# Catalog
# Contents

Rohde&Schwarz is the only supplier of a complete range of transmission, monitoring and measurement equipment in the world. Broadcasting is a key business field at Rohde&Schwarz. Customers can benefit from expert solutions for analog and digital TV and sound broadcasting. The broad range of supported standards makes Rohde&Schwarz test and measurement and transmitter products unique.

# Our Business Fields and Products

For 75 years, Rohde&Schwarz has stood for quality, precision and innovation in all fields of wireless communications.

- Test and measurement
- Secure communications
- Radiomonitoring and radiolocation
- Broadcasting
- Present in over 70 countries
- Net revenue of € 1.4 billion
- 7500 employees

Executive Board (from left): Manfred Fleischmann, Michael Vohrer (Chairman), Christian Leicher.

The privately owned company group has a global presence. It develops, produces and markets a wide range of electronic capital goods for industry, infrastructure operators and government agencies.

Rohde&Schwarz numbers among the market leaders in all of its business fields, including wireless communications and RF test and measurement, terrestrial TV broadcasting and technologies relating to the interception and analysis of radio signals.

Numerous subsidiaries and representatives not only ensure quick and competent on-site support anywhere in the world, but also safeguard customer investments with comprehensive service and support offerings.

## Fiscal year 2007/2008

In fiscal year 2007/2008, Rohde&Schwarz maintained the high level of incoming orders achieved in the previous year. The company again made a major investment in research and development – 16 percent of its net revenue.

The results from the past year continue to reflect the strength of our business model, which is characterized by the broad diversification of our business fields, high flexibility and a global approach to developing our targeted markets and to providing customer support.

Stabilizing factors included not only the broad diversification and the global presence, but also the continued substantial increase in productivity.

With investment in research and development at about 16 percent of its net revenue, the company remained true to its credo of always providing sufficient means for securing growth and innovation.

Rohde&Schwarz is viewed as an attractive employer. In 2008, the company again held leading positions in representative surveys of employee satisfaction and rankings of favorite employers.

**Our business fields**

| Test and measurement | Secure communications | Radiomonitoring and radiolocation | Broadcasting |
|---|---|---|---|
| T&M instruments and systems for wireless communications, electronics and microwave applications | (Radio) systems providing encrypted communications for police, armed forces, government agencies and industry | Spectrum monitoring systems and radiomonitoring equipment for public safety and national security | Sound and TV broadcasting and measuring equipment |

## Test and measurement

Rohde&Schwarz is one of the world's largest manufacturers of electronic test and measurement equipment. Our products set standards in research, development, production and service. We are a key partner of industry and network operators for all T&M tasks in radiocommunications.

In the past year, Rohde&Schwarz launched new product highlights for signal generation, spectrum analysis and EMC measurement, again proving its innovative strength in RF test and measurement. In the extremely high frequency range, the introduction of products for network analysis in the millimeter-wave range marked the entry in the terahertz technology of the future. On the wireless market, the company strengthened its leading position as a supplier of T&M solutions for next-generation technologies such as LTE, WiMAX™ and MIMO.

**Our test and measurement portfolio:**

- Instruments and systems for testing mobile radio and wireless technologies
  - Wireless device testers
  - Infrastructure testers
  - Protocol testers
  - Conformance/preconformance testers
  - Test systems and accessories
- Spectrum and signal analyzers
- Signal generators
- Network analyzers
- Coverage measurement systems
- EMC and field strength test solutions
- Modular instruments
- Power meters and voltmeters
- Audio analyzers
- Video and TV generators and analyzers
- Modulation analyzers
- Power supplies
- RF and microwave accessories
- Industrial PCs

## Radiocommunications systems

Security organizations and armed forces must be able to exchange information efficiently and securely – also in multinational operations. To ensure the rapid coordination of civil, governmental and military forces in times of crisis, Rohde&Schwarz supplies powerful, interoperable communications systems. Due to their modern encryption methods, the company's solutions fulfill the highest requirements of national and international security standards. Software-defined radios ensure the greatest possible flexibility and are in use around the globe. Civil air traffic control agencies in 80 countries and at more than 200 locations – both airports and ATC centers – use Rohde&Schwarz radio systems.

**Professional mobile radio (PMR)**

TETRA radio networks have already been put into operation in more than 30 countries by the Rohde&Schwarz Professional Mobile Radio GmbH subsidiary – for example in the Moscow Metro, at the Panama Canal, in a nationwide network in Malaysia and at major sporting events such as the Asian Games in Qatar.

**Communications security**

Rohde&Schwarz SIT GmbH develops highly secure crypto products and systems for private industry, government agencies and the military. A highlight is the ELCRODAT 4-2 encryption unit, which has been approved for maximum levels of classification and is being used by the German armed forces and NATO.

**Our secure communications portfolio:**

- Integrated communications systems for the following
  - Civil and military air traffic control (ATC)
  - Army
  - Navy
  - Air force
- Encryption technology
- TETRA mobile radio systems

The R&S®CMW500, the third T&M instrument generation from Rohde&Schwarz for digital wireless communications, accompanies new products through all phases of the value added chain, from hardware design to protocol development and production testing.

The R&S®FSV is the fastest and most accurate signal and spectrum analyzer available on the market – and its touch screen makes operation very easy.

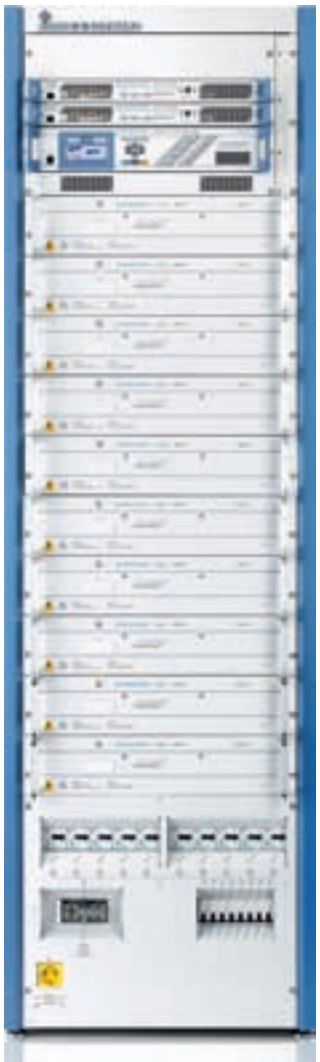
A favorably priced all-in-one solution for signal generation in the field of wireless communications: the new R&S®SMBV100A.

## Radiomonitoring and radiolocation

The need for mobile, wireless exchange of information is increasing drastically, but the usable frequency spectrum for radiocommunications is limited. Therefore, Rohde&Schwarz develops and produces stationary and mobile systems for detecting, locating and analyzing radiocommunications signals. These systems allow efficient monitoring and allocation of the limited radio frequencies.Its receivers, direction finders, signal analyzers, antennas and customized systems have made Rohde&Schwarz a reliable partner for its customers for many decades. Applications include public safety and national security, radiomonitoring by regulatory agencies and frequency management.

**Our radiomonitoring and radiolocation portfolio:**

- Radio intelligence systems
- Spectrum monitoring systems
- Signal analysis systems
- Receivers
- Direction finders
- Antennas



Rohde&Schwarz transmitters for digital terrestrial television are global leaders. The new R&S®Nx8600 family of transmitters is champion in power-saving.

## Broadcasting

TV viewers and radio listeners in more than 80 countries receive their programs via transmitters from Rohde&Schwarz. Our unique product portfolio including both broadcasting and measuring equipment acts as a catalyst for the worldwide development of digital broadcasting.

The company's market leadership in terrestrial TV transmitters, including for mobile TV, was further enhanced in the past year by the installation of Rohde&Schwarz equipment in all regions of the world. One of the primary success factors was the introduction of a new generation of transmitters featuring significantly lower power consumption.

At the bottom end of the transmission power scale, a new family of gap fillers and transposers for TV and DAB now provides cost-effective, seamless coverage even of areas with difficult topography.

To producers of consumer electronics, Rohde&Schwarz supplies all necessary test equipment for the development and production of satellite receivers, TV sets and other user equipment, including for the new high definition formats. The large variety of broadcast and video technologies is covered by Rohde&Schwarz with its multistandard platforms, which allow very flexible use at all stages of the value added chain.

**Our broadcasting portfolio:**

- Digital and analog TV transmitters for all power classes and all conventional standards worldwide, including mobile TV
- Digital and analog sound broadcast transmitters
- Broadcast and video test instruments and systems

The R&S®ETL is a new TV multistandard platform for all required measurements on transmitters and cable headends.

The new R&S®SLx8000 low-power transmitters can be used for both TV and DAB broadcasting.

## Services

Rohde&Schwarz operates a global service network in order to safeguard the investments of its customers.

**Service you can rely on**

- In 70 countries
- Person-to-person
- Customized and flexible
- Quality with a warranty
- No hidden terms

**The following on-site services are offered worldwide**

- Calibration
- Maintenance and repair
- Product updates and upgrades

By cooperating with the regional Rohde&Schwarz service centers as well as the plants and specialized subsidiaries, the company can provide a wide range of additional services:

- System integration
- System support
- Installation and commissioning
- Application support
- Development of customized modules, instruments and systems
- Software development
- Mechanical and electrical design
- Manufacturing to order
- Technical documentation and logistics

## Headquarters

At company headquarters in Munich, around 2000 employees work in research and development, central sales and service, marketing and administration.

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D-81671 München
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Fax +49 89 41 29 121 64
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www.rohde-schwarz.com

## Plants

**Memmingen plant**

The plant in Memmingen is responsible for electronic module assembly, microwave engineering, final production, final inspection and delivery of most Rohde&Schwarz products. The plant's extensive know-how is also available to customers from outside the Rohde&Schwarz group of companies.

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D-87700 Memmingen
Phone +49 8331 108 0
Fax +49 8331 108 11 24
info.rsmb@rohde-schwarz.com

Company headquarters in Munich.

Memmingen plant.

### Teisnach plant

The plant in Teisnach is the service center for mechanical and electronic production in the Rohde&Schwarz group. This plant produces housing parts, antennas, printed boards and electromechanical custom-made products of all types. All sound and TV broadcast transmitters are manufactured in Teisnach. As a system supplier, the plant serves customers around the world.

Rohde&Schwarz GmbH & Co. KG Teisnach Plant
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D-94244 Teisnach
Phone +49 9923 85 70
Fax +49 9923 85 71 174
info.rsdts@rohde-schwarz.com

Vimperk plant.

Teisnach plant.

### Vimperk plant

The Vimperk plant is the only one of Rohde&Schwarz production facilities located outside Germany. The plant produces mechanical and electronic modules ranging from individual parts to complete systems.

Rohde&Schwarz závod Vimperk, s.r.o.
Location Spidrova 49
CZ-38501 Vimperk
Phone +420 388 45 21 09
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## Subsidiaries

### Rohde&Schwarz Professional Mobile Radio GmbH

Rohde&Schwarz Professional Mobile Radio GmbH, formerly R&S Bick Mobilfunk GmbH, specializes in the development and implementation of professional mobile radio systems. In particular, the company supplies TETRA mobile radio networks and applications for public safety, transportation, oil, gas and industry.

Rohde&Schwarz Professional Mobile Radio GmbH
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Phone +49 5042 998 0
Fax +49 5042 998 105
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**Rohde&Schwarz SIT GmbH**
Rohde&Schwarz SIT GmbH provides solutions for information and communications security that have been approved by the German Federal Office for Information Security (BSI) and NATO/SECAN. Key activities of the company are the development of crypto products and systems for the protection of information in modern data processing and communications systems, as well as consulting and IT security analyses for government authorities, armed forces and industry.

Rohde&Schwarz SIT GmbH
Am Studio 3
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info.sit@rohde-schwarz.com

**HAMEG Instruments GmbH**
HAMEG, a German T&M equipment manufacturer with a rich tradition, supplements the Rohde&Schwarz portfolio in the lower price segment by offering reliable T&M instruments for science, industry and education. HAMEG has its own product development and production operations.

HAMEG Instruments GmbH
Industriestraße 6
D-63533 Mainhausen
Phone +49 6182 800 0
Fax +49 6182 800 100
info@hameg.com

**GEDIS GmbH**
GEDIS develops and implements individual solutions for the testing of electronic instruments, modules and submodules and for the management of test and communications systems. The company addresses government authorities, large system houses, the automobile industry and their suppliers.

GEDIS GmbH
Sophienblatt 100
D-24114 Kiel
Phone +49 431 600 51 0
Fax +49 431 600 51 11
sales@gedis-online.de

**R&S Systems GmbH**
R&S Systems GmbH provides system services within the Rohde&Schwarz business fields – from system development and integration to delivery, assembly and commissioning of turnkey T&M and communications equipment. This includes, for example, infotainment test systems for automobile production, mobile ATC systems as well as complete electronics workshops for technical service.

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D-51147 Köln
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info.rssys@rohde-schwarz.com

**Arpège SAS**
The French company works closely with Munich headquarters to develop and implement customer-specific systems in the areas of satellite monitoring and lawful interception for government security agencies.

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**Sales**
The addresses of the local sales companies can be found at: www.sales.rohde-schwarz.com

**Customer Support**
Our regional support centers will be glad to answer any questions regarding our products and service:

Europe, Africa, Middle East
Phone +49 1805 12 42 42 or +49 89 4129 137 74
customersupport@rohde-schwarz.com

North America
Phone 1 888 837 87 72 (1 888 TEST RSA)
customer.support@rsa.rohde-schwarz.com

Latin America
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# Content Chapter 1
# Broadcasting Test and Measurement

Broadcasting is a key business field at Rohde&Schwarz. Customers can benefit from expert solutions for analog and digital TV and sound broadcasting. The broad range of supported standards makes Rohde&Schwarz test and measurement and transmitter products unique.

# R&S®DVSG Digital Video Signal Generator

## Featuring numerous interfaces and a large signal library

- Testing with only one instrument
- Test signals and test patterns for any test case
- Fast and easy testing
- Reference signal source for development and testing
- Convenient portability
- Quick exchange of signal data (files)
- Fast availability even of large signal collections
- Easy operation
- Cost-efficient solution

The R&S®DVSG digital video signal generator is a universal platform for generating and playing compressed and uncompressed video and audio signals. It features transport stream (TS) interfaces as well as all common audio/video (AV) interfaces for the latest TV display technology.

