predefined measurement packets and permits results to be evaluated with reference to a limit line.

Jürgen Kausche; Bernhard Rohowsky

FIG 3 Long-term measurement in frequency band GSM 900. Frequencies causing the essential part of the measured electromagnetic fields can be seen at a glance. The diagram shows peak values of the measured field strength in parts per thousand of a limit value selectable by software.



Condensed data of the R&S TS-EMF

Frequency range	80 MHz to 2.5 GHz
Sensor characteristics	isotropic, passive antenna elements
Measurement range	approx. 1 mV/m to 100 V/m
Operating time of Spectrum Analyzer R&S FSH3	approx. 4 h with battery; alternatively AC supply operation
Software package	R&S RFEX

More information at www.rohde-schwarz-com (search term: TS-EMF)

Data sheet R&S FSH3

REFERENCES

[1] System for statewide EMF monitoring. News from Rohde&Schwarz (2002) No. 174, pp 50–51 (NEWSGRAMS)

[2] Handheld Spectrum Analyzer R&S FSH3 – New mobility in spectrum analysis. News from Rohde&Schwarz (2002) No. 175, pp 20–25

TV Test Transmitter R&S SFQ / R&S SFL

ISDB-T – Digital terrestrial broadcasting in Japan

The transition from analog to digital broadcast transmission is occurring everywhere: in broadband communication networks, satellite transmission and terrestrial broadcasting. The ISDB-T standard is about to be launched in Japan, and Rohde&Schwarz is involved in the development and production with its TV Test Transmitters R&S SFQ and R&S SFL (FIG 1).

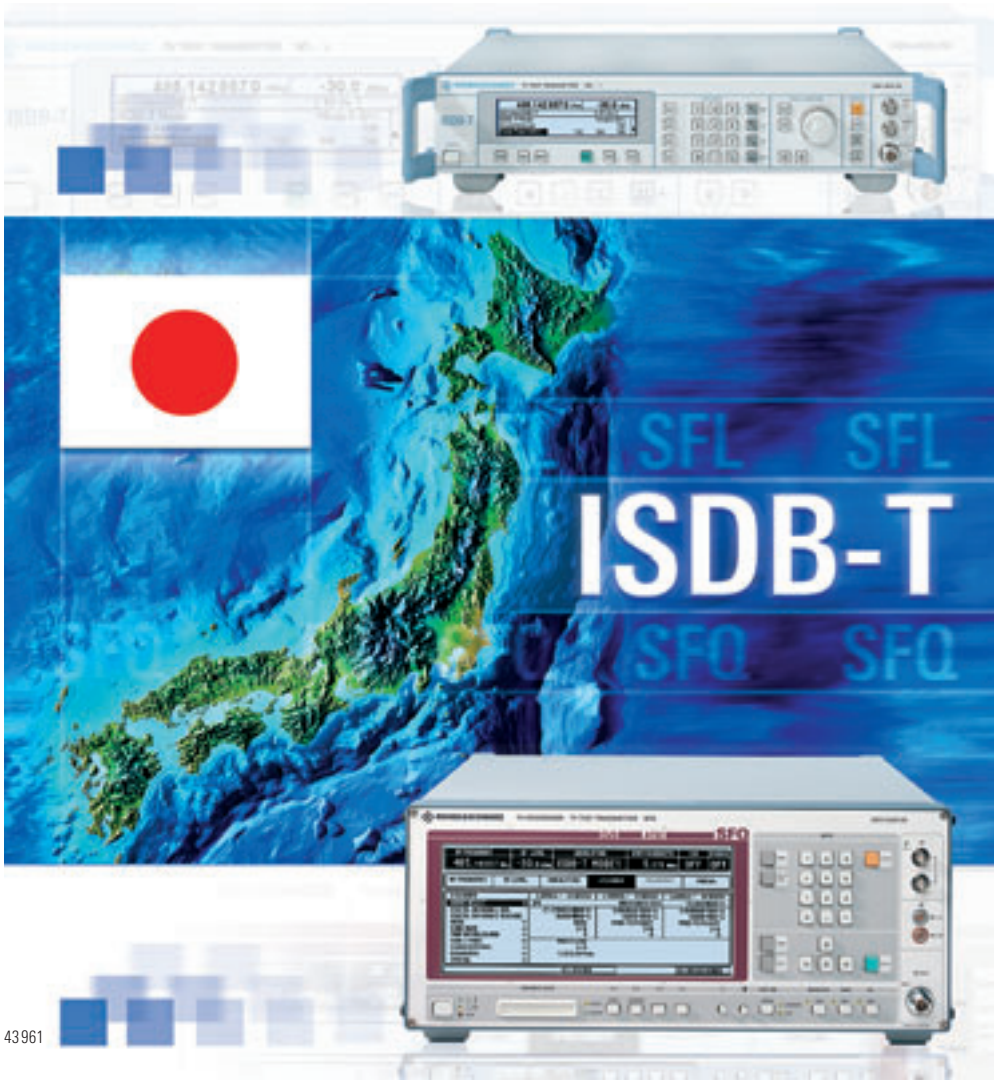


FIG 1 The two TV Test Transmitters R&S SFQ and R&S SFL-I handle the ISDB-T standard.

ISDB-T: one standard for TV, sound broadcasting and data services

In the 90s the Japanese Association of Radio Industries and Business (ARIB) developed a transmission standard for digital terrestrial broadcasting. Unlike in other parts of the world, just one standard was to cover TV, sound broadcasting and data services. Thus, the Japanese broadcasting standard ISDB-T (Terrestrial Integrated Services Digital Broadcasting) was established, in which these services can be transmitted separately in a large number of combinations [1, 2]. Currently, comprehensive field tests are taking place in several regions in Japan,

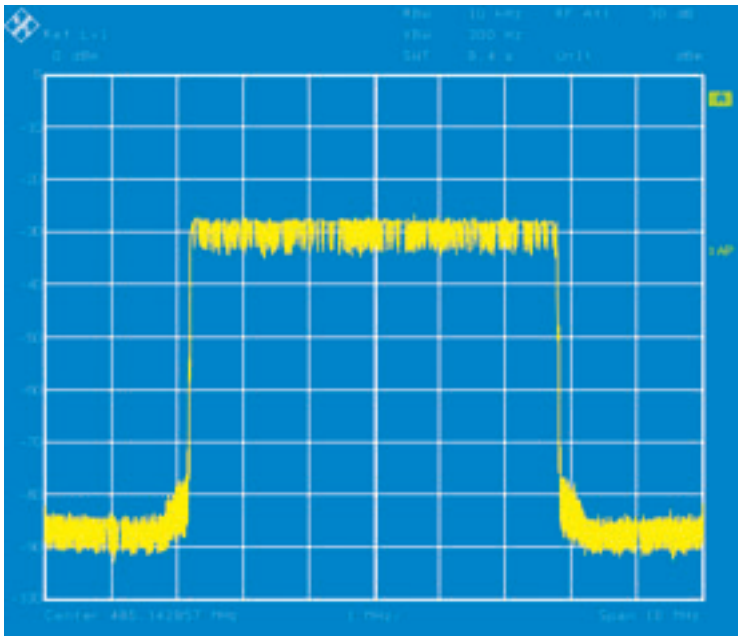
confirming the system's performance. Testing includes the following:

- TV, radio data transmission and sound broadcasting
- Mobile multimedia services
- Feeding into cable networks
- Emergency services
- TV shopping, shopping information services and pay TV
- Single frequency networks (SFN) in buildings, at sea and in the mountains
- On-demand services, etc

The system's special strengths are SFN, the positive characteristics in mobile reception, possible narrowband reception where only some of the transmitted data is evaluated (partial reception) as well as the hierarchical transmission for adaptation to different receive conditions.

The field test results will come in useful when regular ISDB-T operation is introduced in the three main regions of Tokyo, Nagoya and Osaka between 2003 and 2005. By 2006, ISDB-T is to cover all of Japan so that analog TV broadcasting can be discontinued in 2010.

FIG 2 ISDB-T spectrum.



ISDB-T characteristics

For both ISDB-T and the other digital TV standards (e.g. DVB-T), the MPEG2 method was chosen as the source coding for the digital TV signals to be transmitted. The RF transmission channel uses orthogonal frequency division multiplexing (OFDM), which is state-of-the-art technology in terrestrial digital TV broadcasting. The transmission bandwidth is 5.6 MHz, making the signal suitable for transmission in a 6 MHz channel (FIG 2 and 3).

Hierarchical transmission

Up to three different services with different transmission parameters can be sent simultaneously in a transmission channel. This method is referred to as hierarchical transmission and generally addresses various types of receivers (FIG 4). A 6 MHz channel can thus provide different services with the same infrastructure. For example, a stationary TV receiver is supplied with an HDTV program while mobile TV receivers in a tour bus receive a TV picture at reduced resolution and portable receivers in mobile phone format get the same TV program at a suitably reduced resolution. Auxiliary information about the current program can be transmitted and retrieved by the viewer, if required.

FIG 3 Transmission parameters for ISDB-T (6 MHz channel).

	Mode 1	Mode 2	Mode 3
Number of segments	13		
Bandwidth	5.575 MHz	5.573 MHz	5.572 MHz
Carrier offset	3.968 kHz	1.984 kHz	0.992 kHz
Number of carriers	1405	2809	5617
Carrier modulation	QPSK, 16 QAM, 64 QAM, DQPSK		
Symbols per frame	204		
Symbol duration (actual)	252 µs	504 µs	1008 µs
Guard interval	1/4, 1/8, 1/16, 1/32		
IFFT length	2K	4K	8K
Inner code	Convolutional code (1/2, 2/3, 3/4, 5/6, 7/8)		
Outer code	Reed-Solomon (204,188)		

Partial reception

Partial reception of the broadcasting spectrum is a special case of hierarchical transmission. The OFDM spectrum consists of 13 segments (FIG 4). If the influence range of the transmission parameters is limited to one OFDM segment, this segment can be received independently of the other 12 segments. A narrowband receiver evaluating only this OFDM segment receives a complete signal. If suitable transmission parameters are selected, this segment can be designed to be particularly immune to interference. Thus, the available services especially address mobile and portable receivers, e.g. mobile phones and personal digital assistants (PDA). Application examples are the downstream for mobile Internet or the download of video, audio and software.

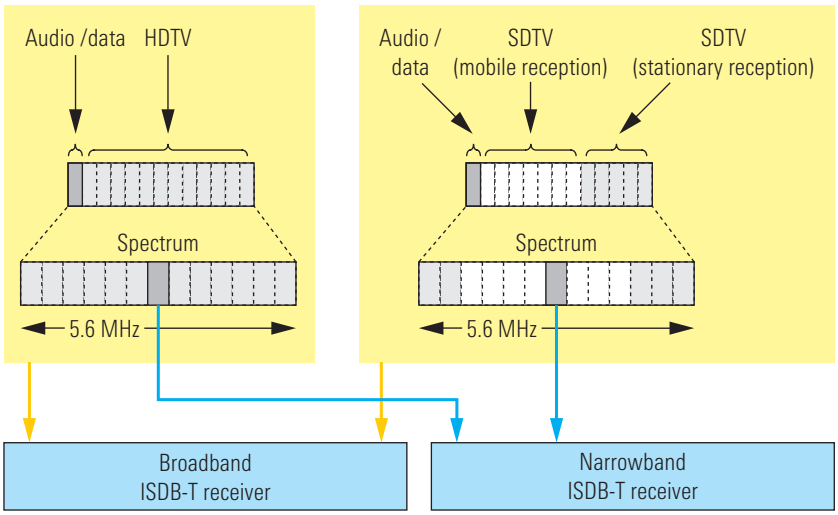


FIG 4 Schematic of hierarchical transmission and partial reception.