The R&S®DVSG is modular in design. Two functional units are available for generating uncompressed analog and digital audio and video signals with a wide variety of characteristics. The AV signal generator option enables the R&S®DVSG to generate video signals synthetically. This means that each pixel can easily be defined and the display equipment can be tested under lab conditions. In addition to working with the numerous signals that come with the instrument, users can easily import their own signals.

The AV signal player option provides exactly the type of signals that a display must be able to handle when operated by an end user. This is achieved by generating the AV signals on the basis of MPEG-2 transport streams. In addition to the comprehensive set of signals supplied with the option, users may also use their own recordings of live signals. This means that users can easily simulate any live situation in the lab.

MPEG-2 transport streams can be recorded and played by means of the TS player and recorder option. The numerous transport streams supplied with the option are played in a seamless loop. It is also possible to play transport stream recordings of other devices with no problem.

### Testing with only one instrument
- Digital video interfaces
- Analog video interfaces
- Digital audio interfaces
- Analog audio interfaces
- Support of numerous signal formats

### Test signals and test patterns for any test case
- AV signal player
- AV signal generator
- TS player and recorder

### Fast and easy testing
- AV signals simultaneously available on different analog and digital interfaces
- AV signal player with integrated format conversion
- Availability at the press of a button

### Reference signal source for development and testing
- Error-free signals
- Seamless signals

### Convenient portability
- Compact design (three height units)
- Integrated display

### Quick exchange of signal data (files)
- USB interface
- Network interface

### Fast availability even of large signal collections
- Huge hard disk capacity
- Support of USB hard disks

### Easy operation
- Self-explanatory GUI

### Cost-efficient solution
- Excellent price/performance ratio

## Specifications in brief

| | |
|---|---|
| **AV signal generator (R&S®DVSG-K10 option)** | |
| Video standards and interfaces | |
| Analog composite video | CCVS (BNC, SCART, D4) |
| Analog component video | RGB/$YP_bP_r$ (BNC, SCART, D4) |
| Digital component video | RGB/$YC_bC_r$ (HDMI) |
| Computer format | RGB (VGA, HDMI, DVI) |
| Video resolution | SDTV, HDTV, computer formats |
| Basic signal set | more than 120 still pictures and moving pictures with different resolution and in raw data format for geometry, brightness, contrast, color measurement |
| **AV signal player (R&S®DVSG-B30 option)** | |
| Video standards and interfaces | same as AV signal generator (R&S®DVSG-K10 option)<br>$YC_bC_r$ (via the R&S®DVSG-K30 SDI/HD-SDI output option) |
| Video resolution | SDTV, HDTV |
| Basic signal library | Continuously extended library containing:<br>- Test pattern (still and moving)<br>– For tests of color, geometry, motion blur, pixel overdrive, contrast<br>– ITU test lines (SD only)<br>– Teletext (SD only)<br>- Critical live sequences<br>– Natural sequences with typical artifacts such as noise, film judder, blocking and other coding artifacts<br>- Promotion sequences<br>– High-quality sequences for display promotion |

## Specifications in brief

| | |
|---|---|
| **TS player and recorder (R&S®DVSG-K20 option)** | |
| Playing of Rohde&Schwarz TS seamless loop library | |
| Format | in line with ISO/IEC1-13818 |
| File type, MPEG-2 transport stream | GTS (Rohde&Schwarz proprietary) |
| Basic signal set | selection of transport streams for testing MPEG-2 SDTV (25 Hz, 29.97 Hz) signal processing; general DVB and ATSC transport stream testing; moving picture sequences and test patterns with test tones for 625 and 525 lines |
| Sequence length | endless and seamless generation with repetition of video, audio and data contents |
| Playing of TS and binary bit stream | |
| Format | in line with ISO/IEC1-13818 |
| File type | MPEG-2 transport stream, 8 bit, 10 bit |
| Endless replay | frame-exact cut at transition from end of file to beginning of file |
| Recording of TS bit stream | |
| Format | in line with ISO/IEC1-13818 |
| File type | MPEG-2 transport stream, 8 bit, 10 bit |
| Transport stream libraries and tools | see page 14 |
| **Signal interface for AV signal generator and AV signal player** | |
| Analog composite video | |
| Connectors | CCVS (BNC), SCART, D4 (14-pin D) |
| Standards | NTSC M/N (SMPTE170M), PAL B/G/M/N (ITU-R BT.470) |

## Specifications in brief

| | |
|---|---|
| Analog component video | |
| Connectors | G/Y, $B/P_b$, $R/P_r$ (3 × BNC), SCART, D4 (14-pin D) |
| Standard | RGB, $YP_bP_r$ (SMPTE/EBU N10 and SMPTE274M) |
| Video formats | SDTV, HDTV |
| Analog S-Video | Y, C (PAL and NTSC), S-VIDEO (4-pin mini DIN), SCART |
| Analog video – VGA | RGB, 15-pin D-Sub |
| Digital video – HDMI | HDMI 1.3 |
| Digital video – SDI/HD-SDI (R&S®DVSG-K30 option) | SDI, HD-SDI (BNC) |
| Analog audio | RCA jack, SCART |
| Digital audio | 19-pin HDMI, TOSLINK (optical), BNC (embedded audio) |
| Reference clock – input | BNC |
| **Signal interface for MPEG-2 transport stream player and recorder** | |
| Serial inputs/outputs | ASI, SMPTE310M (user-selectable) |
| Maximum cable length | 180 m |
| Parallel input/output (switchable, 25-pin) | SPI, in line with EN50083-9 |
| **General data of base unit** | |
| Operating system | Windows XP Embedded, 250 Gbyte internal hard disk |
| Local control | rotary knob, hardkeys and softkeys |
| Display | VGA, 640 × 480 pixel |
| Extended local control | external mouse and keyboard via USB |
| Remote control | Ethernet 10/100BaseT |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| **Base unit** | | |
| Digital Video Signal Generator | R&S®DVSG | 2113.0008.02 |
| Including: quick start guide, operating manual with firmware on CD, power cable | | |
| **AV signal player and AV signal generator options** | | |
| AV Signal Player | R&S®DVSG-B30 | 2113.0237.02 |
| AV Signal Generator | R&S®DVSG-K10 | 2113.0314.02 |
| SDI/HD-SDI Output | R&S®DVSG-K30 | 2113.0337.02 |
| **TS player and recorder options** | | |
| TS Player and Recorder | R&S®DVSG-K20 | 2113.0320.02 |
| Stream libraries | | |
| HDTV Sequences | R&S®DV-HDTV | 2085.7650.02 |
| H.264 Stream Library | R&S®DV-H264 | 2085.9052.02 |
| DVB-H Stream Library | R&S®DV-DVBH | 2085.8704.02 |
| Test Card M Sequences | R&S®DV-TCM | 2085.7708.02 |
| ISDB-T Stream Library | R&S®DV-ISDBT | 2085.9146.02 |
| TS creation tool | | |
| Advanced Stream Combiner™ (dongle for USB interface) | R&S®DV-ASC | 2085.8804.03 |
| **Rack installation** | | |
| 19" Adapter (R&S®DVSG with spare slot) | R&S®ZZA-T34 | 1109.4464.00 |
| 19" Adapter (R&S®DVSG with second instrument) | R&S®ZZA-T33 | 1109.4458.00 |
| **Recommended extras** | | |
| Keyboard with USB Interface (US assignment) | R&S®PSL-Z2 | 1157.6870.04 |
| Printed operating manual (English) | | 2113.1862.12 |
| Mouse with USB Interface, optical | R&S®PSL-Z10 | 1157.7060.02 |
| Documentation of R&S®DVSG Calibration Values | R&S®DVSG-DCV | 2082.0490.33 |
| **Service options** (Service options can only be ordered in connection with the purchase of an instrument.) | | |
| **Repair options** | | |
| One-Year Repair Service following the warranty period | R&S®RO2DVSG | please contact your local sales office |
| Two-Year Repair Service following the warranty period | R&S®RO3DVSG | |
| Four-Year Repair Service following the warranty period | R&S®RO5DVSG | |
| **Calibration options** | | |
| Two-Year Calibration Service | R&S®CO2DVSG | please contact your local sales office |
| Three-Year Calibration Service | R&S®CO3DVSG | |
| Five-Year Calibration Service | R&S®CO5DVSG | |

[1] Option identification: R&S®DVSG-Bxxx = hardware option; R&S®DVSG-Kxxx = software option.

# R&S®DV-ASC Advanced Stream Combiner™

Generating transport streams for replay on transport stream generators

- Generation of user-specific transport streams
- Elementary stream library
- Insertion of external elementary stream files
- Support of DVB, ATSC and DVB-H (MPE, MPE-FEC and time slicing)
- Editing of PSI and SI tables as required
- Setting of defined non-conforming states

The R&S®DV-ASC advanced stream combiner makes it possible to easily generate new transport streams for seamless and endless replay on transport stream generators from Rohde&Schwarz. The following instruments are supported:

- R&S®DVG
- R&S®DVRG
- R&S®DVM400 with R&S®DVM400-B2 option
- R&S®SFU with R&S®SFU-K20/21/22 options

The R&S®DV-ASC advanced stream combiner is a further development of the tried-and-tested R&S®DVG-B1 stream combiner software for generating MPEG-2 transport streams for various transmission methods such as DVB-T, DVB-S, DVB-C and ATSC.

R&S®DV-ASC provides all the functions of R&S®DVG-B1. DVB-H is also supported (MPE, MPE-FEC, time slicing and INT). Furthermore, operation has been simplified even more without eliminating extensive setting options (including standard violations). Various new descriptors have also been implemented.

A wide collection of elementary streams and data comes with the software. In addition, users can also integrate elementary streams of different stream libraries, as well as their own elementary streams and data.

The demo version of the advanced stream combiner shows the full functionality of the software. However, the user cannot generate any transport stream files and the scope of the elementary stream and data collection is very limited in the demo version.

**Ordering information**

| Designation | Type | Order No. |
|---|---|---|
| Advanced Stream Combiner™ | R&S®DV-ASC | 2068.9835.02 |

# R&S®DV-xxx Stream Libraries for Rohde&Schwarz TS Generators

Standard-compliant and proven reliable in worldwide use

- Endless and seamless generation for video components, audio components and TS syntax including DVB-H time slicing
- Available at the push of a button
- Clear and simple property rights
- Comprehensive documentation

Whenever the development, production and testing of DTV components is involved, suitable test signals are needed. To meet this need, Rohde&Schwarz offers not only the generators that are required but also an extensive collection of transport stream files.

## Devices supporting the stream libraries

- R&S®DVM400 digital video measurement system
- R&S®SFE/SFE100 broadcast tester
- R&S®SFU broadcast test system
- R&S®DVSG digital video signal generator

## Applications

- General testing of picture and sound decoding and display
- Testing and alignment of D/A converters in video path of decoders
- Testing of monitor geometry alignment
- Testing of left/right allocation and synchronization of audio decoders
- Testing of electromagnetic compatibility of receivers
- Testing of frequency response in analog audio path of decoders

## Broadcast standards supported

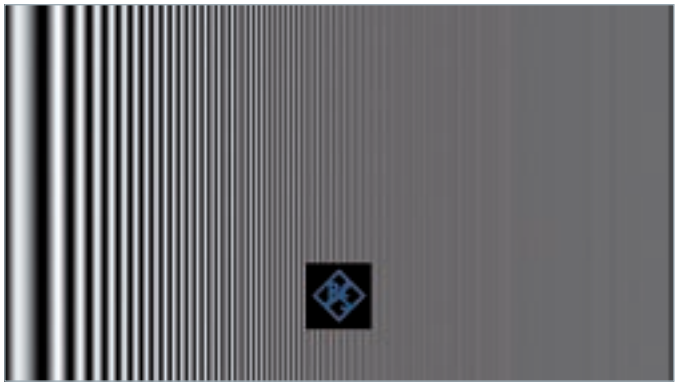
All video content is available in the form of transport streams for DVB and ATSC with all required PSI (MPEG-2), SI (DVB) and PSIP (ATSC) information.

**Software and stream libraries available for TS generators from Rohde&Schwarz**

| Type | Designation | Main application |
|---|---|---|
| R&S®DV-ASC | Advanced Stream Combiner™ | Software for generation of user-specific transport streams |
| Supplied with TS generators | SDTV stream library | Testing of MPEG-2 SDTV signal processing, testing of analog interfaces (PAL, NTSC) |
| R&S®DV-HDTV | HDTV sequences | Testing of MPEG-2 HDTV signal processing |
| R&S®DV-H264 | H.264 stream library | Testing of H.264 SDTV and HDTV signal processing |
| R&S®DV-TCM | Test Card M sequences | Testing of various DTV receiver and decoder STB functions |
| R&S®DV-DVBH | DVB-H stream library | Testing of entire DVB-H signal processing chain (signaling, FEC, MPE, time slicing) |
| R&S®DV-ISDBT | ISDB-T stream library | Testing of ISDB-T signal processing |
| R&S®DV-ESA | Elementary stream analyzer | MPEG-2 elementary stream analysis |
| In addition to these libraries, a T-DMB/DAB stream library is available exclusively for the R&S®SFU. | | |

Color bar with moving element.

Horizontal frequency sweep.



The delivery descriptor part of the NIT in DVB streams specifies different network types (DVB-T, DVB-S or DVB-C, depending on the stream). All streams for ATSC contain the TVCT specifying terrestrial transmission.

## Seamless and endless generation

All transport streams of the different TS libraries are stored in GTS format. This format allows seamless and endless generation of transport streams at the transport and elementary stream layer. Realtime calculation of all time-relevant parameters ensures error-free replay even at the transition from the start to the end of the stored sequence. This refers to the transport stream syntax as well as to the elementary streams. In the case of DVB-H, even the time slicing is seamless.

## Documentation on the transport streams

Comprehensive documentation on each transport stream makes working with the transport stream libraries fast and effective.

## Installation and activation

All libraries are delivered on CD or DVD and preinstalled on instruments purchased after the option was released. The stream libraries are activated via an instrument-specific key code, which is part of the delivery. The key code is valid only for the instrument specified (serial number). The SDTV library is part of every Rohde&Schwarz TS generator that supports GTS format. There is no need to order it as a separate option and no key code is required.

## Copyrights

The streams can only be used with a Rohde&Schwarz transport stream generator if the related option is installed. Recording or copying these libraries for use with any other players is not allowed. Furthermore, individually composed transport streams with content taken from the libraries may only be played on Rohde&Schwarz generators that have the related option installed. For R&S®DV-TCM, special copyrights apply.

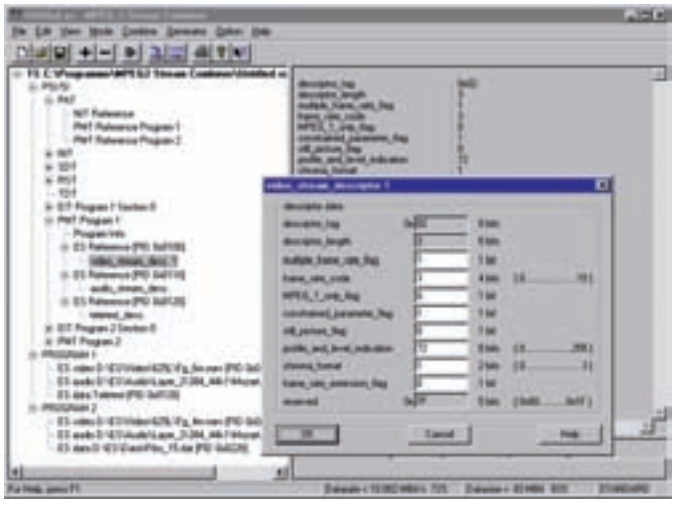
## R&S®DV-ASC advanced stream combiner

R&S®DV-ASC is a software for generating MPEG-2 transport streams for various transmission methods such as DVB-T, DVB-S, DVB-C and ATSC. It makes it possible to generate or modify new transport streams for seamless and endless replay on Rohde&Schwarz TS generators.

- Generation of user-specific transport streams
- Elementary stream library
- Insertion of external elementary stream files
- Support of DVB, ATSC and DVB-H (MPE, MPE-FEC and time slicing)
- Editing of PSI and SI tables as required
- Setting of defined non-conforming states

A wide collection of elementary streams and data comes with the software. In addition, users can also integrate elementary streams of different stream libraries, as well as their own elementary streams and data.

R&S®DV-ASC: display of transport stream structure with information on individual elements.



Film sequence “flowers”.

Film sequence “ice hockey”.

## SDTV stream library

The SDTV stream library is supplied with all TS generators from Rohde&Schwarz and provides a wide range of pre-configured MPEG-2 transport streams for the ATSC and DVB standards. The transport streams consist of several elementary streams and contain video, audio and other data (e.g. teletext or PRBS). Video streams with different data rates, formats, frequencies and content are available.

The signal set consists of sequences with moving picture content (i.e. for visual checking of the decoder functionality) as well as some static test patterns (i.e. color bars, zone plate, ITU-R17/18/331, ITS1 to ITS4, etc. and the Rohde&Schwarz Codec test pattern).

Audio data streams with different sampling rates, encoded in accordance with MPEG-1 Layer II or Dolby AC-3, contain the accompanying sound for the video sequences as well as special audio test signals.

## R&S®DV-HDTV HDTV sequences

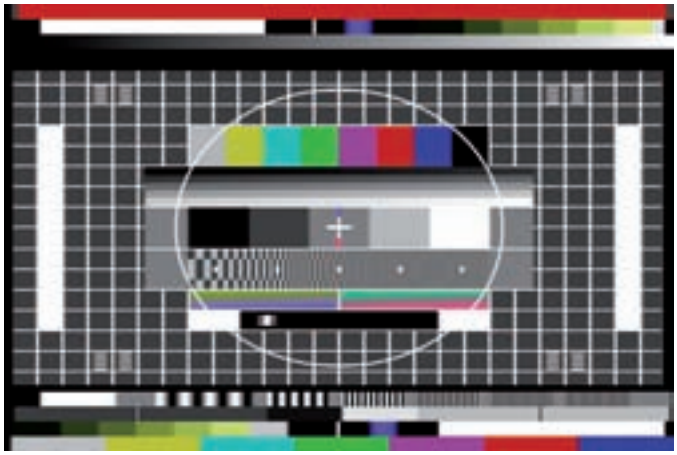
R&S®DV-HDTV is a versatile combination of MPEG-2-coded streams for high-definition TV. Its versatility enables the testing of diverse units in accordance with almost all worldwide standards. In addition to several video formats for European and American television, MPEG-coded and AC-3-coded audio data supplied.

All video content selections (seven film sequences/test pictures) are available in all listed video formats (6). Thus, the library contains 42 different videos.

**Film sequences/test pictures**

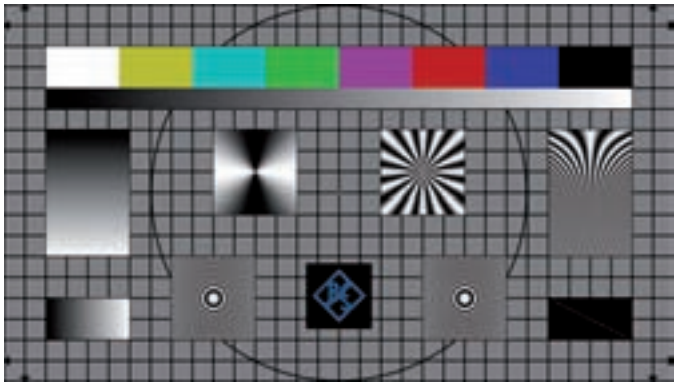
- Fireworks
- Public park
- Shark and other fish in the aquarium
- Horizontal ramp
- Color bars
- HDTV test pattern
- Horizontal frequency sweep

Codec test pattern 4:3 and 16:9.



Film sequence “fireworks”.

HDTV test pattern.



Film sequence “public park”.

## R&S®DV-H264 stream library

The R&S®DV-H264 stream library consists of more than 30 transport streams. These streams contain programs with different video and audio content in various resolutions including high definition. All transport streams contain service information for DVB with an NIT defining different transmission systems. All included video elementary streams are encoded using H.264, also known as MPEG-4 Part 10 or Advanced Video Codec (AVC). The audio elementary streams are AC-3 or MPEG-1 Layer II encoded.

### Film sequences/test pictures

- Flowers
- Public park
- Ice hockey
- Codec 4:3 and 16:9
- Color bar with moving element
- HDTV test pattern

## R&S®DV-TCM test card M sequences

The transport streams provided by this option have been derived from the test card M libraries from Snell&Wilcox. They have been adapted for endless, continuous and error-free replay by the Rohde&Schwarz generators and allow simple and effective testing of standard as well as special DTV receiver and decoder functions without the need for any additional measuring equipment. The library contains more than thirty transport streams, some in line with the DVB and some in line with the ATSC standard. The collection allows a large variety of tests in accordance with the related standard.

### Tests on elementary video stream

- Use of active format descriptor AFD (only DVB streams)
- Decoding sequence of the group of pictures
- Decoding of various coding formats
- D/A converter tests and tests for analog signal processing

### Tests on elementary audio stream

- Decoding of various coding formats
- Left-right identification
- Synchronization with video

### Tests on elementary data stream

- DVB subtitling

### DVB-specific tests (SI)

- Identification of transport stream syntax

### ATSC-specific tests (PSIP)

- Identification of transport stream syntax
- Extended text table (ETT)

## R&S®DV-DVBH stream library

The R&S®DV-DVBH stream library contains a wide range of ready-made signals for testing systems with extremely different transmission parameters and signal contents. All signals contain RS data sections, which supports the MPE-FEC test in the receiver. Since signals are generated using seamless time slicing, power management in the receiver is not disrupted even at the end of the sequence. All transport streams are generated with user-definable data rates (directly set on the generator by inserting null packets) without affecting the time slicing. Because of the integrated electronic service guide (ESG) the signal processing in the receiver for detection of the DVB-H service is also tested. For the different test applications, the library contains 13 transport streams each with three different resolutions for the DVB-H video content (CIF, QVGA and QCIF). This yields a total of 39 transport streams.

R&S®DV-TCM test card M sequences: example from transport stream collection.


## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| Advanced Stream Combiner | R&S®DV-ASC | 2068.9835.02 |
| SDTV Stream Library | Part of Rohde&Schwarz TS generators | |
| HDTV Sequences | R&S®DV-HDTV | 2085.7650.02 |
| H.264 Stream Library | R&S®DV-H264 | 2085.9052.02 |
| Test Card M Sequences | R&S®DV-TCM | 2085.7708.02 |
| DVB-H Stream Library | R&S®DV-DVBH | 2085.8704.02 |
| ISDB-T Stream Library | R&S®DV-ISDBT | 2085.9146.02 |
| Elementary Stream Analyzer | R&S®DV-ESA | 2085.8904.02 |

# R&S®TestDVD Professional Compendium

## The world's most comprehensive DVD set with test patterns and data streams

- More than 150 test patterns, video and audio sequences including tests for EMS measurement
- Audio stereo and multichannel test sequences
- Data streams for measuring the automatic error correction as well as the reliability of systems including DVD components


The R&S®TestDVD Professional Compendium from Rohde&Schwarz is an unrivaled collection of professional test patterns and data streams. These test sequences are used for audio, video and EMC measurements in development and conformance testing as well as for objective testing of video and audio signals.

The scope and quality of test signals can greatly affect the quality of many measurements – in particular with video and audio equipment. For this reason, Rohde&Schwarz, in cooperation with BUROSCH and other partners has compiled a DVD compendium that includes all conceivable test sequences and data streams for sound and TV broadcasting. In addition to well over 250 different video and audio sequences on two video DVDs and an audio DVD, two other DVDs provide different data streams for measuring the reliability of systems with DVD components.

Particular attention was paid to ensuring high quality in the creation of digitally generated test sequences. By specifically selecting suitable picture structures and frequencies, the test data optimally supports standard-conforming and objective measurements as well as subjective evaluation. Specific test sequences used in combination with T&M equipment from Rohde&Schwarz also allow automatic test evaluations.

**Ordering information**

| Designation | Type | Order No. |
|---|---|---|
| DVD Professional Compendium | | |
| PAL | R&S®TestDVD | 1159.6090.02 |
| NTSC | R&S®TestDVD | 1159.6090.03 |

**The test suite comes on five DVD-ROMs comprising three albums**

| Album | DVD No. | Format | Type | Content/application | Remarks | Rohde&Schwarz products |
|---|---|---|---|---|---|---|
| 1 | 1 | Video | 9 | - Test patterns<br>- Video streams<br>- EMS test sequences | - More than 150 streams<br>- PAL or NTSC 4:3, 16:9 | - R&S®VSA video measurement system<br>- R&S®UAF video analyzer<br>- R&S®UPV audio analyzer<br>- R&S®TS9980 EMS test system |
| | | Booklet | | - General instructions and stream lists | | |
| 2 | 2 | Video | 5 | - Stereo and multichannel test sequences | - More than 100 streams<br>- Dolby Digital and DTS signals<br>- DVD-Video, PAL or NTSC | - R&S®UPV audio analyzer |
| | 3 | Audio | 5 | | | |
| 3 | 4 | Video | 5 | - Laser and memory check | - NTSC, 4:3 signal or PAL, 4:3 signal<br>- 30 tracks (all with identical ring width) | - R&S®DVQ digital video quality analyzer<br>- Recognize picture freeze/loss<br>- A/D converter required |
| | 5 | Video | 5 | - Reliability tests | - NTSC, 4:3 or PAL, 4:3<br>- Endless replay (short picture freeze at end of DVD) | |

# R&S®SAF CCVS + Component Generator R&S®SFF CCVS Generator

Multistandard generators for all TV applications; optionally PALplus and ITU-R BT. 601

The R&S®SAF and R&S®SFF TV generators are multistandard instruments (B/G/PAL, M/NTSC, M/PAL, N/PAL) suitable for all applications in the field of television. The R&S®SAF CCVS + component generator supplies all test signals and patterns required for video measurements in CCVS, $YC_BC_R$, RGB and S-VHS formats, an aspect ratio of 4:3 or 16:9 being selectable for test patterns. Where only the CCVS format is required, the R&S®SFF CCVS generator can be used.

The R&S®SAF and the R&S®SFF also generate all test signals in line with ITU-R Rec. 801, a number of common pathological test signals and shallow ramps with a resolution of 10 bits. The PALplus test pattern option provides all PALplus reference signals and the bits required for wide screen signaling (WSS). Both generators allow extensive signal variations via softkey-controlled menus. Such amplitude and phase adjustments of signal components enable testing of gain control circuits, white-level limiting circuits and video analyzers over the entire range of the devices. User-specific signals can be defined via front-panel entry and stored in the generator or on a memory card.

## Main features

- Clear menu-guided operation on large-size EL display
- Twelve signal groups with up to 8 signal menu pages each; each page may contain 7 signals
- Superposition of hum, sweep, noise or other signals with different clamping modes
- APL and bounce signals with preselectable parameters
- Insertion of external test signals such as teletext or data lines
- User programming of test-line coding and monitoring
- Entry of texts as source identification or scrolling text
- Program monitoring + substitution pattern
- System compatibility and full remote control capability (IEC 625/IEEE 488 bus)
- Definition of customer-specific signals by “signal edit” via the front panel
- Zone-plate signals, 8 user-selectable coefficients

## Function

The generator section is of digital design. A transputer – a high-speed RISC processor – calculates the three components Y, $C_B$ and $C_R$ of all test signals which in the R&S®SAF CCVS + component generator are applied to three D/A converters. An analog matrix converts the three components into the RGB format. Therefore, the RGB signals are made available simultaneously with the $YC_BC_R$ components. The digital CCVS in R&S®SAF and R&S®SFF is determined from the $YC_BC_R$ components in realtime with the aid of two LSI gate arrays.

## R&S®SAF-Z1 digital video interface

The R&S®SAF-Z1 optional digital video interface upgrades the R&S®SAF and R&S®SFF for use in digital TV studios. In addition to the analog video signals, a parallel and two serial digital video signals are thus simultaneously available.