Channel coding

FIG 5 shows the functional design of channel coding with ISDB-T. Basically, three identical paths (hierarchical coding) are provided.

First, the transport stream passes through the outer coder where the Reed-Solomon code is applied to every transport stream packet, which enables the receiver to correct up to eight erroneous bytes in a transport stream packet.

The error-protected data stream now passes through a splitter in which the transport stream packets are divided into up to three hierarchical layers.

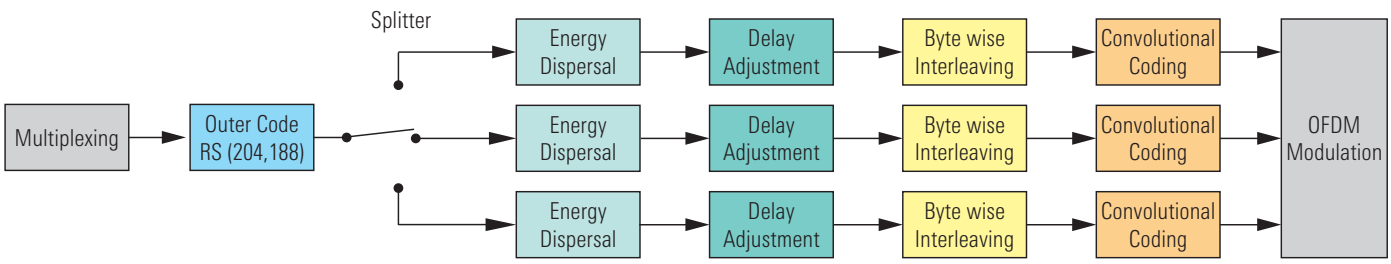
The subsequent energy dispersal module adds a pseudo random binary sequence (PRBS) to the data stream to ensure a sufficient number of binary changes.

Depending on the two transmission parameters "modulation" and "code rate", the different delays of the data streams in the three paths are caused by bytewise interleaving in the transmitter and de-interleaving in the receiver. A delay adjustment is performed in the coder to minimize receiver delay. This module delays the three data streams in such a manner as to compensate in advance for subsequent delay differences.

The following bytewise interleaver separates adjacent data by rearranging the sequence. Burst-like errors often occur in the transmission channel, always interfering with subsequent data. However, the de-interleaver in the receiver restores the original data sequence. During this process, burst errors are sorted into single errors that can then be corrected by the Reed-Solomon decoder.

The convolutional coder with integrated puncturer adds further redundancy to the data stream to permit error correction in the receiver (Viterbi decoder). The code rate can be selected according to the required transmission characteristics of the system.

FIG 5 ISDB-T channel coding.



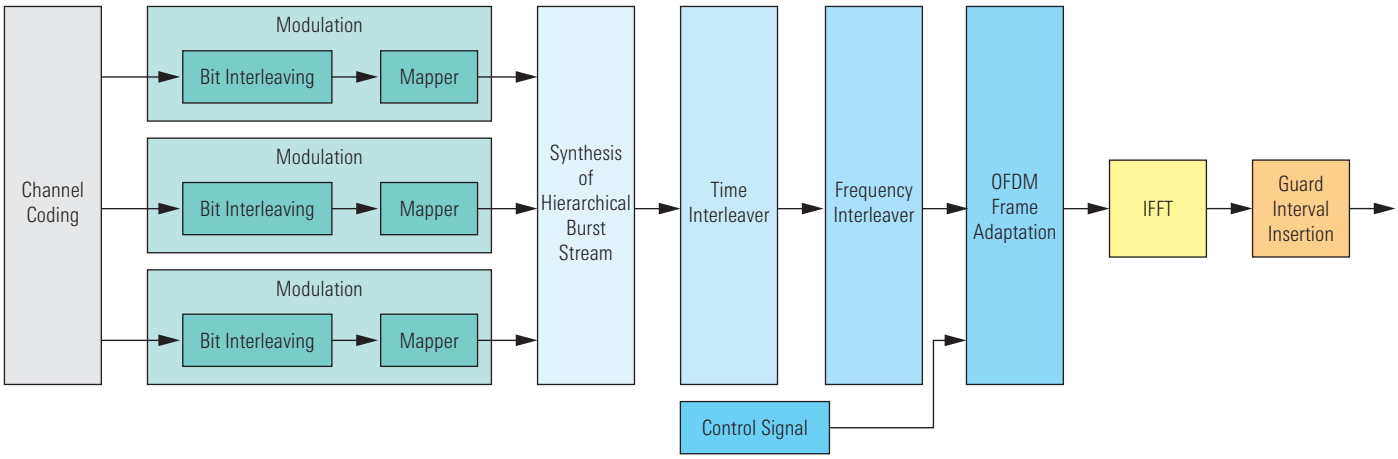


FIG 6 Schematic of modulation block with ISDB-T.

Modulation

FIG 6 shows the functional design of the OFDM modulation block with ISDB-T. The first block performs the modulation, which includes bitwise interleaving with delay adjustment and the mapping of the constellation diagram of the modulation. Possible constellations with ISDB-T are DQPSK, QPSK, 16 QAM and 64 QAM. The constellation can be selected according to the required transmission characteristics of the system. Suitable bitwise interleaving and delay adjustment are automatically selected.

The hierarchical data stream is now synthesized. For this purpose, the complex mapped data from each of the three paths is appended end-to-end to form a serial data stream.

The subsequent symbol-by-symbol time interleaving is performed by an intra-segment time interleaver, whose depth can be set independently for each layer. Delay adjustment is also assigned to the time interleaver in order to compensate for different delays in the paths.

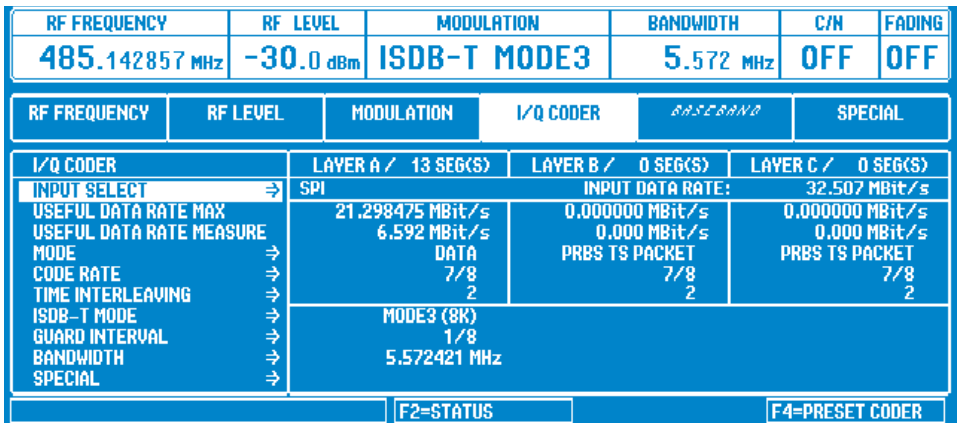
Frequency interleaving then scrambles the data within an OFDM symbol, i.e. at the frequency layer. First, an inter-segment interleaver is applied between the OFDM segments that have the same modulation, followed by an intra-segment interleaver that rotates the data in a segment. The data then passes through an intra-segment randomizer that shifts it to quasi-random positions within a segment.

Frames are formed from 204 OFDM symbols by adding pilot carriers. Depending on the mode and the selected modulation, the module adds pilot carriers, transmission and multiplexing configuration control (TMCC) as well as auxiliary channel (AC) carriers at different positions in the data stream.

The generated data is subjected to an inverse Fourier transform (IFFT) to transfer it from frequency to time domain. The IFFT length depends on the selected ISDB-T mode and can be 2K, 4K or 8K.

By inserting a guard interval, the OFDM symbols are extended by a specific factor (1/4, 1/8, 1/16 or 1/32). This has a positive effect on the receiving characteristics with multipath propagation.

FIG 7 The R&S SFQ shows all parameters at a glance.



Test transmitters from Rohde&Schwarz for ISDB-T

Rohde&Schwarz offers the new digital modulation standard in two product families. The tried-and-tested **TV Test Transmitter R&S SFQ** [3] can be expanded by the optional ISDB-T coder (R&S SFQ-B26). The R&S SFQ is a multistandard device that is primarily designed for the development of set-top boxes. The **R&S SFL** instrument family already features five different models [4] and has now been expanded by the R&S SFL-I which mainly covers production applications. The newly developed ISDB-T coder is large-scale integrated and, like the other coders of the product family, accommodated on a single board. The use of FPGAs allows highly flexible response to possible modifications or expansions of the standard. A simple software update keeps the product family up-to-the-minute.

Manual operation of both the R&S SFQ and the R&S SFL test transmitter is very user-friendly. The R&S SFQ features tried-and-tested operation via keys, while the R&S SFL provides a practical rollkey. The large display on the R&S SFQ (FIG 7) shows all relevant and easy-to-set operating parameters at a glance. Both instruments can be remote-controlled via the IEC/IEEE bus (IEEE 488) and the serial interface (RS-232-C).

Possible simulations

The TV Test Transmitter R&S SFQ provides a fully standard-compliant RF signal. Moreover, a test transmitter must be able to simulate real transmission conditions. The R&S SFQ is designed as a stress generator, allowing tests at the specification limits and beyond.

Thus, phase and amplitude of the I/Q modulator can be influenced to simulate a poorly aligned receive section. Realistic receive conditions can be simulated with the aid of a noise generator. Noise power can be precisely set and allows the determination of the BER characteristics of ISDB-T receivers. The END point, a key parameter of a receiver, can also be determined in this way.

The optional fading simulator for the R&S SFQ is ideal for simulating terrestrial receive conditions, mainly the reflections in adverse environments and the inherent motion of a mobile receiver.

The TV Test Transmitter R&S SFL features an optional digital noise generator, allowing the same measurements possible with the R&S SFQ.

A BER option is available for both instruments so that the quality of a DUT can be evaluated also via the BER. This is an extremely space-saving solution, since no other instruments are required apart from the generator.

Summary

The ISDB-T coder underscores the universal expandability of the R&S SFQ, which is an instrument that handles all standards and features comprehensive means of simulation as required in development, service and quality control. The favourably priced R&S SFL with its optional digital noise generator is just the right choice for production. The instruments can always be upgraded to current developments by installing software updates.

Peter Schmidt

More information and data sheets at www.rohde-schwarz.com (search term: SFQ or SFL)

Data sheet R&S SFQ

Data sheet R&S SFL

REFERENCES
[1] ISDB-T standard: ARIB STD-B31
[2] Overview of ISDB-T specifications: www.nhk.or.jp/strl/open99/de-2/shosai-e.html
[3] TV Test Transmitter R&S SFQ: Now signals to digital cable standard ITU-T / J.83B. News from Rohde&Schwarz (2001) No. 170, pp 34–36
[4] TV Test Transmitter R&S SFL – Five specialists in production: test signals for all digital standards. News from Rohde&Schwarz (2001) No. 172, pp 30–33

Condensed data of the R&S SFQ with optional ISDB-T coder (-B26)

Frequency range	0.3 MHz to 3.3 GHz
Level range	–99 dBm to +4 dBm
Data inputs	ASI, SPI, TS PARALLEL + AUX
Options	coder (for several standards), fading, BER, noise generator, diversity
Remote control	IEC-625 (IEEE 488) and RS-232-C

Condensed data of the R&S SFL-I

Frequency range	5 MHz to 1.1 GHz
Level range	–140 dBm to 0 dBm
Data inputs	ASI, SPI
Options	BER, digital noise generator
Remote control	IEC-625 (IEEE 488) and RS-232-C

FIG 1 An extended transport stream signal library is now available for the MPEG2 Generators R&S DVG and R&S DVRG.

MPEG2 Generators R&S DVG / R&S DVRG

Transport stream signal library for comprehensive tests in production

In cooperation with Snell & Wilcox, Rohde & Schwarz developed and compiled the new R&S DV-TCM signal library as an option for the MPEG2 Generators R&S DVRG and R&S DVG [1, 2]. The new library significantly increases the test depth obtained with the signals available up to now.

Reliability is essential

A great variety of test signals is required in the development and production of TV sets and receivers (set-top boxes) to make sure that the products can handle and are not impaired by the variations and possibilities allowed by the TV standard. The MPEG2 Generators R&S DVG and R&S DVRG (FIG 1) from Rohde & Schwarz generate endless transport streams, i.e. TV signals, in accordance with MPEG2, DVB and ATSC standards. The two generators are among the most widely used generators in the development, production and monitoring of digital TV equipment. On the one hand, this is due to continuous signal generation – which is a prerequisite for interference-free testing and measurements of DUTs – and, on the other, to the great variety of test signals available for automatic measurements of analog outputs of decoders and set-top boxes.

However, the complexity of the standards allows for the most diverse configurations so that it is highly probable that a changed configuration will impair correct functioning. Just imagine what would happen if a TV set had to be rebooted after each signal change! For a more reliable introduction of digital TV and to increase customer acceptance, Snell & Wilcox developed a signal library (Test Card M) that simulates a number of TV scenarios that may be encountered in real life. Rohde & Schwarz has converted all important signals of this library and

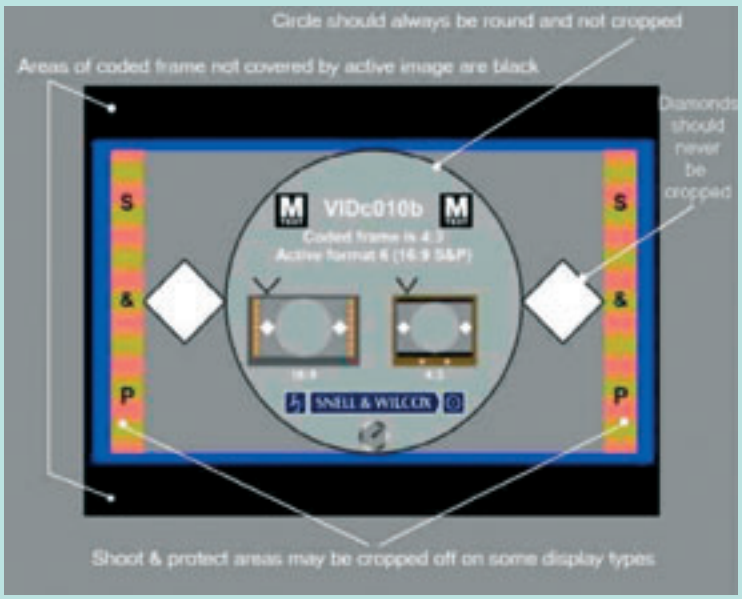
generated endless transport streams for the MPEG2 Generators R&S DVG and R&S DVRG. For the first time, the following tests can now be performed with the R&S DV-TCM signal library:

- Error-free processing of various SDTV and HDTV coding formats (360 to 1920 pixels in 480 to 1080 lines) (FIG 2)
- Geometry and picture quality
- Decoding of different picture groups (GOPs)
- Synchronization of audio signals and subtitles to the video signal
- Correct assignment of audio channels for MPEG1 layer II and Dolby AC-3
- Correct handling of active format descriptor (AFD)
- Conformance with program (service) information of DVB and ATSC standards; particularly important are
  - Huffman coding in ATSC tables, specifically the
  - use of virtual programs and the
  - flexibility to make changes in the signal structure (adding and removing elementary data streams, FIG 4)

With the aid of these tests, manufacturers of equipment to MPEG2 (DVB and ATSC) standard can be sure that their products will hold their own under real conditions and will not fail when the received signals are generated in the transmitter by an encoder or multiplexer other than the commonly used.

FIG 2
Test pattern with reduced horizontal resolution (360 pixels).

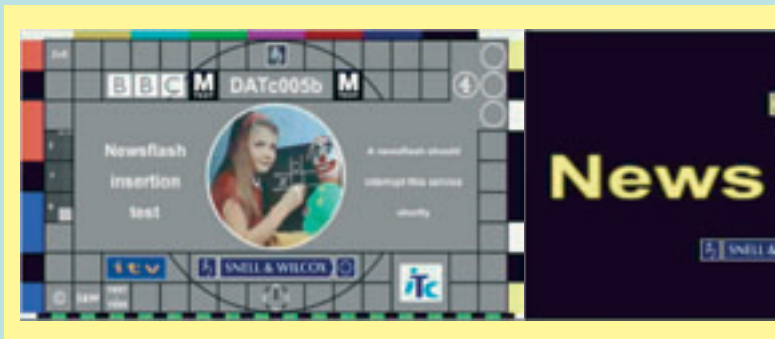
FIG 3
Interpretation of picture areas described by the AFD.



Active format descriptor

The active format descriptor (AFD) is a process (ETR-154; A/53B) that has been subsequently introduced in DVB and now also in ATSC for optimum display of different film formats on a variety of TV sets. The video material is coded in 4:3 format, for examle, with the usual black bar at the top and bottom, but the AFD decides how the transmitted picture is to be displayed on the different screens so that no distortions occur and no areas

FIG 4
Sequence with temporarily inserted elementary stream.



Group	Content	PID	PCR-PID
TS	Summary	0...	-
PSI	Summary	-...	-
PSI	PAT	0x0000	-
PSI	PMT 3 [tcm-A 1]	0x0030	-
PSI	PMT 260 [tcm-A 2]	0x1020	-
PSIP-1FFB	Summary	-...	-
PSIP-1FFB	MGT	0x1FFB	-
PSIP-1FFB	TVCT	0x1FFB	-
PSIP-1FFB	RRT-1	0x1FFB	-
PSIP-1FFB	STT	0x1FFB	-
PSIP	Summary	-...	-
PSIP	EIT-0	0x012C	-
PSIP	EIT-1	0x012D	-
PSIP	EIT-2	0x012E	-
PSIP	EIT-3	0x012F	-
PSIP	CETT	0x0190	-
PSIP	ETT-0	0x0191	-
PSIP	ETT-1	0x0192	-
PSIP	ETT-2	0x0193	-
PSIP	ETT-3	0x0194	-
Program 3 [tcm-A 1]	Summary	-...	0x0031
Program 3 [tcm-A 1]	Video MPEG2	0x0031	-
Program 260 [tcm-A 2]	Summary	-...	0x0031
Program 260 [tcm-A 2]	Video MPEG2	0x0031	-
Null Packets	Stuffing	0x1FFF	-

FIG 5
Multiple use of the video elementary stream.

of interest are cut off. In combination with the 4:3 and 16:9 coding formats specified by MPEG2, eight different formats have been defined where the AFD may be contained either in the sequence, GOP or picture headers of the video data stream.

To make handling of the undoubtedly confusing number of combinations easier for the person carrying out the tests, the nominal display formats described by the test sequence are represented in the form of a TV screen (FIG 3). Thus the user can see at a glance whether the AFD has been correctly interpreted by the TV set.

Virtual programs

Virtual programs are structures in which elementary streams are used several times under different program names. As can be seen in FIG 5, the video elementary stream is only available once under the PID 0x0031, while a reference to the elementary stream is contained in program 3 and program 260. This reference must also be included in the MPEG2 tables PAT (program association table) and PMT (program map table) as well as in the DVB table SDT (service description table) or the ATSC table VCT (virtual channel table). A typical application of this procedure is the emission of identical, high-quality video content with different languages or comments for different programs.

Harald Weigold

REFERENCES

[1] MPEG2 Generator R&S DVG and MPEG2 Measurement Decoder R&S DVMD – Test equipment for digital TV in line with MPEG2. News from Rohde & Schwarz (1996) No. 152, pp 20–23

[2] DTV Recorder Generator R&S DVRG – Recording, processing and replaying MPEG2 transport streams. News from Rohde & Schwarz (2000) No. 167, pp 8–10

More information and data sheets at www.rohde-schwarz.com (search term: DV-TCM, DVG or DVRG).

43 924

FIG 1 DTV Exciter R&S SV 702.

DTV Exciter R&S SV 702

Compact exciter for digital terrestrial TV

The new DTV Exciter R&S SV 702 was developed specially for use in low-power transmitters. It is notable for its compact design and integrated control function.

Transmitter concepts – easy to implement

Digital terrestrial networks are being set up all over the world. Basic coverage is ensured by means of high-power and medium-power transmitters. Complete coverage throughout the network can be achieved economically with the aid of 10 W to 200 W low-power transmitters.

Due to its compact design, the new DTV Exciter R&S SV 702 (FIG 1) is ideal for use in low-power transmitters. The integrated control interface for low-power amplifiers from Rohde & Schwarz makes external components superfluous and permits flexible transmitter concepts to be easily implemented.

Compact design

The DTV Exciter R&S SV 702 meets the DVB-T (ETS 300744) standard. It comes as a compact 19-inch rackmount of two height units and consists of an encoder, a precorrector and a synthesizer/modulator.

The DVB encoder has two ASI (asynchronous serial interface) inputs with flexible clock processing and data buffering (FIFOs) so that network operators can use standard feed paths such as directional radio links or satellite links. Automatic input switchover allows the implementation of redundant feed paths.

For operation in single-frequency networks (SFNs), an SFN adapter integrated

in the encoder accepts time reference pulses from an external or, optionally, from an integrated GPS receiver. Continuous tracking of the processing clock compensates for inconsistent time patterns of the reference signals without impairing the signal quality so that an especially high availability of the output signal in the SFN can be ensured.