## Specifications in brief

| | |
|---|---|
| **Base unit** | |
| **Amplitude adjustment** | |
| The signal components CCVS, CVS, chroma, sync pulse, burst, setup and the components Y, $C_B$, $C_R$ in the range 0% to 140% are variable. | |
| **Phase/time adjustment** | |
| $H_{EXT} - H_{INT}$ | ±9 µs |
| $SC_{EXT} - SC_{INT}$ | 0° to 360° |
| SC/H phase | –180° to +180° |
| Horizontal frequency | ±5% (burst switched off from +1.5%) |
| Color subcarrier frequency | 100 Hz to 6 MHz |
| **Program path** | |
| Input/output | BNC, 75 Ω |
| Amplitude-frequency response | ±0.1 dB (up to 6 MHz) |
| Group-delay error | ≤5 ns (up to 5.5 MHz) |
| Differential amplitude/phase | ≤0.2%/≤0.2° |
| S/N ratio (rms, weighted, 0.2 MHz to 5 MHz) | ≥78 dB |
| **Test signal insertion** | |
| Level (same as generator signal) | CAL (normal mode), setting of CVS up to $V_{pp}$ = 1.2 V, for testing automatic gain control circuits, video analyzers, etc. |
| Insertion range BG/PAL, N/PAL | |
| In 1st field (lines) | 6 to 22 |
| In 2nd field (lines) | 319 to 335 |
| Insertion range M/NTSC, M/PAL | |
| In 1st field (lines) | 10 to 22 |
| In 2nd field (lines) | 10 to 22, 273 to 284 |
| Teletext signals BG/PAL, N/PAL | 5 pages and teletext measurement line |
| Teletext signals M/NTSC, M/PAL | eye test pattern and teletext measurement line |
| Data lines | 4 sequences |
| Coding, clock | biphase coding, 5 MHz |
| ITU-R 601 option | in line with ITU-R Rec. 801, pathological signals, digital shallow ramps: 10-bit resolution; all other signals: 9-bit resolution |
| **Remote control interface** | IEC625-2 (IEEE488) |
| **CCVS** | |
| Standards | BG/PAL, N/PAL, M/NTSC, M/PAL |
| Signals | squarewave, staircase and sawtooth, 2T/10T/20T pulse |
| Amplitude-frequency response | multipulse, multiburst, sweep |
| Up to 5.5 MHz | ±0.1 dB |
| >5.5 MHz to 6 MHz | ±0.15 dB |
| Group delay | |
| 10T and 20T pulses (modulated with frequencies ≤5 MHz) | ≤5 ns |

## Specifications in brief

| | |
|---|---|
| Line-time nonlinearity | |
| Five-step staircase | ≤0.8% |
| Chrominance phase | |
| Phase between R-Y and B-Y axes | 90° ±1° |
| Maximum deviation of chrominance phase from nominal | ±2° |
| S/N ratio, rms, weighted, 0.2 MHz to 5 MHz | |
| Measured on all-black picture | ≥78 dB |
| Measured on sawtooth signal | ≥70 dB |
| Sync frame | |
| PAL | sync frame and burst phase in line with ITU-R Rec. 624-3 |
| NTSC | coupled with stable SC/H phase (in line with RS-170 A) |
| SC/H phase (calibrated) | 0° to ±5° |
| V component | can be disabled for special measurement |
| The tolerances in S-VHS format correspond to those of the CCVS. | |
| **Component signals** | |
| $YC_B$, $C_R$ | for 525/625 lines, not for R&S®SFF |
| Signals | squarewave, staircase, sawtooth, 2T to 20T pulses, 3T to 20T pulses, sweep, multiburst |
| RGB | each component can be disabled separately; the rise times are determined by those of the $YC_BC_R$ signals |
| Sync pulse (can be added to or removed from each component) | 300 mV ±7 mV |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| **Base unit** | | |
| CCVS + Component Generator | R&S®SAF | 2007.1005.02 |
| CCVS Generator | R&S®SFF | 2007.1057.02 |
| **Options** | | |
| Digital Video Interface | R&S®SAF-Z1 | 2007.1063.03 |
| Digital Video Interface | R&S®SFF-Z1 | 2007.1063.02 |
| PALplus Test Pattern for R&S®SAF and R&S®SFF | R&S®SAF-B20 | 2007.1011.02 |
| Documentation of R&S®SAF Calibration Values | R&S®SAF-DCV | 2082.0490.02 |
| Documentation of R&S®SFF Calibration Values | R&S®SFF-DCV | 2082.0490.03 |
| **Recommended extras** | | |
| 32 kbyte Memory Card | R&S®ZZM-32 | 2005.4394.02 |
| 512 kbyte Memory Card | R&S®ZZM-512 | 2005.4388.02 |
| Service Kit | R&S®SAF-Z | 2007.1111.00 |
| Service Kit | R&S®SFF-Z | 2007.1105.00 |

# R&S®SGxF TV Generators

## The right generator for every standard: PAL, SECAM and NTSC

In its R&S®SGxF TV generators for all traditional color standards, Rohde&Schwarz has the right unit for any production, studio and service requirement.

### Main features

- More than 30 baseband signals
- General-purpose test pattern with optional text insertion for source identification
- Signal output on front and rear panel
- Remote control of all generator functions via IEC/IEEE
- Insertion test signals included in every signal
- Insertion of external test signals into field blanking interval or application of sweep signals to active picture area
- Use as test signal inserter with genlock option fitted

### Digital picture generation

With the PAL generator, the three components Y, $C_B$ and $C_R$ are stored for digital generation of the realtime composite color video signal (CCVS). For generating test signals in line with PAL, NTSC and SECAM, about 1000 different video lines are stored digitally and can be combined to obtain the desired pattern under program control.

### Test signals

With all three generators, the assignment of a test signal to a specific line can be programmed via DIP switches. Eight complete test signal configurations can be stored and recalled, enabling the user to tackle any measurement task.

### Output signal

The signal amplitude can be set via the IEC/IEEE bus or manually by a potentiometer. Separate amplifiers on all models ensure decoupling between front and rear outputs.

### Options

For options, see ordering information. Some options cannot be retrofitted. If the genlock option for test signal insertion is fitted, switchover to the selected substitution pattern is ensured in the case of program failure.

## Specifications in brief

| | R&S®SGPF | R&S®SGSF | R&S®SGMF |
|---|---|---|---|
| **Level tolerances** | | | |
| Luminance | 700 mV ±4 mV | – | 714 mV ±4 mV |
| Chrominance | 700 mV ±7 mV | – | 714 mV ±7 mV |
| Squarewave, staircase, sawtooth | nominal ±4 mV | | |
| 2T pulse | nominal ±5 mV | | |
| 10T and 20T pulses | nominal ±7 mV | nominal ±7 mV | – |
| 12.5T pulse | – | – | nominal ±7 mV |
| Amplitude setting | on front panel or via IEC/IEEE bus between –50 % and +40 % of calibrated value | | |
| **Amplitude/frequency response** | | | |
| Multipulse, sweep | +0.1 dB (up to 5.5 MHz) | | |
| Multiburst | +0.1 dB (up to 5.8 MHz) | | +0.1 dB (up to 5.5 MHz) |
| **Group delay** | | | |
| 10T and 20T pulses | ≤5 ns (modulated with frequencies ≤5 MHz) | | – |
| 12.5T pulse | – | – | ≤5 ns |
| **Rise time (10 % to 90 %) and half-amplitude duration** | | | |
| Sync | – | – | 140 ns ±5 ns |
| Luminance | 200 ns ± 5 ns, 231 ns ±5 ns | | 125 ns ±5 ns, 250 ns ±5 ns |
| Chrominance | 300 ns ±10 ns, 1000 ns ±15 ns | | |
| 4.43 MHz components | – | 300 ns ±10 ns, 1000 ns ±15 ns | – |
| Half-amplitude duration | | | |
| 2T pulse | 200 ns ± 5 ns | | 250 ns ±5 ns |
| 10T pulse | 1000 ns ±15 ns | | – |
| 20T pulse | 2000 ns ±30 ns | | – |
| 12.5T pulse | – | – | 1570 ns ±5 ns |
| **Line-time nonlinearity** | | | |
| Five-step staircase | ≤0.8 % | | |
| **SECAM color coding** | | | |
| Tolerance of color-difference signal preemphasis | – | ±0.2 dB | – |
| Tolerance of subcarrier preemphasis | – | ±0.15 dB | – |
| Waveforms | – | in line with ITU-R Rep. 624-3 | – |
| **Chrominance phase** | | | |
| Phase between R-Y and B-Y axes | 90° ±1° | – | – |
| Maximum departure of chrominance phase from nominal | ±2° | – | – |
| **S/N ratio, rms, weighted, 0.2 MHz to 5 MHz (R&S®SGPF, R&S®SGSF)/4.2 MHz (R&S®SGMF)** | | | |
| All-black picture | ≥74 dB | | |
| Sawtooth signal | ≥70 dB | | |
| **Clock frame** | sync frame and burst phase in line with ITU-R Rep. 624.3 | sync frame and color subcarrier DR and DB in line with ITU-R Rep. 624-3 | standard coupling with stable SC/H phase (in line with RS-170 A) |
| SC/H phase | 0° ±5° | – | – |
| V component | can be switched off for special measurements | | |
| **Inputs/outputs** | BNC, 75 Ω | | |
| Return loss | ≥34 dB (up to 6 MHz) | | |
| Sync pulse output | 2 V into 75 Ω | | |

## Specifications in brief

| | R&S®SGPF | R&S®SGSF | R&S®SGMF |
|---|---|---|---|
| EXT-VITS input | for insertion of external signals into test line region or for application of sweep signal to active picture region | | |
| Connector | BNC, 75 Ω | | |
| Gain | 0 ± 0.1 dB | | |
| Amplitude/frequency response | ±0.1 dB (up to 6 MHz) | | |
| Differential gain | ≤0.3 % | | |
| Differential phase | ≤0.3° | | |
| **Option "genlock with test signal insertion"** | | | |
| Coupling the generator clock with the sync pulse and burst (R&S®SGPF only) and color subcarrier (R&S®SGMF only) of the applied CCVS to permit test signal insertion | | | |
| Input/output | BNC, 75 Ω | | |
| Return loss | ≥34 dB (up to 6 MHz) | | |
| Amplitude/frequency response | ±0.1 dB (up to 6 MHz) | | |
| Group delay error | ≤5 ns | | |
| Differential gain | ≤0.3 % | | |
| Differential phase | ≤0.3° | | |
| S/N ratio (rms, weighted) | ≥74 dB | | |
| Test signal insertion | | | |
| Insertion range | | | |
| In 1st field | lines 6 to 22 | | lines 10 to 21 |
| In 2nd field | lines 319 to 335 | lines 319 and 329 to 335 | lines 10 to 21 |
| Identification signals of applied CCVS | – | in lines 7 to 15 and 320 to 328, can be replaced by all-black line or other signal | – |
| Manual setting | output amplitude, field-repetitive/line-repetitive operation, application of sweep signal to active picture region, coding and selection of 8 test line blocks, front panel disabled by 6th bit of IEC/IEEE bus address switch | | |
| Remote control | IEC625-2 (IEEE488) | | |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| **Base unit** | | |
| TV Generator for | | |
| PAL | R&S®SGPF | 2016.4049.03 |
| SECAM | R&S®SGSF | 2016.7048.03 |
| NTSC | R&S®SGMF | 2016.0943.03 |
| **Options (some options cannot be retrofitted)** | | |
| Source Identification | R&S®SG.F-B1 | 2016.1004.02 |
| PAL Test Signal Insertion | R&S®SGPF-B2 | 2016.4278.02 |
| SECAM Test Signal Insertion | R&S®SGSF-B2 | 2016.7190.02 |
| NTSC Test Signal Insertion | R&S®SGMF-B2 | 2016.1185.02 |
| FuBK Test Pattern | R&S®SGPF-B3 | 2016.4284.02 |
| French Front-Panel Labelling | R&S®SGSF-B3 | 2016.7225.02 |
| General-Purpose Test Pattern with 16:9 Aspect Ratio | R&S®SGPF-B4 | 2016.4290.02 |
| **Recommended extras** | | |
| Junction Panel with Bypass | R&S®SG.F-Z | 2016.1679.02 |
| 19" Adapter | R&S®ZZA-91 | 0396.4870.00 |
| Documentation of R&S®SGxF Calibration Values | R&S®SG-DCV | 2082.0490.04 |

# R&S®SFE Broadcast Tester

Compact signal generator for all digital and analog TV and audio broadcasting standards

- Broadcast multi-standard platform
- Realtime signal generation for digital and analog transmission standards
- Wide frequency range with excellent signal quality
- Integrated transport stream player and video/audio generator
- Arbitrary waveform generator
- Ideal supplement to the high-end R&S®SFU broadcast test system
- Integrated noise generator and BER tester
- Compact cabinet with convenient graphical user interface

The R&S®SFE is a multistandard-capable broadcast signal generator that supports all common TV standards and a number of sound broadcasting standards. Whether analog or digital terrestrial TV, cable, satellite and mobile TV, or sound broadcasting – all these signals can be modulated in realtime. For this purpose, the R&S®SFE combines a high-quality RF modulator, a universal realtime coder and baseband signal sources in one instrument.

Owing to its modular concept, the R&S®SFE can be optimally adapted to the requirements at hand – for example, with an integrated noise generator or a BER tester. And even after purchase the R&S®SFE can be quickly and easily expanded to include new modulation modes by installing software options.

The versatile baseband signal sources for digital TV standards allow the generation of test signals from Rohde&Schwarz libraries as well as the replay of proprietary transport streams. For analog TV, the R&S®SFE offers an integrated video/audio test signal generator. Alternatively, the user can feed transport streams as well as analog A/V signals from external baseband generators. Irrespective of the realtime coders used, it is possible to generate user-defined modulation signals by means of an optional arbitrary waveform generator and to replay waveform files of the customer.

Although the R&S®SFE has a compact design and does not require much space, it offers the same convenient graphical user interface as the high-end R&S®SFU as well as extensive remote control functions.

The multistandard capability and the flexible option concept make the R&S®SFE an extremely versatile instrument for many lab applications. However, due to its excellent price/performance ratio, the R&S®SFE is also ideally suited for service and quality assurance applications. In addition, the optional ARB generator in combination with the compact design make the R&S®SFE a cost-efficient solution for production applications.