The encoder transfers the digital baseband signals to the precorrector which optimally corrects linear (group delay) errors of a power filter that may be used and nonlinear distortions of the power amplifier. Since digital signals are processed in the two stages, the results of precorrection can be accurately reproduced. The precorrected baseband signals are then D/A converted. The subsequent modulator generates the RF signal by direct quadrature modulation. A fast-settling modulator chip of excellent stability, developed and produced especially for Rohde&Schwarz, is used in this case. The mixer frequency required for modulation is supplied by a synthesizer that can be synchronized to external references or to the internal GPS receiver (option). Since a high-quality reference oscillator is used, operation in SFNs can be continued for up to 24 hours if the reference frequency or GPS reception fails.

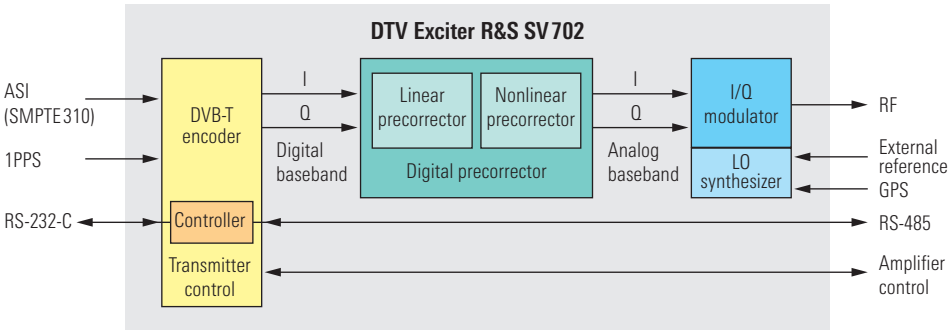


FIG 2 Block diagram of the DTV Exciter R&S SV702.

Integrated transmitter control

The control function integrated in the encoder generates all signals required for operating a Rohde&Schwarz low-power amplifier up to the variable setting of the output power. The voltage at the RF rectifier in the amplifier is evaluated and the output power is monitored so that a complete transmitter can be set up without any external components being required.

In transmitter systems with standby configuration, the new R&S NetCCU takes over transmitter control. In this case, the integrated control function is deactivated.

Operation from PC, display or Internet

All setting parameters of the R&S SV702 and of the integrated transmitter control function can be accessed from a PC via a graphical user interface. Alternatively, the exciter can be operated from the graphics display of the R&S NetCCU, which also permits remote-control and monitoring via the Internet (TCP/IP) or SNMP networks.

Cornelius Heinemann

More information and data sheets for all transmitters and exciters from Rohde&Schwarz at www.rohde-schwarz.com

Condensed data of the R&S SV702

Frequency ranges	170 MHz to 240 MHz 470 MHz to 860 MHz
RF output power	13 dBm
TV standard	DVB-T ETS 300 744
Channel bandwidths	6 / 7 / 8 MHz, selectable
Interfaces	RS-232-C, RS-485
Dimensions (W × H × D)	465 mm × 93 mm × 494 mm
Weight	approx. 9 kg

R&S NetLink

Enhanced capabilities for management of broadcasting networks

The new R&S NetLink [*] system for monitoring and remote control of transmitter systems has been available for more than a year now. With the aid of the new Parallel Interface option, even older transmitters or non-Rohde&Schwarz instruments can be integrated into transmitter systems.

Worldwide success of R&S NetLink

With the introduction of R&S NetLink about a year ago, Rohde&Schwarz set out on a completely new path. R&S NetLink only uses standard protocols of the IP protocol family (*TCP/IP*) for transmitting remote communication and control data of broadcast equipment. A web browser on the client side is sufficient for transmitter operation and monitoring. R&S NetLink can be smoothly incorporated into an *SNMP*-based management system merely by integrating the *MIB* of the transmitter system.

R&S NetLink is being used in many countries around the world, e.g. England, Switzerland and the USA. In Finland, R&S NetLink has been integrated into a network comprising 16 transmitter systems. A great number of different application scenarios has already been implemented: all standby configurations up to (n+1) systems, integration of older transmitters, stations for analog and digital TV with and without direct connection to a modem.

The new Parallel Interface option

Many queries from customers were concerned with the integration of older systems or of instruments from other manufacturers. Integration is easy with the new Parallel Interface option. All kinds of equipment, e.g. alarm systems or emergency power units such as diesel generators, can now be integrated via the 32 digital inputs and outputs that can be assigned as required.

The operating concept of R&S NetLink was not changed. The contacts are described in a configuration file and colour-coded. The web browser displays this information on a separate page (FIG 1). Check boxes representing the switching states of the outputs are available in addition.

Expansion is just as simple when *SNMP* is used. A supplementary branch added to the existing *MIB* shows the functions assigned to the contacts. Traps indicating possible faults, e.g. signal failure at an input that was previously linked to the station controller via parallel contacts, can, of course, also be configured.

The new option is of particular interest for users wishing to integrate new transmitters into existing stations and take advantage of the new technology. FIG 2 shows that existing systems can be easily connected to the LAN via the Parallel Interface option. This opens up new possibilities for system monitoring not only in the transmitter control room but in the remote control center as well.

Fault reporting

A primary aspect of remote reporting is that faults in the transmitter system are signalled automatically. Up to now, R&S NetLink was only able to send traps to the network management center by way of *SNMP*. In most cases, such management centers are available only in large broadcasting networks yet monitoring is decentralized in many countries. In these cases, a transmitter with R&S NetLink can be directly contacted via a modem.

More information and application note at www.rohde-schwarz.com (search term: NetLink)

A demo version for transmitter operation is available at http://netlink.rohde-schwarz.com/ It demonstrates the operating concept and the capabilities of the new Parallel Interface option. To try it out you simply have to set up a user account.

REFERENCES
[*] R&S NetLink: Remote control and monitoring of transmitters on the Internet. News from Rohde&Schwarz (2001) No. 170, pp 27–29

In this scenario, an e-mail and, if supported by the mail server, an SMS can be sent to the mobile service personnel. FIG 3 shows the available paths for transmitting fault reports.

Summary

The worldwide success of R&S NetLink enhances Rohde&Schwarz's position as a technological leader in the field of terrestrial broadcasting and underscores the trend towards open, standardized solutions for service-oriented management of complete broadcasting networks. The new Parallel Interface option considerably simplifies the shift away from earlier connection and remote-control concepts – e.g. a link to a station controller – and paves the way for a wealth of new applications.

Torsten Hübscher

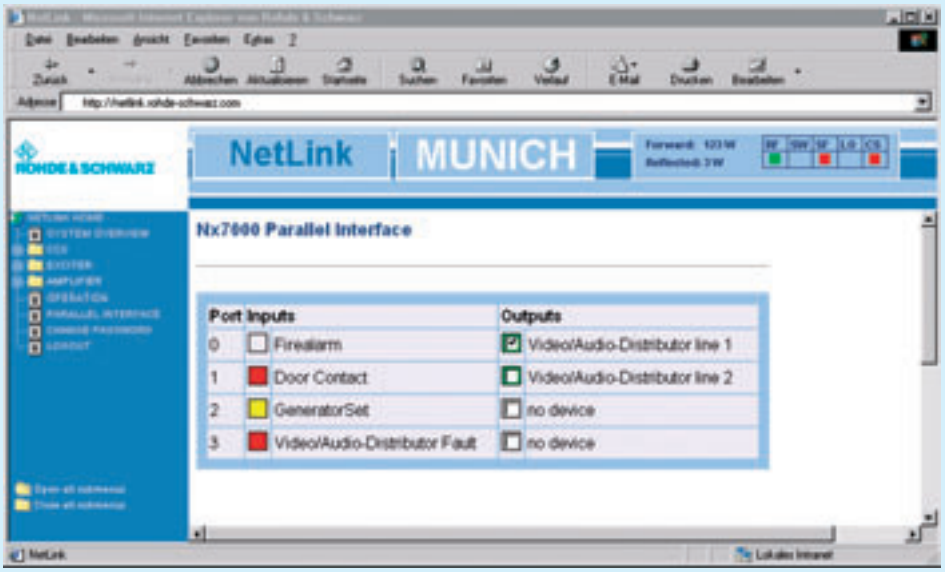


FIG 1 Display of parallel contacts in the web browser.

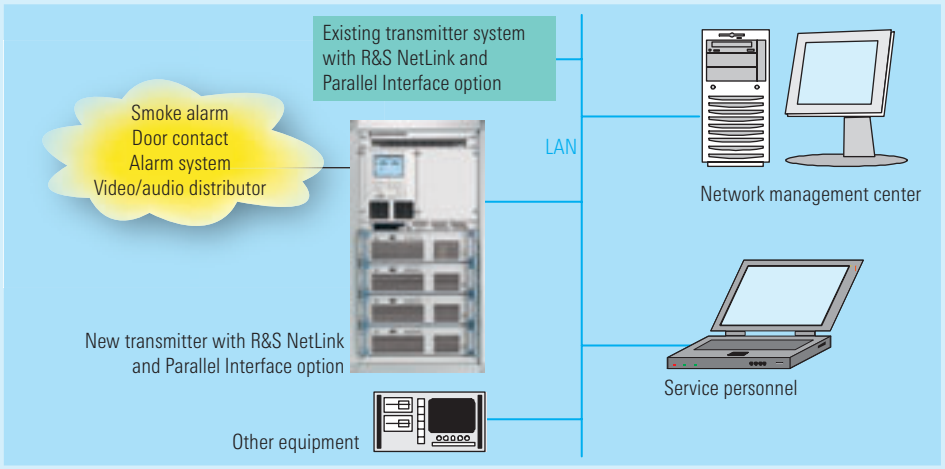


FIG 2 Connecting transmitters to a LAN with R&S NetLink.

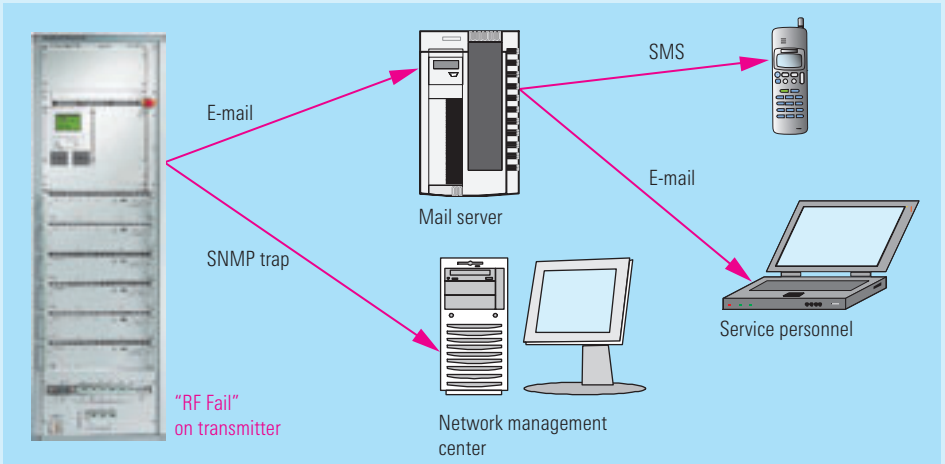


FIG 3 Various means of fault reporting.

Abbreviations

TCP/IP	Transmission control protocol / Internet protocol
SNMP	Simple network management protocol
MIB	Management information base

FIG 1 The family of Switch Units R&S ZS129x.

Monitoring and coverage measurement systems

Expanded system devices line

One reason why Rohde&Schwarz monitoring and coverage measurement systems are among the most successful on the global market is that they undergo permanent development and thus "set the tone." This applies not only to the extensive range of standard equipment which form the core of the systems, but also to the system or special devices, which are also of interest for numerous other applications.

Switch Units R&S ZS129x

The Switch Units R&S ZS129x (FIG 1) supersede the R&S ZS127x family [1]. They are designed as RF and IF switch units for stationary, transportable and mobile systems and can dynamically switch a variety of reception antennas to one or two receivers.

The Switch Unit R&S ZS129A1 is available in various different models covering the frequency range from DC to 3 GHz. Depending on the model, it is equipped with 1-out-of-6, 1-out-of-8, 1-out-of-12 or 2-out-of-2 RF switches. These switches are implemented as relays. However, it is also possible to install GaAs switches, which switch about a 1000 times faster but cause intermodulation. As further options, switches for higher frequency ranges are available. The R&S ZS129A1 can be supplied with 10 V to 35 V DC, or with 115/230 V AC via the external AC/DC converter that comes with the unit. The models can be optionally equipped with up to six DC power feeds that allow them to supply power to active antennas via the RF cable.

The R&S ZS129A1 can be operated either manually via the front panel or via software, e.g. R&S ARGUS (page 46), or by way of the RS-232-C or USB interfaces. In addition, Rohde&Schwarz receivers can drive the units via a TTL interface.

The family is rounded out by the Switch Units R&S ZS129A2, -A4 and -A5 and by the R&S ZS127Z1 (see [1]), as well as by multicouplers, power dividers and various filters. The R&S ZS129A1 can control these units, enabling complex switching tasks to be performed.

Mast Control Unit R&S GB 127 MU

The new Mast Control Unit R&S GB 127 MU can control any extendable masts, provided they are equipped with an optical resolver. The Antenna Control Unit R&S GB 127 M (FIG 2) [1] controls, in turn, the mast control unit, allowing all rotary (azimuth and polarization or elevation) and vertical movements of the antennas to be set from this central device.

Communication Unit R&S GC 128

The R&S GC 128 supersedes the GSM Communication Unit R&S GC 127 [1]. It supports both the GSM 900 and GSM 1800 band as well as GPRS (general packet radio service), the packet-switching service for mobile data communication, which speeds up transmission (multislot class 8, mobile station class B). The precondition for this is that the provider in the country in which the device is used also offers GPRS.

The R&S GC 128 provides a further means of increasing the data rate via the GSM network, should there be no GPRS available, by having two additional GSM modules installed in the unit as an option. Channel banding is performed by the communication unit and the associated router, so it is possible to attain a speed three times greater than that achieved with only one GSM module. Another optional GSM module is supplied with a headset for use as a telephone.

Compact PC R&S SPCC

The Compact PC R&S SPCC has been added to the family of System Process Controllers R&S SPCx [1]. Like the R&S SPCR, it is designed for installation into a rack, but is smaller in height (2 HU) and provides optional space for a router. It is thus optimally suited for use in transportable and mobile systems. Four standard models are available:

- Model 02: integrated PC and router with interface to analog dial-up or leased line (the modem that comes with this model must be set up externally)
- Model 03: integrated PC and router with interface to ISDN dial-up line
- Model 04: integrated PC and router with interface and GSM module to GSM/GPRS 900/1800 connection (the GSM antenna that comes with this model must be set up externally)
- Model 05: integrated PC with two free PCI and ISA slots (for half-length cards)

GPS Receiver R&S GPS 129

For direction finding and locating operations, it is absolutely essential to know the exact location of the DF antenna so that the monitoring system can compute the transmitter location. The computer should also be synchronized with the GPS time in order to be able to link the bearings of different DF stations with each other. The new GPS Receiver R&S GPS 129 supplies accurate time and position data for this purpose.

In addition, it provides two high-precision frequencies (2048 kHz and 10 MHz) which increase the frequency accuracy of receivers and direction finders with the corresponding reference frequency input, as shown by the Monitoring Receiver R&S ESMB [2].

Jörg Pfitzner

FIG 2 Antenna Control Unit R&S GB 127 M.

43697/1

More information, data sheets and technical information sheets at www.argus.rohde-schwarz.com (search term: type designation)

Data sheet R&S ZS 129 x

Data sheet R&S GB 127 x

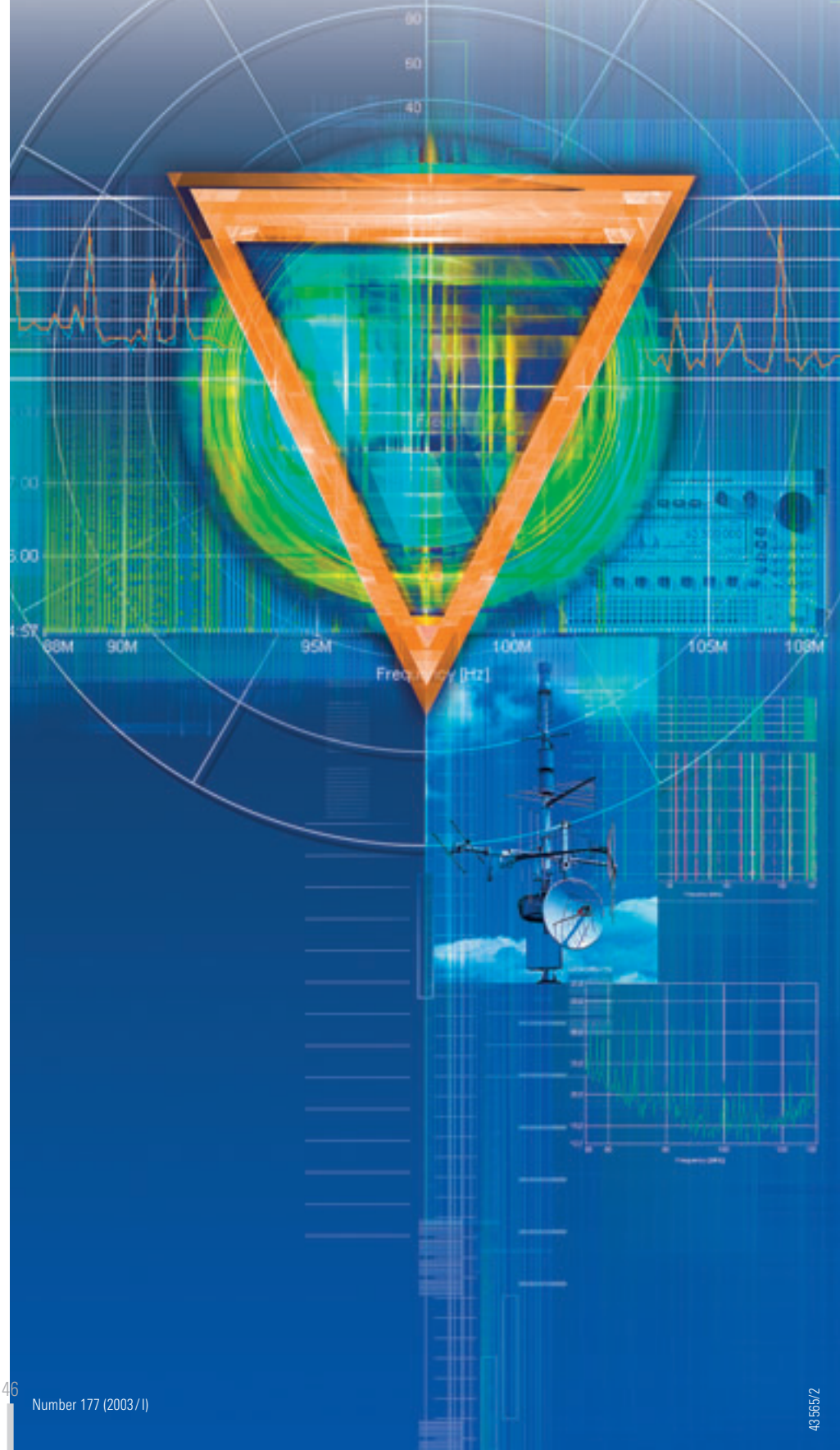
REFERENCES

[1] Monitoring and coverage measurement systems: Complete product line from a single source. News from Rohde & Schwarz (2001) No. 171, pp 45–47

[2] ITU-conformant Monitoring Receiver ESMB: Incredibly compact – and high-end into the bargain. News from Rohde & Schwarz (2000) No. 167, pp 4–7

Spectrum Monitoring Software R&S ARGUS

The successful “classic” now available as version 5



Spectrum Monitoring Software R&S ARGUS is the core of the software packages for the Spectrum Monitoring and Management System R&S ARGUS-IT [1, 2] and the Coverage Measurement System R&S ARGUS-FMTV [3]. The comprehensive software package has been continuously developed and updated since 1987 for various operating systems from MS-DOS to Windows™ XP. Version 5 of R&S ARGUS is now available. Numerous customer requests and extensions such as the latest ITU recommendations have been implemented in this version.

Rich in innovations

Spectrum Monitoring Software R&S ARGUS provides a variety of modes and routines for measuring and evaluating electromagnetic emissions in line with ITU recommendations. It can be scaled by using modular components, whether for the control of single instruments [4] or the operation of a nationwide radiomonitoring system with many fixed, mobile and transportable stations [5]. The modular structure of the software with options permits customized solutions to be configured for individual requirements.

Version 5.0 of R&S ARGUS is now available featuring a large number of customer requests and extensions such as the latest ITU recommendations. The software is also user-friendly and easier to operate. The most important modifications compared to version 4.4 are described in this article.

R&S ArgusMon and R&S ArgusEval combined into R&S ARGUS

The most important innovation is the combination of Measurement Software R&S ArgusMon and Evaluation Software R&S ArgusEval to form Monitoring Software R&S ARGUS. Data no longer needs to be transferred between the two software packages, and all tasks can be centrally controlled. In addition, R&S ARGUS data from all test stations rather than from just one can now be displayed and processed.

Order/report module

Owing to the new, optional order/report module (ORM), other applications can send orders to R&S ARGUS and receive results in the form of reports (FIG 1). This is done by exchanging extensible markup language (XML) files between the software packages (blue in FIG 2). For instance, a spectrum management system can now send measurement orders to the monitoring software. R&S ARGUS returns the results after the measurements, which are then compared to predicted values with the aid of planning tools. The measurements can be performed either fully automatically by R&S ARGUS or manually using R&S ARGUS.

Orders may contain suborders for various stations. For instance, if R&S ARGUS receives an order at station 1, it processes the suborders for station 1, then forwards the order to the next station for processing, and so on. The last station in the chain returns the complete report to station 1, which sends it to the application from which the order was received (FIG 2). A network has to be set up in this case and the ORM option must be installed in each station. R&S ARGUS can also send orders to itself and to other stations and will then receive the reports.