### Broadcast multistandard platform

- Digital terrestrial TV: DVB-T, ISDB-T/ISDB-$T_B$, 8VSB/ATSC, DTMB (GB20600-2006)
- Cable TV: DVB-C (J.83/A), ISDB-C (J.83/C), J.83/B
- Mobile TV: DVB-H, T-DMB, MediaFLO™, ISDB-T 1-segment (partial reception), DMB-TH
- Satellite TV: DVB-S, DVB-S/DSNG, DVB-S2, DirecTV
- Analog TV: B/G, D/K, M/N, L, I, PAL, NTSC, SECAM
- Sound broadcasting: DAB, DAB+, HD Radio™, DRM (ARB waveform), ISDB-$T_{SB}$, AM/FM/RDS
- Open for future standards

### Realtime signal generation for digital and analog transmission standards

- Universal coder for realtime signal generation
- Settable modulation parameters
- Additional modulation modes as software options

### Wide frequency range with excellent signal quality

- Frequency range 100 kHz to 2.5 GHz
- Signal level –110 dBm to +15 dBm
- SSB phase noise at 300 MHz, typ. <–115 dBc at 20 kHz

### Integrated transport stream player and video/audio generator (option)

- R&S®SFE-K20 TS generator, an optional transport stream generator in the baseband
- Transport stream libraries
- R&S®SFE-K22 TRP player
- R&S®SFE-K23 ATV video generator
- ATV video library from Rohde&Schwarz

### R&S®SFE-K35 arbitrary waveform generator (option)

- Up to 256 Msample memory space
- Sample rate up to 100 Msamples/s
- Compatible with R&S®WinIQSIM™ (R&S®SFE-K350 option required)
- Waveform libraries from Rohde&Schwarz

### Integrated noise generator and BER tester

- R&S®SFE-K40 broadband AWGN generator
- R&S®SFE-K60 BER measurement at transport stream or bit level

### Compact cabinet with convenient GUI

- Extremely compact instrument: ½ 19" × 3 height units
- 5.7" easy-to-read VGA color display, 640 × 480 pixels
- Intuitive user interface under Windows XP Embedded
- Same graphical user interface as used in the R&S®SFU
- Easy operation via keypad and rotary knob, additionally via keyboard and mouse (USB)
- Context-sensitive help system
- User-definable favorites for quick access
- Quick and easy software updates via LAN or USB 2.0
- Remote operation
  - Via Remote Desktop or VNC
  - By means of SCPI control commands via LAN (VXI11)
  - Remote control commands compatible with the R&S®SFU

## Specifications in brief

| | |
|---|---|
| **RF signal** | |
| Frequency range | 100 kHz to 2.5 GHz |
| Frequency resolution | 1 Hz |
| Level | –110 dBm to +15 dBm |
| Level accuracy | <1.0 dB |
| **Spectral purity** | |
| SSB phase noise, at 300 MHz with 20 kHz offset | typ. <–115 dBc/Hz |
| Broadband noise >10 MHz | <–135 dBc (1 Hz) |
| **Digital modulation modes** | |
| Terrestrial TV | DVB-T, DTMB, ISDB-T, ATSC/8VSB, ISDB-$T_B$ |
| Cable TV | DVB-C, J.83/B, ISDB-C |
| Satellite TV | DVB-S/DSNG, DVB-S2, DirecTV |
| Mobile TV | DVB-H, T-DMB, ISDB-T 1-segment (partial reception), DMB-TH, MediaFLO™ |
| Digital sound broadcasting | DAB, DAB+, HD Radio™, DRM (wave-form), ISDB-$T_{SB}$ |
| **Analog modulation modes** | |
| Analog TV | B/G, D/K, I, M/N, L |
| Analog sound broadcasting | AM/FM/RDS |
| **I/Q modulator** | |
| Frequency range | DC to 35 MHz |
| **Noise generator** | |
| RF bandwidth | 96 MHz |
| Distribution functions | Gaussian, statistical, separate for I and Q |
| PRBS measurement | BER clock input, data, enable |
| MPEG-2 TS measurement | ASI input |
| **TS generator** | |
| Net data rate | max. 90 Mbit/s |
| **General data** | |
| PC platform | Windows XP Embedded |
| Remote control | SCPI 1999.5 |
| Ethernet | 10/100BaseT, RJ-45 |
| USB | 2.0 |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| **Base unit** | | |
| Broadcast Tester | R&S®SFE | 2112.4300.02 |
| **Options** | | |
| Digital modulation modes | | |
| DVB-T/H | R&S®SFE-K1 | 2113.4010.02 |
| DVB-C/ISDB-C | R&S®SFE-K2 | 2113.4032.02 |
| DVB-S/DSNG | R&S®SFE-K3 | 2113.4055.02 |
| ATSC/8VSB | R&S®SFE-K4 | 2113.4078.02 |
| J.83/B | R&S®SFE-K5 | 2113.4090.02 |
| ISDB-T/ISDB-$T_{SB}$/ISDB-$T_B$ | R&S®SFE-K6 | 2113.4110.02 |
| DVB-S2 | R&S®SFE-K8 | 2113.4132.02 |
| DirecTV | R&S®SFE-K9 | 2113.4155.02 |
| MediaFLO™ | R&S®SFE-K10 | 2113.4178.02 |
| T-DMB/DAB | R&S®SFE-K11 | 2113.4190.02 |
| DTMB | R&S®SFE-K12 | 2113.4210.02 |
| Analog modulation modes | | |
| AM/FM/RDS | R&S®SFE-K170 | 2113.4432.02 |
| ATV-B/G | R&S®SFE-K190 | 2113.4655.02 |
| ATV-D/K | R&S®SFE-K191 | 2113.4678.02 |
| ATV-I | R&S®SFE-K192 | 2113.4690.02 |
| ATV-M/N | R&S®SFE-K193 | 2113.4710.02 |
| ATV-L | R&S®SFE-K194 | 2113.4732.02 |
| Multi ATV | R&S®SFE-K195 | 2113.4755.02 |
| Baseband | | |
| TS Generator, includes SDTV stream library | R&S®SFE-K20 | 2113.4878.02 |
| TRP Player | R&S®SFE-K22 | 2113.5274.02 |
| Video Generator | R&S®SFE-K23 | 2113.4890.02 |
| Simulation | | |
| ARB Generator | R&S®SFE-K35 | 2113.4932.02 |
| R&S®WinIQSIM™ | R&S®SFE-K350 | 2113.4955.02 |
| AWGN Generator | R&S®SFE-K40 | 2113.4910.02 |
| Measurement and analysis functions | | |
| BER Measurement | R&S®SFE-K60 | 2113.5151.02 |
| Baseband inputs | | |
| Extended I/Q Input | R&S®SFE-K80 | 2113.5251.02 |
| Other expansions | | |
| Memory Expansion | R&S®SFE-B3 | 2113.4500.02 |
| Compact Flash Memory | R&S®SFE-B6 | 2112.4522.06 |

# R&S®SFE100 Test Transmitter

## Powerful broadcast signal generator for production test systems

- Single-standard signal generator with realtime coding
- Models for all common digital and analog broadcasting standards
- Wide frequency range with high signal quality
- Integrated power amplifier for high output levels
- Integrated transport stream player or audio/video generator
- Model with arbitrary waveform generator
- Convenient control elements and remote operation

The R&S®SFE100 is a single-standard test transmitter with realtime coding for broadcast signals. R&S®SFE100 models are available for all common TV standards and a number of sound broadcasting standards. The R&S®SFE100 is a compact and reliable instrument that can be equipped with a power amplifier unique in this class, making it particularly valuable in production test systems. Plus, it can be used as a simple and economical signal generator as well as for special applications as a second RF channel for the R&S®SFU broadcast test system.

Every R&S®SFE100 model can be equipped with the appropriate digital or analog baseband signal source with which test signals from Rohde&Schwarz libraries or customer-specific test signals can be replayed. The R&S®SFE100 thus combines two functions in one box, thereby significantly simplifying complex production test systems.

The R&S®SFE100 model with an arbitrary waveform generator makes it possible to generate modulation signals of any type and to replay customer-specific waveform files, irrespective of the available realtime coder models.

Occupying only one height unit, the R&S®SFE100 is extremely compact. Nevertheless, all functions can be selected locally on the instrument. Alternatively, the R&S®SFE100 can be remote-operated from a PC. In this case, operation is performed using the same convenient graphical user interface as for the R&S®SFE and R&S®SFU.

In addition, Rohde&Schwarz offers an all-in-one system solution around the R&S®SFE100, that allows centralized signal generation to meet customer specific requirements.

### Single-standard signal generator with realtime coding

- Coder for realtime signal generation
- Adjustable modulation parameters

### Available for the following standards

- Terrestrial digital TV: DVB-T, DTMB, ATSC/8VSB, ISDB-T, ISDB-$T_B$
- Cable TV: DVB-C, J.83/B, ISDB-C
- Satellite TV: DVB-S/DSNG, DVB-S2, DirecTV
- Mobile TV: DVB-H, T-DMB, ISDB-T 1-segment, MediaFLO™, ATSC/AVSB, DMB-TH
- Analog TV: B/G, D/K, I, M/N, L
- Sound broadcasting: DAB, DAB+, HD Radio™, ISDB-$T_{SB}$, DRM (as ARB waveform), AM/FM/RDS

### Wide frequency range with very good signal quality

- Frequency range 100 kHz to 2.5 GHz
- Low phase noise and high MER

### Integrated power amplifier for high output levels

- Maximum output power +27 dBm
- 0 dB to 30 dB attenuation, adjustable
- RF monitor output with 50 dB attenuation
- Signal level –110 dBm to +15 dBm

### Integrated transport stream player or audio/video generator

- TS generator (R&S®SFE100-K20)
- Transport streams from Rohde&Schwarz – SDTV test streams for DVB and ATSC
  - HDTV tests of HDTV receivers
  - DVB-H tests of mobile receivers
  - ISDB-T test streams
  - H.264 test streams
  - TCM-STB tests
  - The range of transport stream libraries is constantly being expanded
- Compatible with the R&S®DV-ASC advanced stream combiner
  - ATV video generator (R&S®SFE100-K23) for generating test ATV video libraries

### Model with arbitrary waveform generator

- 256 Msample memory space
- Sample rate up to 100 Msamples/s
- Waveform libraries from Rohde&Schwarz
  - T-DMB/DAB (R&S®SFU-K351)
  - DVB-H (R&S®SFU-K352)
  - DRM (R&S®SFU-K353)
  - DTV interferer (R&S®SFU-K354)
  - MediaFLO™ (R&S®SFU-K355)
  - Cable interferer (R&S®SFU-K356)
  - HD Radio™ (R&S®SFU-K357)
- Compatible with R&S®WinIQSIM™ (R&S®SFE100-K350)

### Convenient control elements and remote operation

- Keypad and liquid crystal display (LCD) on front panel
- Easy software updates via USB 2.0 or LAN
- Remote control via Remote Desktop (LAN) or VNC
- Remote control commands compatible with the R&S®SFU and R&S®SFE

## Specifications in brief

| | |
|---|---|
| **RF signal** | |
| Frequency range | 100 kHz to 2.5 GHz |
| Frequency resolution | 1 Hz |
| Level | –110 dBm to +15 dBm |
| Level accuracy | <1.0 dB |
| Level with power amplifier | +27 dBm, adjustable from 0 dB to –30 dB |
| **Spectral purity** | |
| SSB phase noise, at 300 MHz with 20 kHz offset | typ. <–115 dBc/Hz |
| Broadband noise >10 MHz | <–135 dBc (1 Hz) |
| **Digital modulation modes** | |
| Terrestrial TV | DVB-T, DTMB, ISDB-T, ATSC/8VSB, ISDB-$T_B$ |
| Cable TV | DVB-C, J.83/B, ISDB-C |
| Satellite TV | DVB-S/DSNG, DVB-S2, DirecTV |
| Mobile TV | DVB-H, T-DMB, ISDB-T 1-segment (partial reception), DMB-TH, MediaFLO™ |
| Digital sound broadcasting | DAB, DAB+, HD Radio™, DRM (waveform), ISDB-$T_{SB}$ |
| **Analog modulation modes** | |
| Analog TV | B/G, D/K, I, M/N, L |
| Analog sound broadcasting | AM/FM/RDS |
| **I/Q modulator** | |
| Frequency range | DC to 35 MHz |
| **TS generator** | |
| Net data rate | max. 90 Mbit/s |
| **General information** | |
| PC platform | Windows XP Embedded |
| Remote control | SCPI 1999.5 |
| Ethernet | 10/100BaseT, RJ-45 |
| USB | 2.0 |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| **Base unit** | | |
| Test Transmitter, DTV, requires DTV or ARB option | R&S®SFE100 | 2112.4100.02 |
| Test Transmitter, ATV, requires ATV option | R&S®SFE100 | 2112.4100.03 |
| **Options** | | |
| Digital modulation modes | | |
| DVB-T/H | R&S®SFE100-K1 | 2113.4003.02 |
| DVB-C/ISDB-C | R&S®SFE100-K2 | 2113.4026.02 |
| DVB-S/DSNG | R&S®SFE100-K3 | 2113.4049.02 |
| ATSC/8VSB | R&S®SFE100-K4 | 2113.4061.02 |
| J.83/B | R&S®SFE100-K5 | 2113.4084.02 |
| ISDB-T/ISDB-$T_{SB}$/ ISDB-$T_B$ | R&S®SFE100-K6 | 2113.4103.02 |
| DVB-S2 | R&S®SFE100-K8 | 2113.4126.02 |
| DirecTV | R&S®SFE100-K9 | 2113.4149.02 |
| MediaFLO™ | R&S®SFE100-K10 | 2113.4161.02 |
| T-DMB/DAB | R&S®SFE100-K11 | 2113.4184.02 |
| DTMB | R&S®SFE100-K12 | 2113.4203.02 |
| Analog modulation modes | | |
| ATV-B/G | R&S®SFE100-K190 | 2113.4649.02 |
| ATV-D/K | R&S®SFE100-K191 | 2113.4661.02 |
| ATV-I | R&S®SFE100-K192 | 2113.4684.02 |
| ATV-M/N | R&S®SFE100-K193 | 2113.4703.02 |
| ATV-L | R&S®SFE100-K194 | 2113.4726.02 |
| AM/FM/RDS | R&S®SFE100-K170 | 2113.4426.02 |
| Baseband | | |
| TS Generator (includes SDTV stream library) | R&S®SFE100-K20 | 2113.4861.02 |
| TRP Player | R&S®SFE100-K22 | 2113.5268.02 |
| Video Generator | R&S®SFE100-K23 | 2113.4884.02 |
| Simulation | | |
| ARB Generator | R&S®SFE100-K35 | 2113.4926.02 |
| R&S®WinIQSIM™ | R&S®SFE100-K350 | 2113.4949.02 |
| T-DMB/DAB Waveforms | R&S®SFU-K351 | 2110.4277.04 |
| DVB-H Waveforms | R&S®SFU-K352 | 2110.4425.02 |
| DRM Waveforms | R&S®SFU-K353 | 2110.4554.02 |
| DTV Interferer Waveforms | R&S®SFU-K354 | 2110.4690.02 |
| MediaFLO™ Waveforms | R&S®SFU-K355 | 2110.2974.02 |
| Cable Interferer Waveforms | R&S®SFU-K356 | 2110.3212.02 |
| Baseband inputs | | |
| Extended I/Q Input | R&S®SFE100-K80 | 2113.5245.02 |
| Other extensions | | |
| Power Amplifier | R&S®SFE100-B90 | 2112.4900.02 |
| Memory Extension | R&S®SFE100-B3 | 2112.4400.02 |
| Compact Flash Memory | R&S®SFE100-B6 | 2112.4539.02 |
| Exchange Kit for RF Out Rear [1] | R&S®SFE100-U1 | 2112.4297.02 |
| Hard Disk Upgrade Kit 160 GByte [1] | R&S®SFE100-U2 | 2112.4380.02 |

[1] Only for R&S®SFE100 without R&S®SFE100-B90, upgrade in service department only.
[2] Upgrade in service department only.

# R&S®SFU Broadcast Test System

Analog and digital TV multistandard platform with signals for antenna, satellite and cable

- Multistandard platform
- Realtime TV signal and audio broadcasting signal generation
- Digital and analog transmission standards
- Wide output frequency range 100 kHz to 3 GHz
- Internal digital and analog interferer simulation
- Realtime transmission simulations
- Bit error ratio (BER) measurement
- TS baseband generator
- TRP and ETI player, recorder
- I/Q arbitrary waveform generator

The R&S®SFU broadcast test system has been designed as a platform for different applications and for future options. It provides a number of instruments and applications in a cabinet of only four height units and offers unrivaled RF and baseband characteristics.

Due to its modular design, the R&S®SFU can be optimally adapted to the requirements of different applications. It is an ideal research and development tool for making improvements to introduced standards and for generating new standard signals. Applications that previously required many different instruments are now fully covered by the R&S®SFU.

The modern, intuitive concept of the R&S®SFU ensures fast and easy operation. The user can easily switch operating parameters (e.g. roll-off, puncturing rate, QAM mode) and select operating parameters whose values exceed those defined in the standard for lab applications. For special tasks such as in DVB-T/H, modulation, individual carriers and carrier groups can be deactivated. Sweeps across the entire RF range are possible.

The R&S®SFU's modular design makes it a future-ready investment. Options can usually be activated quickly and conveniently on-site at any time by means of firmware update and license code. This feature ensures fast and easy availability without time loss and is a big advantage for use in production and development. The R&S®SFU can be adapted to perfectly match current requirements and its configuration can be tailored to meet customer-specific needs. It thus saves a lot of money yet offers full flexibility and openness for new, evolving fields of application.

## General characteristics

- DTV, ATV and audio broadcasting signal generation
- Generation of internal interferers
- Fully digital baseband signal processing
- Upgradeability to multifunctional broadcast test system
- Easy installation of most options at customer site

## Intuitive, fast and easy operation

- Color display with 1024 × 768 pixels (XVGA, 8.4")
- Intuitive user interface with Windows XP Embedded
- Context-sensitive help system
- User-definable favorites for fast access
- Easy software update by means of USB and Windows

## Outstanding signal quality

- I/Q modulator with 180 MHz RF bandwidth
- Very low SSB phase noise of typ. –135 dBc at 1 GHz (20 kHz carrier offset, 1 Hz measurement bandwidth)
- High optional output power of up to +19 dBm (PEP), overrange +26 dBm
- High-stability reference oscillator as standard

## Unrivaled flexibility for research and development

- Expandable multistandard platform
- Universal coder for realtime signal generation
- Transmission simulations
- TS baseband generator
- TRP and ETI player, recorder
- Video and audio generator
- Arbitrary waveform generator with 128 Msample, supported by R&S®WinIQSIM™ software
- Variety of signal libraries with waveforms and transport streams
- Internal hard disks for storing waveforms and streams
- Integrated power measurement with external power sensors

## Ideal for use in production

- Wear-free electronic attenuator of up to 3 GHz over the full level range
- Minimum space requirements: TS/video generator and test transmitter are accommodated in one instrument of only four height units
- Favorably priced and future-ready non-realtime production solution, since it can be upgraded with software at any time
- Fast, flexible software option solutions for new requirements

## Easy remote access

- Remote control via GPIB and LAN (VXI 11)
- User-friendly remote control by VNC or Remote Desktop
- USB connectors for keyboard, mouse and memory stick
- Remote control command compatibility to R&S®SFE and R&S®SFE100

## One-box solution

### Test transmitter

RF signals for a variety of transmission standards can be transmitted over a wide, user-variable frequency range by the integrated test transmitter. All the different standards – for terrestrial, satellite or cable transmission – can be easily loaded into the multistandard test transmitter via software and an extremely pure spectrum can be generated.

### Bit error ratio meter

The integrated BER meter makes it possible to measure and evaluate errors on the transmission link. A BER value can be determined on the transport stream as well as via the data and clock circuits.

### Channel simulator

Integrated transmission simulators for AWGN, phase noise, impulsive noise and fading, as well as adjacent channel simulations are available for simulating real and, above all, reproducible environmental conditions in the lab.

### Transport stream signal source

Video and audio applications require baseband signals. A variety of such signals are available as transport stream signal sources.

- Rohde&Schwarz libraries with ready-to-use special signals for tests and development can be replayed with the transport stream generator
- Customer files can be easily loaded and replayed with the transport stream player
- The internal transport stream recorder supports recording of customer transport streams from any sources

### I/Q signal generator

Customer I/Q waveforms or Rohde&Schwarz waveform libraries for different transmission standards can be replayed with the arbitrary waveform generator.

### Power measurement

High-precision power measurements with R&S®NRP-Zxx power sensors can be performed and displayed on the R&S®SFU's large screen.

## Coders

All coders are software-based; with the appropriate hardware, they can be activated immediately by means of an enabling code. It is thus not necessary to open the instrument.

## Specifications in brief

| | |
|---|---|
| **Frequency** | |
| Frequency range | 100 kHz to 3 GHz |
| Frequency sweep | digital sweep in discrete steps |
| Operating modes | automatic, single shot, manual or external trigger, linear or logarithmic |
| Sweep range, step width (lin) | full range |
| Step width log) | 0.01 % to 100 % |
| **Level** | |
| Maximum level | +13 dBm (PEP), –120 dBm to +20 dBm |
| With R&S®SFU-B90 option | +19 dBm (PEP), –120 dBm to +30 dBm |
| Level accuracy | <0.5 dB |
| VSWR (f ≤ 3 GHz, ALC ON) | typ. <1.4 |
| **Spectral purity** | |
| Harmonics | <–30 dBc |
| Nonharmonics (CW, offset >10 kHz, 200 MHz < f ≤ 1.5 GHz) | <–80 dBc |
| Subharmonics (f >1.5 GHz to 3.0 GHz) | <–74 dBc |
| Wideband noise (offset >5 MHz, 1 Hz CW, 200 MHz < f ≤ 1.5 GHz | <–150 dBc |
| I/Q modulator | ext. wideband I/Q, internal baseband I/Q |
| **Transmission standards** | |
| Digital TV | DVB-T, DVB-C, DVB-S, DVB-S2, DVB-SH, ATSC/8VSB, J.83/B, DirecTV, ISDB-T, GB20600-2006 |
| Analog TV | B/G, D/K, M/N, L, I, with PAL, SECAM, NTSC |
| Mobile TV | DVB-H, ISDB-T, MediaFLO™, DMB-TH, T-DMB, ATSC M/H |
| Audio broadcasting | DAB, DAB+, HD Radio™, DRM (waveform), ISDB-$T_{sb}$ |
| Modulation frequency range | 100 MHz (I/Q wideband ON) |
| **Noise generator** | |
| AWGN | R&S®SFU-K40 option |
| Phase noise | R&S®SFU-K41 option |
| Impulsive noise | R&S®SFU-K42 option |
| RF bandwidth | >70 MHz (3 dB spectrum (AWGN)) |
| Noise (density distribution) | Gaussian, statistical, separate for I and Q |
| BER measurements | R&S®SFU-K60 option |
| PRBS measurements | input BER clock, BER data, BER enable |
| MPEG-2 TS measurements | ASI, SPI stuffing off, SMPTE310 |
| Fading simulator | option R&S®SFU-B30 |
| Number of paths | 20 (with R&S®SFU-K31 option: 40) |
| Speed range | 0 km/h to 1725 km/h for 1 GHz |
| Fading profiles | pure Doppler, Rayleigh fading, Rice fading, lognormal fading |
| Enhanced fading | R&S®SFU-K30 option |
| Number of paths, fine delay 50 MHz mode | 8 (with R&S®SFU-B31 option: 16) |
| Number of paths, fine delay 30 MHz mode | 12 (with R&S®SFU-B31 option: 24) |
| Moving delay mode | 2 fading paths per signal path |
| Birth-death mode | 2 fading paths per signal path |
| Gaussian fading | Gauss 1, Gauss 2, Gauss DAB |
| **TS generator** | R&S®SFU-K20 option |
| ASI data rate | 270 Mbit/s |
| Net data rate | max. 90 Mbit/s |
| Signal set: moving picture sequences and test patterns with test tones, for 625 and 525 lines; DVB/ATSC systems, additional signals via options | |

## Specifications in brief

| | |
|---|---|
| **TS recorder** | R&S®SFU-K21 option |
| Recording | |
| Operating mode TRP | ASI, SPI, SMPTE310M or ETI |
| Operating mode T10 | SPI |
| Operating mode BIN | SPI, ETI |
| Data rate | 100 kbit/s to max. 90 Mbit/s |
| Parallel input | |
| Operating mode | SPI, 60 Mbit/s (NTFS), 90 Mbit/s (CFS) |
| Clock | |
| 60 Mbit/s NTFS | 84.375 kHz to 7.5 MHz |
| 90 Mbit/s CFS | 84.375 kHz to 11.25 MHz |
| Serial TS input | |
| Operating mode | ASI, SMPTE310M (selectable) |
| Data rate ASI | 270 Mbit/s |
| Data rate SMPTE310M | 19.392658 Mbit/s |
| **ARB waveform generator** | R&S®SFU-K35 option |
| Waveform memory | 128 Msamples (256 Msamples in preparation) |
| Waveform files | waveform libraries, defined by user (R&S®WinIQSIM™, MATLAB®, etc.) |
| **TS player** | R&S®SFU-K22 option |
| Play back | |
| File format | TRP, T10, BIN, ETI format DAB/DAB_C |
| Data rate | 100 kbit/s to max. 90 Mbit/s |
| Serial TS output | |
| Operating mode | ASI, SMPTE310M (selectable) |
| Data rate ASI | 270 Mbit/s |
| Data rate SMPTE310M | 19.392658 Mbit/s |
| Serial TS input | R&S®SFU-B11 option |
| **Video signal generator** | included in R&S®SFU-K190 to R&S®SFU-K194 option |
| Video signals (ATV video basic) | COLORBARS_75 (PAL, NTSC, SECAM), FuBK (PAL) |
| ATV video | libraries with analog video test signals |
| **General data** | |
| PC platform | Windows XP Embedded |
| Memory for settings | internal hard disk |
| Display | 1024 × 768 pixels (XVGA) |
| Remote control | IEC60625 (IEEE488), SCPI 1999.5 |
| Ethernet | 10/100BaseT, RJ-45 |

## Ordering information

Option identification:
R&S®SFU-Bxy = hardware option, R&S®SFU-Kxy = software option.
Delivery of R&S®SFU base unit only with at least one coder or with the R&S®SFU-K81 option installed. If the R&S®SFU-K81 option is installed, no digital or analog modulation system can be used.