Interface to spectrum management database

Via this interface, transmitter data as well as assigned and non-assigned frequencies can be queried and imported from the spectrum management database according to specific criteria. The interface uses the same method and XML format as the order/report module.

Difference measurement module

The new difference measurement module (DIFF) is available as an option for the automatic measurement mode. It permits simultaneous difference measurements to be performed with two receivers. The measured frequency spectra of the two receivers and their difference are displayed. Settable thresholds are available for noise suppression so that only relevant information is indicated. Emissions in monitored rooms can be detected, for instance, by comparison with a reference room (FIG 3). Even cable defects can be determined with this method.

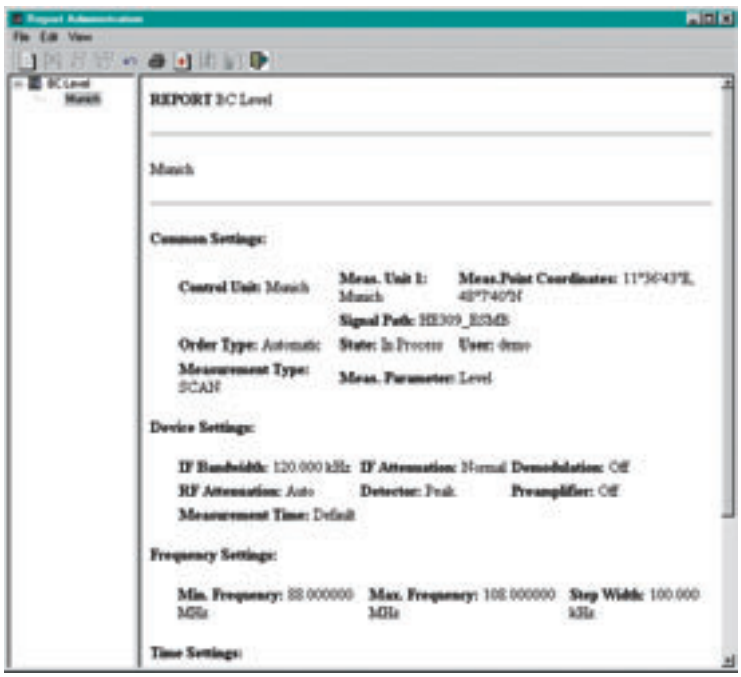


FIG 1
Typical R&S ARGUS report.

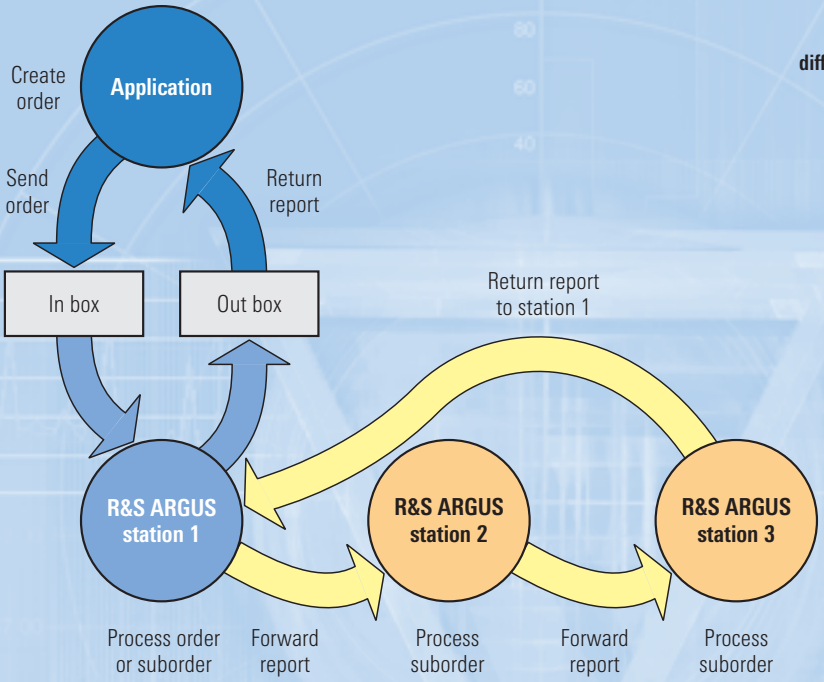
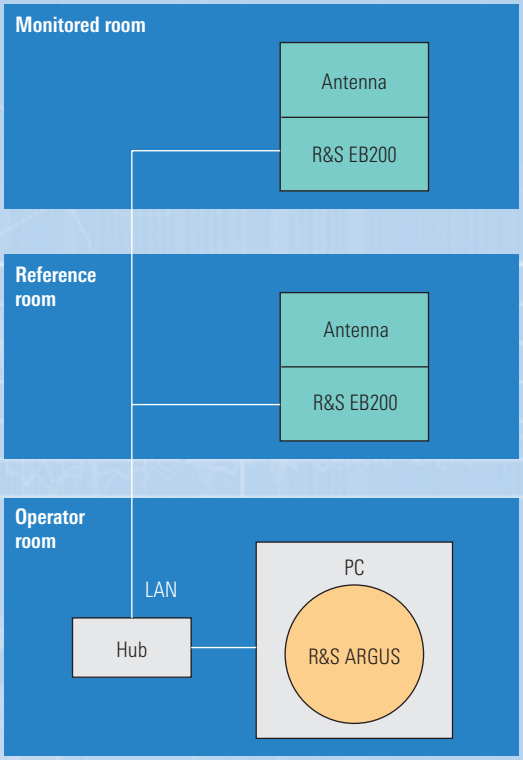


FIG 2 Order/report processing with one or more stations.

FIG 3
Basic setup for difference measurements.



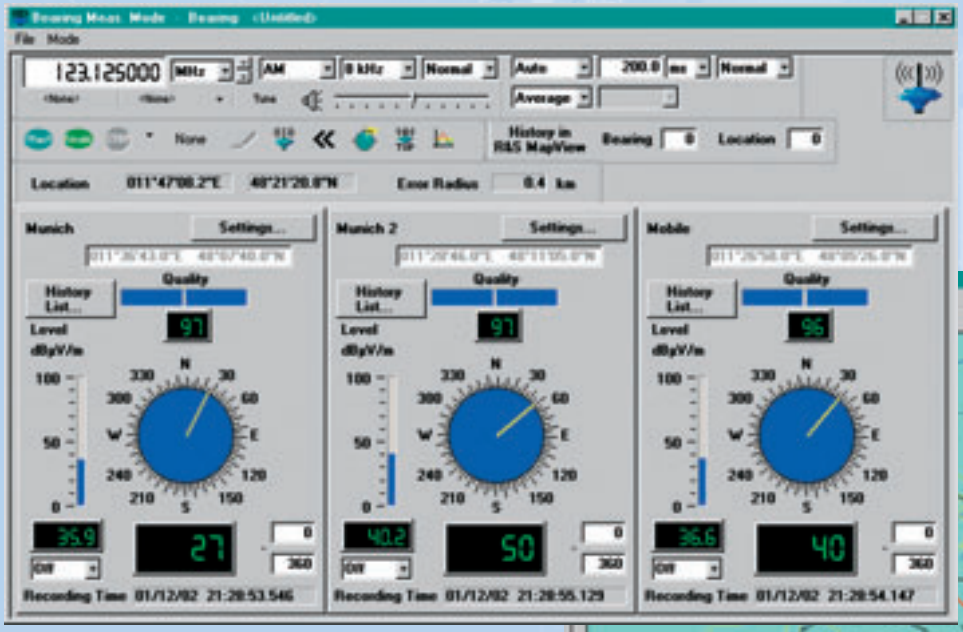


FIG 4 New dialog window for the bearing measurement mode.

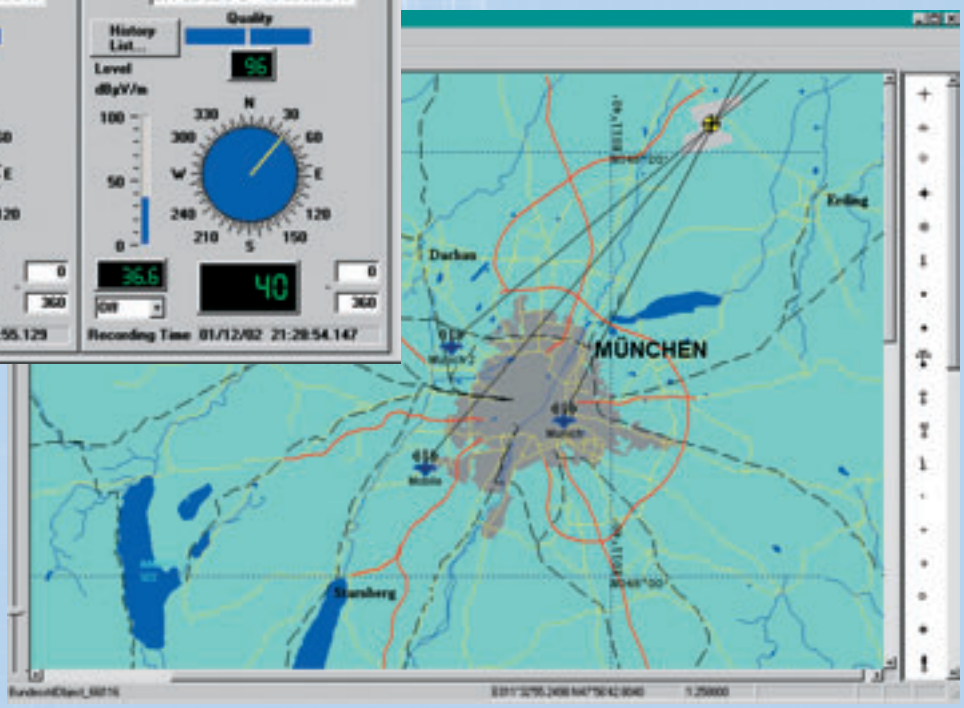


FIG 5
Geographic Information Software R&S MapView.

Intermodulation analysis

If the originating frequencies of intermodulations are known, they can be directly specified for intermodulation analysis. The desired number of originating frequencies can also be exactly determined. These two new features considerably simplify the search for originating frequencies.

Bearing measurement mode

The user interface of the bearing measurement mode was completely revised to simplify operation with several DF stations (FIG 4). An aspect deserving special mention is that entered frequencies are automatically buffered in a history list so that they are available whenever required. Bearings can also be automatically stored and displayed by the Geographic Information Software R&S MapView (FIG 5). The dialog window of the bearing measurement mode can always be displayed in the foreground so that settings are no longer covered by R&S MapView.

Automatic measurement mode

Several innovations have improved the automatic measurement mode.

Saving measurement results

All or no measurement results as well as preprocessed results can be saved. The following can be selected:

- Only the maximum value is saved for each measured frequency (MaxHold)
- The maximum, minimum and average values measured within a user-defined period are saved for each frequency
- All values measured during an alarm are saved
- Only the values measured at the beginning and the end of an alarm are saved
- All values measured during an alarm are saved; outside the alarm, the maximum, minimum and average values measured within a user-defined period are saved for each frequency

Since modern receivers may provide a considerable amount of data, these functions, selectable in the Measurement Definition window (FIG 6), will help reduce the number of measurement results. If all measurement results are stored, they can be processed at a later time. This is of particular advantage if the results are stored in a remote-controlled measurement station. In this case, only the evaluated results have to be transmitted via the network.

Improvements in brief

- R&S ARGUS now runs under Windows™ XP / 2000 / NT 4.0.
- Frequency assignment was revised in line with the new ITU manual.
- Limit lines can be entered in a mask that can be easily shifted to a frequency. This is of great importance when measuring digital signals that have to meet specific criteria.
- Frequency lists can be generated directly from measurement results. Only frequencies with results above a specific threshold will be considered.
- General transmitter data can be imported and exported by R&S ARGUS also in dBase, Excel, Access, text and HTML formats.
- The Switch Unit R&S ZS129A1 is supported (page 44).
- The RF Step Attenuator R&S DPSP as well as manual attenuation or amplifier switches can be easily integrated and operated in the software.
- Live graphics can be stored as images.
- Receivers or analyzers with two inputs can be integrated in the software so that the correct input is always used when a system path (antenna/receiver) is selected.
- MaxHold data can also be stored in the interactive measurement mode.
- In measurement statistics, the number of measurement results can be displayed in addition to the percentage.
- All manuals and the link to the ARGUS homepage can be opened from the help menu.
- Data and programs may be stored on different hard disks or in different partitions. Data can therefore be stored on backup media without storing the whole program.
- Detailed glossary.

Radiolocation now also by means of transmitter list scans

Tiresome conversion of transmitter lists to frequency lists is therefore no longer required.

Limit values in the transmitter lists may be directly used as alarm conditions

No more tedious setting of limit values in a separate dialog window.

New user manuals

The new interactive user manuals for R&S ARGUS-IT and R&S ARGUS-FMTV (FIG 7) will help users to quickly and efficiently familiarize themselves with the software. The most common, typical measurement tasks and their solutions are explained step by step with the aid of examples.

Another step ahead

Version 5.0 of R&S ARGUS meets many new customer requirements. The large number of improvements and additions makes the software easier to operate and increases productivity.

Jörg Pfitzner

FIG 6
Measurement Definition window.

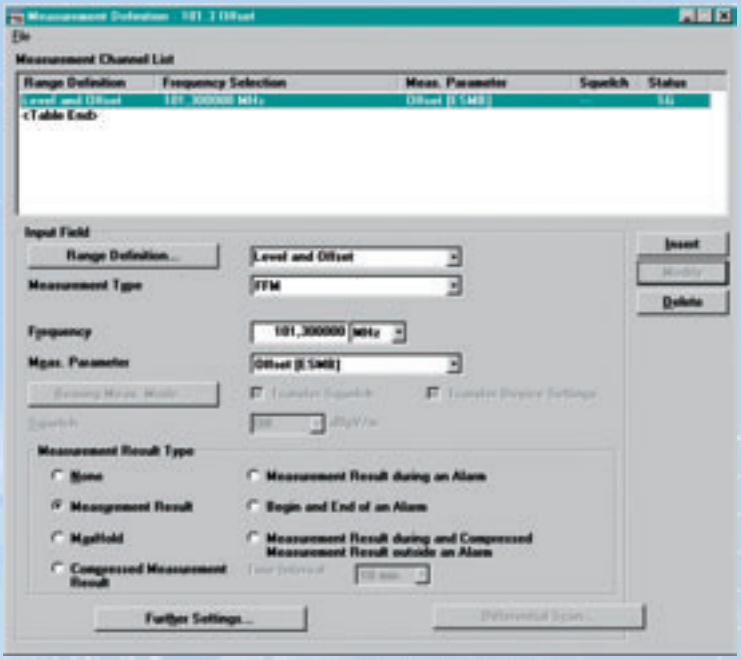
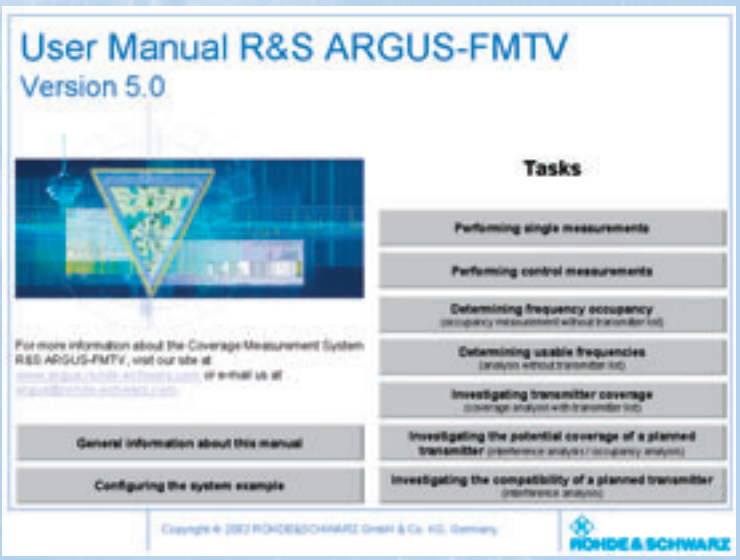


FIG 7
Interactive user manual for R&S ARGUS-FMTV



More information, data sheets and technical information sheets at www.argus.rohde-schwarz.com or www.rohde-schwarz.com

REFERENCES

[1] Spectrum monitoring and management system for Sri Lanka – Electromagnetic waves do not stop at frontiers. News from Rohde&Schwarz (2000) No. 168, pp 40–42

[2] Transportable Monitoring and Direction Finding Systems R&S TMS – Versatile solutions for spectrum monitoring. News from Rohde&Schwarz (2002) No. 175, pp 47–51

[3] Coverage Measurement System R&S ARGUS-FMTV – Optimum use of frequency thanks to reliable forecasts in planning. News from Rohde&Schwarz (2001) No. 170, pp 30–33

[4] Miniport Receiver EB200/Compact Receiver ESMC – Minireceivers: remote control lends weight to network role. News from Rohde&Schwarz (1999) No. 165, pp 16–17

[5] Nationwide radiomonitoring system for Nicaragua. News from Rohde & Schwarz (2002) No. 176, p 45

Information & Communication System R&S PostMan II

Advanced communication technology for global radio networks

With R&S PostMan II, mobile stations can easily be radio-connected to modern communication services such as e-mail, fax or the Internet. The system can be implemented in a wide variety of applications. For example, R&S PostMan II can be combined with shortwave systems to provide maximum independence from public means of communication to diplomatic contingents anywhere in the world.

Standardization ensures communication

R&S PostMan II – the successor to R&S PostMan [*] – is a combined hardware/software product that implements advanced Internet communication through a variety of transmission media. The system conforms to international standards, thus ensuring interoperability with systems of other producers, operation in computer networks using different controller platforms and operating systems, as well as the use of a broad scope of standard communication programs.

The key to unrestricted, cross-network information exchange is TCP/IP, the internationally standardized protocol on which almost all computer network communication services throughout the world are based. Using TCP/IP, R&S PostMan II offers state-of-the-art office and Internet communication technologies via HF, VHF and UHF. Owing to a number of innovative properties, R&S PostMan II is also implemented together with conventional wire and mobile transmission media as well as for satellite transmission. Even shortwave, which provides almost unlimited range but is subject to a number of interfering effects, can be used for this purpose owing to new protocols and coding procedures. Depending on requirements, users can choose between different transmission protocols at the air interface.

One alternative is a special data transmission protocol developed by Rohde&Schwarz for high data rates in TCP/IP-based semiduplex connections, which are common on most radio links. The high data rates enable the use of virtually any modern communication program, and communication is not restricted to e-mail or file transfer. Of course, live video conferences are still out of the question because of the 3 kHz bandwidth that is standard in shortwave communication.

If interoperability with systems from other manufacturers is required, however, the transmission method defined in STANAG 5066 can be applied.

Convenient new services

Fax is one of the many new services offered in R&S PostMan II. Even if a station is not equipped with a computer, faxes can be exchanged with another station directly from the fax machine via radio (FIG 1). The called station can be addressed in the normal manner by dialling the number on the fax machine. If a PC is available, a fax can also be generated electronically. The recipient can be either a computer or a fax machine.

Voice mail recorded straight from a telephone is just one example of the various voice services offered by R&S PostMan II (FIG 2). The procedure involves dialling the other party and leaving a message on the R&S PostMan II server. The communication system then automatically delivers the voice message, bundled in an e-mail, to the other party. Like fax service, this service is available to practically any subscriber on a connected PSTN.

Open operating system

The R&S PostMan II hardware platform is a communication server running on the Linux operating system and also controlling the connected radios. Linux has become an international standard and is used worldwide in many safety-critical systems. The open source text of the operating system permits all functions to be reproduced and allows full system management. The communication server is connected to the computer network via a standard Ethernet interface. After just a few entries by the system administrator, the preconfigured R&S PostMan II server is fully integrated into the network and operational (plug & play).

GPS tracking

Another feature is mobile station tracking by GPS (global positioning system). If a station is equipped with a GPS receiver, position data can be transmitted simultaneously after analysis of the National Marine Electronics Association (NMEA) protocol. The current positions of and the routes covered by the individual mobile stations can thus be tracked from a command center (FIG 3). The position of a mobile station or the distances covered can be used to choose the optimum frequency for contacting the mobile station.

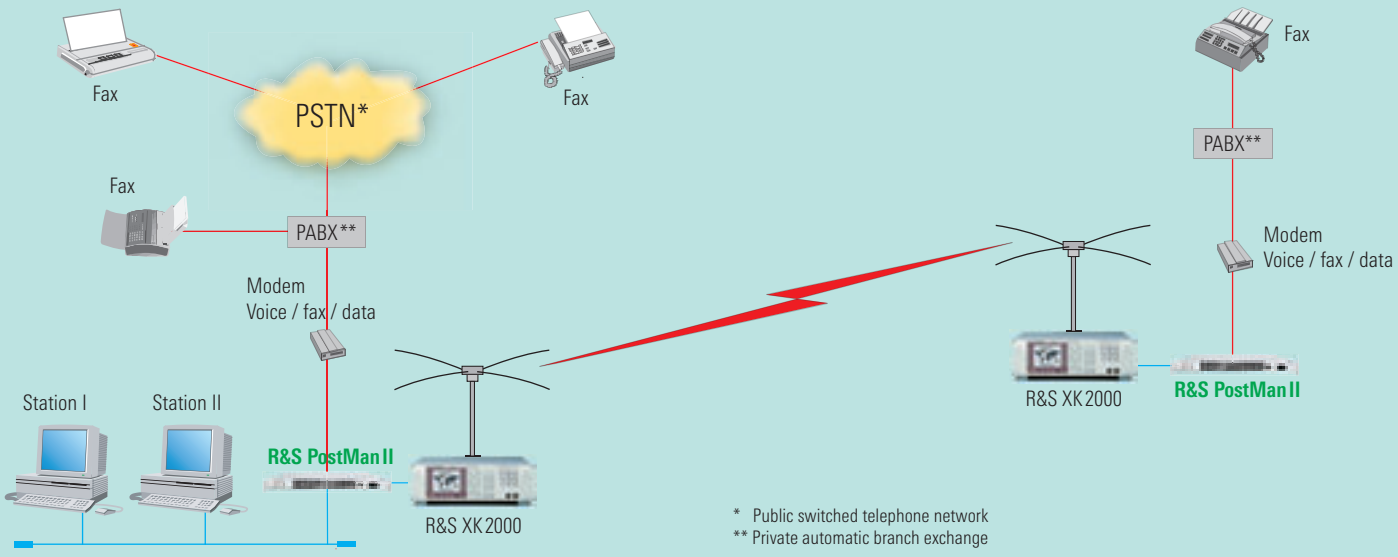
Reliable and encrypted transmissions

After specifying the addressee and selecting the desired transmission medium, the message author can set the transmit time or leave the decision up to the Information & Communication System R&S PostMan II, which will send the message at the ideal time based on criteria such as good radio link quality or cheaper satellite communication rates.