| Designation | Type | Order No. |
|---|---|---|
| **Broadcast Test System** | | |
| Including power cable, quick start guide, operating manuals (CD-ROM) | R&S®SFU | 2110.2500.02 |
| **Options** | | |
| Basic configuration | | |
| Realtime Disabled [1] | R&S®SFU-K81 | 2110.7960.02 |
| Realtime Enabled [2] | R&S®SFU-K82 | 2110.7976.02 |
| RF path | | |
| High Power | R&S®SFU-B90 | 2110.8008.03 |
| Digital modulation systems | | |
| DVB-T/H Coder | R&S®SFU-K1 | 2110.7301.02 |
| DVB-C/ISDB-C Coder | R&S®SFU-K2 | 2110.7324.02 |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| Digital modulation systems (continued) | | |
| DVB-S/DVB-DSNG Coder | R&S®SFU-K3 | 2110.7330.02 |
| DVB-S2 Coder [3] | R&S®SFU-K8 | 2110.7399.02 |
| DVB-SH Coder [3] | R&S®SFU-K13 | 2110.7801.02 |
| ATSC/8VSB Coder | R&S®SFU-K4 | 2110.7353.02 |
| ATSC/A-VSB Coder | R&S®SFU-K14 | on request |
| ATSC M/H Coder | R&S®SFU-K18 | 2110.7860.02 |
| J.83/B Coder | R&S®SFU-K5 | 2110.7360.02 |
| ISDB-T/ISDB-$T_B$/ISDB-$T_{SB}$ Coder | R&S®SFU-K6 | 2110.7376.02 |
| MediaFLO™ Coder [4] | R&S®SFU-K10 | 2110.7524.02 |
| T-DMB/DAB Coder | R&S®SFU-K11 | 2110.7518.02 |
| DMB-T (TDS-OFDM) Coder [3] | R&S®SFU-K7 | on request |
| DTMB/DMB-TH Coder [3] | R&S®SFU-K12 | 2110.7760.02 |
| CMMB Coder [3] | R&S®SFU-K15 | 2110.7818.02 |
| DirecTV Legacy Modulation Coder [3] | R&S®SFU-K9 | 2110.7401.02 |
| AMC Coder [5] | R&S®SFU-K108 | on request |
| Coder Extension 1 | R&S®SFU-B1 | 2110.7424.02 |
| Coder Extension 10 | R&S®SFU-B10 | 2110.7747.02 |
| Analog modulation systems | | |
| AM/FM RDS Coder [6] | R&S®SFU-K170 | 2110.7830.02 |
| ATV Standard B/G Coder [6] | R&S®SFU-K190 | 2110.8050.02 |
| ATV Standard D/K Coder [6] | R&S®SFU-K191 | 2110.8037.02 |
| ATV Standard I Coder [6] | R&S®SFU-K192 | 2110.8043.02 |
| ATV Standard M/N Coder [6] | R&S®SFU-K193 | 2110.8066.02 |
| ATV Standard L Coder [6] | R&S®SFU-K194 | 2110.8072.02 |
| Multi ATV Predefined [7] | R&S®SFU-K199 | 2110.8089.02 |
| Coder Extension 2 [23] | R&S®SFU-B2 | 2110.7430.02 |
| Simulation | | |
| Fading Simulator | R&S®SFU-B30 | 2110.7530.02 |
| Extension to 40 Paths [8] | R&S®SFU-B31 | 2110.7547.02 |
| Enhanced Fading [8] | R&S®SFU-K30 | 2110.7560.02 |
| Gaussian Fading [8] | R&S®SFU-K32 | 2110.7630.02 |
| ARB Generator [7] | R&S®SFU-K35 | 2110.7601.02 |
| Memory Extension 1 [23] | R&S®SFU-B3 | 2110.7447.02 |
| T-DMB/DAB Waveforms [9] | R&S®SFU-K351 | 2110.4277.02 |
| DVB-H Waveforms [9] | R&S®SFU-K352 | 2110.4425.02 |
| DRM Waveforms [9] | R&S®SFU-K353 | 2110.4554.02 |
| DTV Interferers [9] | R&S®SFU-K354 | 2110.4690.02 |
| MediaFLO™ Waveforms [9] | R&S®SFU-K355 | 2110.2974.02 |
| Cable Interferers [9] | R&S®SFU-K356 | 2110.3212.02 |
| HD Radio™ Waveforms [10] | R&S®SFU-K357 | on request |
| CMMB Waveforms [9] | R&S®SFU-K358 | 2112.3726.02 |
| Interferer Management | R&S®SFU-K37 | 2110.7647.02 |
| AWGN Noise | R&S®SFU-K40 | 2110.7653.02 |
| Phase Noise | R&S®SFU-K41 | 2110.7660.02 |
| Impulsive Noise | R&S®SFU-K42 | 2110.7676.02 |
| Multinoise Use [11] | R&S®SFU-K43 | 2110.7682.02 |
| Custom OFDM | R&S®SMU-K15 | 1160.6402.02 |
| Baseband inputs/outputs | | |
| Extended I/Q | R&S®SFU-K80 | 2110.7953.02 |
| ETI Input/Output | R&S®SFU-B11 | 2110.7553.03 |
| Digital baseband | | |
| TS Generator incl. SDTV streams | R&S®SFU-K20 | 2110.7476.02 |
| DVB-H Stream Library [12] | R&S®DV-DVBH | 2085.8704.02 |
| Test Card M Streams [12] | R&S®DV-TCM | 2085.7708.02 |
| HDTV Sequences [12] | R&S®DV-HDTV | 2085.7650.02 |
| H.264 Stream Library [12] | R&S®DV-H264 | 2085.9052.02 |
| ISDB-T Stream Library [12] | R&S®DV-ISDBT | 2085.9146.02 |
| TRP Player [13] | R&S®SFU-K22 | 2110.7499.02 |

## Ordering information

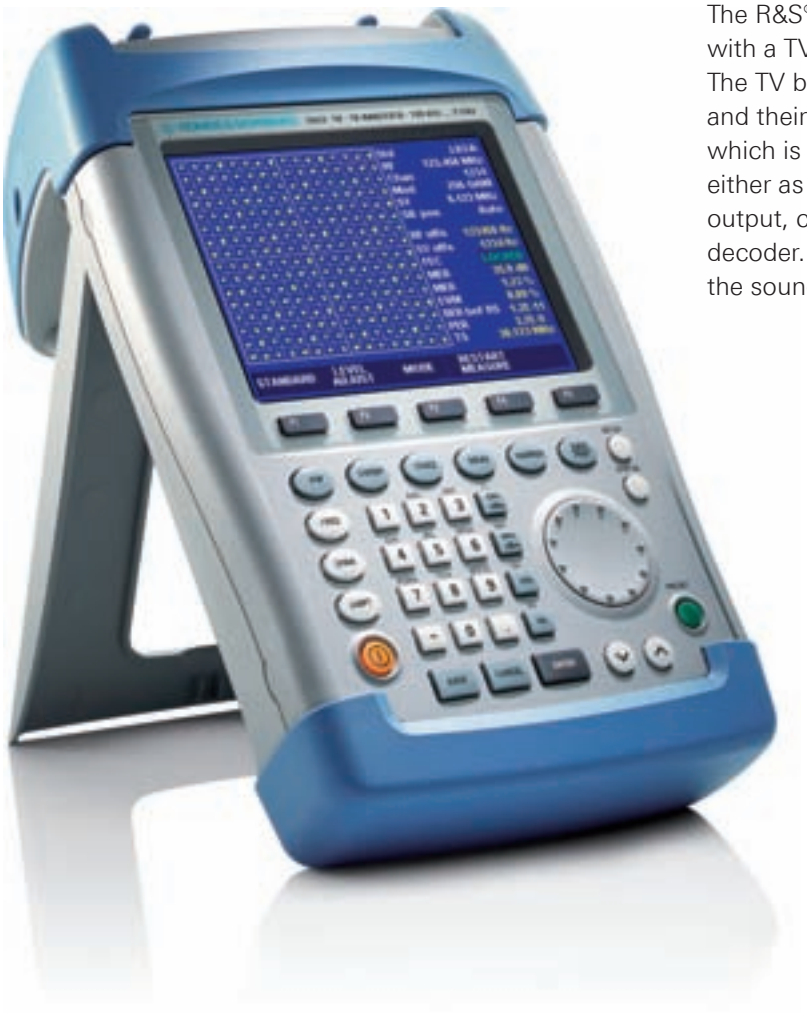
| Designation | Type | Order No. |
|---|---|---|
| TS/ETI Recorder [14] | R&S®SFU-K21 | 2110.7482.02 |
| Memory Extension 2 | R&S®SFU-B4 | 2110.7453.02 |
| Additional Hard Disk [15] | R&S®SFU-B6 | 2110.7501.02 |
| Additional Hard Disk [16] | R&S®SFU-B6 | 2110.7501.03 |
| T-DMB/DAB Streams [17] | R&S®SFU-K221 | 2110.4348.02 |
| DAB+ Streams [17] | R&S®SFU-K223 | 2110.4760.02 |
| MediaFLO™ Streams [17] | R&S®SFU-K222 | 2110.2968.02 |
| ISDB-T Streams [17] | R&S®SFU-K224 | 2110.4777.02 |
| Customer Defined Streams [17] | R&S®DV-SCA | on request |
| Analog baseband | | |
| Video Generator [18] | R&S®SFU-K23 | 2110.7799.02 |
| ATV Video Signals [19] | R&S®ATV Video | 2110.4831.02 |
| Impedance Matching Pad 75/50 Ω [19] | R&S®SFU-Z19 | 2110.7276.02 |
| Measurement and analysis functions | | |
| RF Power Measurements [20] | R&S®SFU-K55 | 2110.7753.02 |
| BER Measurements [21] | R&S®SFU-K60 | 2110.7782.02 |
| Other expansions | | |
| User I/O (additional input/output) [22] | R&S®SFU-B5 | 2110.7460.02 |
| Upgrade Kit for R&S®SFU-K43 | R&S®SFU-U43 | 2110.7699.02 |
| **Recommended extras** | | |
| Hardcopy of operating manuals | | 2110.2522.12 |
| Documentation of R&S®SFU Calibration Values | R&S®SFU-DCV | 2082.0490.30 |
| LVDS Cable for digital I/Q input/output (2 m) | R&S®LVDS BU-BU | 1130.1302.00 |
| Adapter for Telescopic Sliders | R&S®ZZA-T45 | 1109.3774.00 |
| Keyboard with USB Interface (US assignment) | R&S®PSL-Z2 | 1157.6870.03 |
| Mouse with USB Interface, optical | R&S®PSL-Z10 | 1157.7060.02 |
| External USB DVD Drive | R&S®PSP-B6 | 1134.8201.22 |
| **Service options** | | |
| Can only be ordered in connection with the purchase of an instrument. | | |
| Repair Service Following the warranty period | | please contact your local sales office |
| One-Year | R&S®RO2SFU | |
| Two-Year | R&S®RO3SFU | |
| Four-Year | R&S®RO5SFU | |
| Two-Year Calibration Service | R&S®CO2SFU | |
| Three-Year Calibration Service | R&S®CO3SFU | |
| Five-Year Calibration Service | R&S®CO5SFU | |

[1] Option available only at initial delivery.
[2] Only if R&S®SFU-K81 is installed.
[3] Requires an installed R&S®SFU-B1 or R&S®SFU-B10.
[4] Requires an installed R&S®SFU-B10.
[5] Requires an installed R&S®SFU-K8 (DVB-S2) and an installed R&S®SFU-B1 or R&S®SFU-B10.
[6] Requires an installed R&S®SFU-B2.
[7] Requires an installed R&S®SFU-B3.
[8] Requires an installed R&S®SFU-B30.
[9] Can be used with R&S®SFU-K35.
[10] Can be used with R&S®SFU-K35, Ibiquity license required.
[11] Requires at least of one installed R&S®SFU-K40, -K41 or -K42.
[12] Requires an installed R&S®SFU-K20.
[13] Requires an installed R&S®SFU-B6 and R&S®SFU-B4.
[14] Requires an installed R&S®SFU-K22, R&S®SFU-B6 and R&S®SFU-B4.
[15] For instruments with serial numbers <101000.
[16] For instruments with serial numbers >101000.
[17] Requires an installed R&S®SFU-K22.
[18] Included in R&S®SFU-K190 to R&S®SFU-K194.
[19] Can be used with R&S®SFU-K190 to R&S®SFU-K194.
[20] Can be used with R&S®NRP-Zxx power sensors.
[21] Cannot be used at all or only to a limited extent for DVB-S2, DirecTV, DTMB, DMB-TH and MediaFLO™.
[22] Supported by R&S®SFU firmware versions <V1.70.
[23] Preinstalled in R&S®SFU from serial no. 101000.

# R&S®FSH3-TV Handheld TV Analyzer

Universal combined TV and spectrum analyzer from 100 kHz to 3 GHz

- Measurement functions for analog and digital TV signals
- Full-featured spectrum analyzer
- Combined video/ASI output
- Compact and robust housing
- Four hours operating time on battery power
- Wide selection of accessories for diverse measurement tasks
- Preselector option with 75 Ω RF input



The R&S®FSH3-TV handheld TV analyzer combines the functions and features of a complete spectrum analyzer with those of a TV test receiver in a single measurement instrument. It can be taken wherever needed and is ideal for technicians who perform measurements on site – for example, during new installations or maintenance and repair work on components of TV cable networks and transmitters.

The instrument's compact housing is designed for portable use. Its robust edge protection and RF connector covers safeguard the R&S®FSH3-TV against mechanical and weather-related conditions. The R&S®FSH3-TV weighs only 2.8 kg. It has a sturdy carrying handle that also makes reading the display easy when the instrument is placed on a flat surface. In addition, an integrated stand allows the R&S®FSH3-TV to be positioned to the optimum angle for reading results. The powerful, built-in NiMH battery can power the instrument for up to four hours, thus providing reliable operation even at remote locations.

The R&S®FSH3-TV is operated by means of convenient menus and softkeys. Frequently used functions can be selected directly. In addition, a rotary knob allows quick and easy variation of entry values and the selection of items from menus. Measured values and menus are shown on a backlit color liquid crystal display. The display remains legible even under difficult lighting conditions (daylight).

The R&S®FSH3-TV handheld TV analyzer comes equipped with a TV board, a preamplifier and a tracking generator. The TV board permits measurements of analog TV signals and their demodulation. The demodulated video signal, which is made available at an output that can be used either as a CCVS (analog TV) or as a TS-ASI (digital TV) output, can be routed to an external monitor or an MPEG decoder. The supplied headphones can be used to listen to the sound of the analog TV signal.

| TV standards | |
|---|---|
| R&S®FSH3-TV (base unit) | B, G, H, D/K, N, I, M/NTSC, M/PAL |
| R&S®FSHTV-K21 (option) | DVB-C (J.83/A/C) J.83/B |
| R&S®FSHTV-K22 (option) | ATSC/8VSB |

## Made for TV

The R&S®FSH3-TV handheld TV analyzer offers the same scope of functions as any spectrum analyzer from the R&S®FSH family. Additional settings and options have been added that are specially designed for measurements needed by TV cable operators and transmitter network operators. The main expansion is the TV board integrated in the base unit. The R&S®FSH3-TV comes equipped with a female N connector (50 Ω) for the RF input. To ensure correct measurement values even in applications with 75 Ω impedance, the R&S®RAZ and R&S®FSH-Z38 50 Ω/75 Ω matching pads are offered as options.

If the R&S®FSH3-TV is intended for frequent use in cable networks, the R&S®FSHTV-Z60 preselector option is recommended. It improves the usable dynamic range particularly in the case of densely occupied cable systems.

## Many tasks, one solution

In addition to its numerous built-in functions, the R&S®FSH3-TV offers a wide range of options and separate accessories that allow it to be customized to the application at hand. This means that a full scope of configurations is possible – from a special-purpose instrument up to a do-it-all solution.