If a link is interrupted, R&S PostMan II automatically attempts to contact the addressee through alternative routes or media. Despite these complexities, the R&S PostMan II server can still exchange information on several links simultaneously. For example, while a fax is being sent on one radio link, an e-mail can be transmitted on another, or two subscribers can conduct a text dialog in a chat room.

All exchanged information can of course be protected against unauthorized access with the aid of customized encryption methods. A large number of encryption options is available, ranging from pure software solutions to combined software and hardware techniques at the computer end, or even the integration of customized encryption units into the information flow. Various system solutions for this purpose have been developed in cooperation with the Rohde & Schwarz SIT GmbH subsidiary.

FIG 1 Fax service.



Easy system management

System management and network planning are prerequisites for reliable and smooth operation in radio-based communication networks. All required data is entered in a network and communication plan via intuitive graphical user interfaces, and the available resources are managed in the radio link configuration.

Summary

R&S PostMan II is a highly promising system solution that meets all requirements for a modern radiocommunication system. This information and communication system provides a completely new level of quality for radiocommunication.

Thomas Kneidel

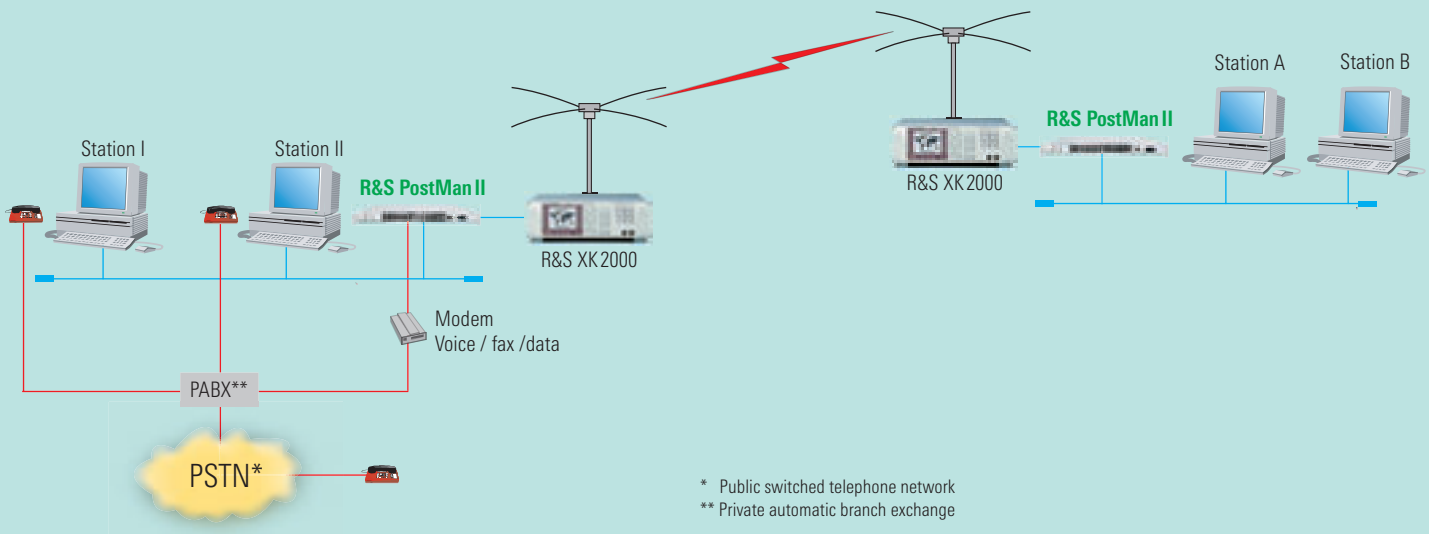
FIG 3
GPS tracking of mobile stations.

More information and data sheet at www.rohde-schwarz.com (search term: PostMan)

REFERENCES

[*] When the PostMan rings on Internet. News from Rohde&Schwarz (1997) No. 153, pp 28–29

FIG 2 Voice mail.



* Public switched telephone network
** Private automatic branch exchange

New air traffic control system at airport in Buenos Aires

New air traffic control (ATC) facilities from Rohde & Schwarz were officially opened in the "Ezeiza" area control center (ACC) at the international airport in Buenos Aires (FIG 1). The new ACC is one of the largest and most modern ATC centers in all of Latin America.

A radar and communications network that also incorporates the Carrasco international airport in Montevideo (Uruguay) was set up here. Altogether 23 workstations with access to 22 VHF AM voice channels are available. The system also includes 19 radio stations with VHF transceivers. In addition, up-to-date meteorological voice information is broadcast round the clock via an advanced digital AF storage system (ATIS). In a formal ceremony, the ACC was officially opened by Dr Horacio Jaunarena, who was accompanied by high officials of the Argentine air force and members of Uruguay's government.

▽

FIG 1 Argentina's Defence Minister Dr Horacio Jaunarena opens the new "Ezeiza" area control center.

Rohde & Schwarz receives official approval for TETRA mobile radio system in Russia

The Russian Ministry of Information and Communication (MINSVIAZ) has issued the first official certificate for the installation and operation of TETRA mobile radio systems. R&S BICK Mobilfunk, a subsidiary of Rohde & Schwarz, was awarded this general approval for its TETRA system *ACCESSNET*®-T with immediate effect. The certification permits connection and access to the Russian telephone network for the first time.

Establishing TETRA networks in Russia has always required each system to be tested and approved separately. This approval is subject to strict conditions and forms the basis for setting up and operating a TETRA radio system. Up to now, R&S BICK Mobilfunk also required a special import license for every system as well as a pilot operation approval. The general approval provides the TETRA system *ACCESSNET*®-T from R&S BICK Mobilfunk with unrestricted suitability and permission for setup and operation in Russia.

FIG 2 The modern control center in Beijing coordinates all of northern China's air traffic.

The certification secures R&S BICK Mobilfunk's position on the Russian market and opens up new business areas involving private network operators, or carriers and transport firms that can be serviced in the future. Operators such as ministries, railway companies or crude oil suppliers are now able to set up TETRA networks without any prolonged approval procedures.

Multimillion-euro order for the development of a tap-proof crypto telephone for Germany's Armed Forces

On behalf of Germany's Armed Forces, the Federal Office of Information Management and Information Technology (IT-AmtBw) has contracted Rohde & Schwarz SIT to develop a crypto telephone.

The order is for the development of the new ELCRODAT 5-4 crypto telephone and also includes supplying a number of device models, accessories and documentation. After the very successful marketing of the world's first tap-proof mobile phone, which is now in widespread use by the government, public authorities and companies, this order enables Rohde & Schwarz to further expand its position as Germany's largest supplier of communication-security solutions.

The new crypto telephone is designed for use in analog networks and in the ISDN network, with encryption based on standardized NATO algorithms. The ELCRODAT 5-4 is therefore also compatible with other crypto devices used by NATO. Using state-of-the-art encryption methods, the telephone ensures tap-proof end-to-end transmission of voice and data. Key distribution is performed automatically via the crypto material distribution centers already in operation in the German Armed Forces. The ELCRODAT 5-4 is primarily designed for office use. However, by way of satellite connections it can also be used for mobile applications or in the field.

Rohde & Schwarz supplies VHF radio systems for Beijing's air traffic control center

Rohde & Schwarz will supply VHF radio systems serving twelve stations equipped with approximately 400 instruments of the R&S Series 200 for the Beijing area control center. The systems will be used to monitor and coordinate all air traffic in northern China (FIG 2).

This marks a continuation of the successful cooperation between the Chinese aviation authority CAAC and Rohde & Schwarz, which began in 1989 with the supply of the first radio system for the Beijing airport. The new control center will be equipped with a central remote-control and monitoring system, allowing even unattended radio stations throughout northern China to be operated by remote control from Beijing.

Rohde & Schwarz Service Center opens first fully automatic calibration service in the Middle East

The Arabian Rohde & Schwarz subsidiary is expanding its service. A new automatic calibration system decreases the time needed to calibrate analog and digital T & M equipment to just a few hours.

Rohde & Schwarz Emirates is thus the only service center in the Middle East which can offer a fully automatic calibration service of this kind, enabling it to considerably lower calibration costs for customers.

Rohde & Schwarz Emirates L.L.C. is a joint venture of Rohde & Schwarz in Munich and Capital Investment in Abu Dhabi, and was established in 1994. In the last eight years, the subsidiary has developed into one of the most important service centers in the region.

In addition, Rohde & Schwarz Emirates has the ISO 9002 certificate as well as an approval certificate issued by the United Arab Emirates' civil aviation authority. This certificate authorizes the company to calibrate, among other things, the T & M equipment of airports and aviation organizations.

Customer survey on the Internet

For Rohde & Schwarz, customer satisfaction has always been one of the main gauges the company uses to continuously improve the quality of its products and services. For this purpose, in past years it selectively conducted customer surveys to determine the experiences customers had with the company and to get an idea of their expectations regarding future cooperation. The surveys show that the majority of customers feel very well served.

Last year Rohde & Schwarz surveyed more than 800 customers in over 15 countries to learn more about their current expectations. On the basis of this survey, concrete corrective measures have been defined and in the meantime selectively implemented. For example, at customer request the service and application structure has been expanded and the electronic provision of software updates improved.

To complement the extensive customer surveys, a virtual "customer opinion barometer" has now been set up on the Rohde & Schwarz website at www.survey.rohde-schwarz.com. Its purpose is to give customers a quick means of expressing their level of satisfaction and making suggestions for improvement.

Eight questions regarding products and services as well as information and communication with Rohde & Schwarz are listed. Answers are given quickly by clicking your mouse, and provide us with a measure of customer satisfaction and potential of improvement.

Thank you for your cooperation, and please let us know what you think of us!

Visit us on Internet at www.rohde-schwarz.com

ROHDE & SCHWARZ

ROHDE & SCHWARZ GmbH & Co. KG · Mühldorfstrasse 15 · 81671 München, Germany · P.O.B. 80 14 69 · 81614 München
Support Center: Tel. (+49) 18 05 12 42 42 · E-Mail: customersupport@rohde-schwarz.com · Fax (+49 89) 41 29-137 77

News from Rohde & Schwarz 177 (2003/I) · PD 0757.7530.21 · B42622