## Hardware and software options for various applications

| | Application | | | | | Software option | | | | Hardware option | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Function/equipment** | **Measurements in cable network** | **Measurements on transmitter** | **Coverage measurements** | **Lab and service** | **Included as standard in R&S®FSH3-TV base unit** | **R&S®FSH-K2 vector transmission and reflection measurements** | **R&S®FSH-K3 receiver mode** | **R&S®FSHTV-K21 DVB-C/J.83/A/B/C (QAM) firmware** | **R&S®FSHTV-K22 ATSC/8VSB firmware** | **R&S®FSH-B1 distance-to-fault measurement** | **R&S®FSHTV-Z60 preselector** | **R&S®FSH-Z2 VSWR bridge and power divider** | **R&S®FSH-Z14/FSH-Z44 directional power sensor** |
| Channel tables | ○ | ○ | ○ | | ✓ | | | | | | | | |
| Measurements – analog TV | ○ | ○ | ○ | ○ | ✓ | | | | | | | | |
| Demodulation – analog TV | ○ | ○ | ○ | ○ | ✓ | | | | | | | | |
| Scope function (video line analysis) | ○ | ○ | ○ | ○ | ✓ | | | | | | | | |
| Modulation parameters – analog TV | ○ | ○ | | ○ | ✓ | | | | | | | | |
| Measurements – DVB-C (J.83/A/C), J.83/B | ○ | | | ○ | | | | ○ | | | | | |
| Demodulation - DVB-C (J.83/A/C), J.83/B | ○ | | | ○ | | | | ○ | | | | | |
| Measurements – ATSC/8VSB | | ○ | ○ | ○ | | | | | ○ | | | | |
| Demodulation – ATSC/8VSB | | ○ | ○ | ○ | | | | | ○ | | | | |
| Defined settings | ○ | ○ | ○ | ○ | ✓ | | | | | | | | |
| Channel power | ○ | | | ○ | ✓ | | | | | | | | |
| C/N measurement | ○ | | | ○ | ✓ | | | | | | | | |
| CSO, CTB, HUM | ○ | | | ○ | ✓ | | | | | | | | |
| Shoulder attenuation | | ○ | | ○ | ✓ | | | | | | | | |
| Power measurements | | ○ | | ○ | | | | | | | | | ○ |
| Zero span, trigger | ○ | | | | ✓ | | | | | | | | |
| Field-strength measurements | | | ○ | | ✓ | | | | | | | | |
| EMC precompliance | ○ | | | ○ | | | ○ | | | | | | |
| Scan mode | ○ | | ○ | | | | ○ | | | | | | |
| Scalar transmission measurements | | | | ○ | ✓ | | | | | | | | |
| Scalar reflection measurements (VSWR) | | ○ | | ○ | | | | | | | | ○ | |
| Vector transmission measurements | | ○ | | ○ | | ○ | | | | | | | |
| Vector reflection measurements (VSWR) | | ○ | | ○ | | ○ | | | | | | ○ | |
| Measurements on cables | ○ | ○ | | | | | | | | ○ | | ○ | |
| Cable loss measurements | | ○ | | ○ | | ○ | | | | | | | |
| Preamplifier | | | ○ | | ✓ | | | | | | | | |
| Preselector | ○ | | ○ | | | | | | | | ○ | | |
| Tracking generator | ○ | ○ | | ○ | ✓ | | | | | | | | |
| R&S®FSH View control software | ○ | ○ | ○ | ○ | ✓ | | | | | | | | |

## R&S®FSH view control software

The control software is included as standard with every TV analyzer. Users can simply install the software on a PC and then connect it to the R&S®FSH3-TV via USB. R&S®FSH View is a convenient tool for recording measurements and quickly configuring the R&S®FSH3-TV.

- Quick and simple transfer of measurement data from the R&S®FSH3-TV to a PC and vice versa
- Printout of all relevant data via Windows (screenshot of the R&S®FSH3-TV display for documentation)
- Storage of graphics data in standard formats (.bmp, .pcx, .png, .wmf)
- Permanent and continuous transfer of sweeps to the PC; facilities for subsequent analysis (markers, zoom, etc.)
- Automatic storage of measurement results at selectable intervals
- Generation of cable data with a built-in cable editor; downloading to the R&S® FSH3-TV for distance-to-fault measurements (R&S®FSH-B1)
- Editor for generating limit lines, antenna factors and correction factors for external attenuators or amplifiers
- Generation of channel tables and downloading to the R&S®FSH3-TV for the receiver mode (R&S®FSH-K3)
- Macro function for Microsoft Word for fast and convenient documentation of results
- Connection between PC and R&S®FSH3-TV via an electrically isolated USB optical interface

## Specifications in brief

| | |
|---|---|
| **Spectrum analyzer** | |
| Frequency range | 100 kHz to 3 GHz |
| Resolution bandwidths | 100 Hz to 1 MHz |
| Video bandwidths | 10 Hz to 1 MHz |
| Displayed average noise level (DANL) | typ. –135 dBm (100 Hz) |
| TOI | typ. 13 dBm |
| SSB phase noise | <–100 dBc (1 Hz) at 100 kHz from carrier |
| Sweep at span = 0 Hz | 100 µs to 100 s |
| Detectors | sample, max/min peak, auto peak, RMS |
| Level measurement uncertainty | <1.5 dB, typ. 0.5 dB |
| Reference level | –80 dBm to +20 dBm |
| Digital TV receiver (R&S®FSHTV-K21 for QAM, R&S®FSHTV-K22 for 8VSB) | |
| Modulation methods | 4-, 16-, 32-, 64-, 128- and 256 QAM, 8VSB |
| Bandwidths, depending on standard | 6 MHz, 7 MHz and 8 MHz |
| Symbol rate | 2 MHz to 6.999 MHz/ 10.762238 MHz |
| Inherent MER (equalizer ON) | >35 dB |
| **Analog TV receiver** | |
| Standards | B, G, H, D, K, I, L, M, N, |
| Sound standards | IRT-A2, NICAM, BTSC, EIA-J |
| Video bandwidths | depending on standard |
| Inherent S/N video, weighted in line with ITU-R Rec. 567 | >50 dB |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| **Base unit** | | |
| TV Analyzer | R&S®FSH3-TV | 2111.7005.63 |
| Accessories supplied: external power supply, battery pack (integrated), USB optical cable, headphones, quick start manual, CD-ROM with R&S®FSH View control software and documentation | | |
| **Options** | | |
| Distance-to-Fault Measurement (includes 1 m cable, R&S®FSH-Z2 required) | R&S®FSH-B1 | 1145.5750.02 |
| DVB-C/J.83/A/B/C (QAM) Firmware | R&S®FSHTV-K21 | 2111.7211.02 |
| ATSC/8VSB Firmware | R&S®FSHTV-K22 | 2111.7228.02 |
| Remote Control via USB (for spectrum analyzer functions only, firmware) | R&S®FSH-K1 | 1157.3458.02 |
| Vector Transmission and Reflection Measurements (firmware) | R&S®FSH-K2 | 1157.3387.02 |
| Receiver Mode (firmware) | R&S®FSH-K3 | 1157.3429.02 |
| **Recommended extras** | | |
| Preselector | R&S®FSHTV-Z60 | 2111.7105.02 |
| Spare F Adapter male/female | R&S®FSHTV-Z61 | 2111.7111.02 |
| Power Sensor, 10 MHz to 8 GHz | R&S®FSH-Z1 | 1155.4505.02 |
| VSWR Bridge and Power Divider, 10 MHz to 3 GHz (contains short, open and load for calibration) | R&S®FSH-Z2 | 1145.5767.02 |
| Directional Power Sensor, 25 MHz to 1 GHz | R&S®FSH-Z14 | 1120.6001.02 |
| Power Sensor, 10 MHz to 18 GHz | R&S®FSH-Z18 | 1165.1909.02 |
| Directional Power Sensor, 200 MHz to 4 GHz | R&S®FSH-Z44 | 1165.2305.02 |
| Matching Pad 50/75 Ω, 0 Hz to 2.7 GHz | R&S®RAZ | 0358.5714.02 |
| Spare RF Cable (1 m), male and female N connectors for R&S®FSH-B1 | R&S®FSH-Z20 | 1145.5867.02 |
| 12 V Car Adapter | R&S®FSH-Z21 | 1300.7579.02 |
| Serial/Parallel Converter | R&S®FSH-Z22 | 1145.5880.02 |
| Carrying Bag | R&S®FSH-Z25 | 1145.5896.02 |
| Transit Case | R&S®FSH-Z26 | 1300.7627.02 |
| Combined Short/Open and 50 Ω Load for VSWR and DTF calibration | R&S®FSH-Z29 | 1300.7504.02 |
| Spare Short/Open Calibration Standard for R&S®FSH-Z2 for VSWR calibration | R&S®FSH-Z30 | 1145.5773.02 |
| Spare 50 Ω Load for R&S®FSH-Z2 for VSWR and DTF calibration | R&S®FSH-Z31 | 1145.5780.02 |
| Spare Battery Pack | R&S®FSH-Z32 | 1145.5796.02 |
| Spare AC Power Supply | R&S®FSH-Z33 | 1145.5796.02 |
| Spare RS-232-C Optical Cable | R&S®FSH-Z34 | 1145.5815.02 |
| Spare CD-ROM with control R&S®FSH View software and documentation | R&S®FSH-Z35 | 1145.5821.02 |
| Spare Headphones | R&S®FSH-Z36 | 1145.5838.02 |
| Spare USB Optical Cable | R&S®FSH-Z37 | 1300.7733.02 |
| Matching Pad 50/75 Ω, 0 Hz to 1 GHz | R&S®FSH-Z38 | 1300.7740.02 |

# R&S®ETH Handheld TV Analyzer

## Portable DVB-T/H signal analysis up to 3.6/8 GHz

- TV, spectrum and network analyzer in a single box
- Detection of short-time interference
- Coverage measurements under real conditions
- Reliable measurement results
- Designed for portable outdoor use
- R&S®ETH View PC software supplied

The R&S®ETH handheld TV analyzer was specially designed for daily service and maintenance work on DVB-T/H gap-filler and low-power transmitters as well as nonvehicular coverage measurements. In addition, the universal capabilities of the R&S®ETH allow it to be used for repair and development of TV components.

The R&S®ETH handheld TV analyzer is a compact combination of a TV analyzer, spectrum analyzer and network analyzer. The functional diversity of the R&S®ETH makes it unnecessary to carry along other measuring equipment. Its frequency range extends up to 3.6 GHz or 8 GHz. The housing was specially designed for mobile use and is therefore rugged and splash-proof. Its large, daylight-friendly color display, low weight and replaceable lithium-ion battery enhance its portability. To improve its receive sensitivity and selectivity, the R&S®ETH can be equipped with internal preselection.

The core component of the R&S®ETH is an FPGA-based DVB-T/H demodulator that operates in realtime. It features maximum measuring performance and provides a demodulated MPEG-2 transport stream at the TS-ASI output. The readings are displayed on straightforward measurement screens and can be stored internally or on SD cards. The R&S®ETH View software that comes with the instrument allows measurement results to be displayed on a PC and makes it easy to transfer the data via the USB or LAN interface.

### TV, spectrum and network analyzer in a single box

- DVB-T/H analysis from 5 MHz to 3.6 GHz or 8 GHz
- Spectrum analysis from 100 kHz to 3.6 GHz or 8 GHz
- FPGA-based realtime DVB-T/H demodulator with TS-ASI output
- Precise analysis of signal quality and output power
- Fast and easy detection of impermissible spurious emissions

### Detection of short-time interference

- Signal analysis and demodulation for DVB-T/H in realtime
- High measurement speed
- BER measurements
- MPEG-2 transport stream output (ASI)

### Reliable measurement results

- Narrow measurement tolerances
- High MER performance >40 dB
- Support of power sensors
- Frequency locking to external 10 MHz reference signal

## Coverage measurements under real conditions

- Outdoor and indoor field strength measurement
- Internal preselection with preamplifier (option)
- Antenna factors taken into account

## Designed for portable outdoor use

- Compact, rugged and splash-proof housing
- Measurement values saved internally or on SD card
- Replaceable lithium-ion battery for 2.5 h to 4.5 h of operation
- High-resolution, daylight-friendly 6.5" color display
- Low weight (approx. 3.3 kg)

## R&S®ETH view PC software supplied

- Easy and fast documentation of measurement results
- Reproducible measurement results due to user-specific instrument configuration
- Configuration instrument settings, measurements, channel tables, etc., via LAN and USB interface
- Exchange of instrument configurations between multiple R&S®ETH analyzers
- Readout of internally stored measurement values
- Remote control via LAN and USB interface in accordance with SCPI standard with access for up to five users

## Specifications in brief

| | |
|---|---|
| Frequency range (TV receiver mode) | |
| Model .04, .14 | 5 MHz to 3.6 GHz |
| Model .08, .18 | 5 MHz to 8 GHz |
| Frequency range (spectrum analyzer mode) | |
| Model .04, .14 | 100 kHz to 3.6 GHz |
| Model .08, .18 | 100 kHz to 8 GHz |
| Frequency accuracy | 1 ppm/year |
| Phase noise (Δf = 30 kHz, RF = 500 MHz) | –98 dBc (1 Hz), typ. –103 dBc (1 Hz) |
| IP3 (RF = 500 MHz, RF attenuation = 0 dB) | |
| R&S®ETH-K1 = OFF | typ. 7 dBm |
| R&S®ETH-K1 = ON | typ. –8 dBm |
| Level uncertainty | typ. <0.5 dB |
| **Tracking generator** | |
| Frequency range, model .14 | 200 kHz to 3.6 GHz |
| Frequency range, model .18 | 200 kHz to 8 GHz |
| Output level | –40 dBm to 0 dBm |
| **DVB-T/H analysis (R&S®ETH-K140 option)** | |
| Channel bandwidth | 5 MHz, 6 MHz, 7 MHz, 8 MHz |
| FFT modes | 2K, 4K, 8K |
| QAM order | 4QAM, 16QAM, 64QAM |
| QAM hierarchy | none, α = 1, 2, 4 |
| Guard interval | 1/4, 1/8, 1/16, 1/32 |
| Code rates | 1/2, 2/3, 3/4, 5/6, 7/8 |
| Measurements | level, shoulder attenuation, carrier frequency offset, symbol rate offset, MER/EVM, bit error rate before Viterbi, bit error rate before Reed-Solomon, packet error ratio, packet errors, MPEG TS bit rate, constellation diagram, TPS information |
| MER system performance (RF = 500 MHz, level = –30 dBm) | ≥40 dB |
| **Spectrum analysis** | |
| Displayed average noise level (DANL), RF = 500 MHz, RF attenuation = 0 dB, resolution bandwidth = 1 Hz, VBW = 10 Hz | |
| R&S®ETH-K1 = OFF | typ. –158 dBm (1 Hz) |
| R&S®ETH-K1 = ON | typ. –165 dBm (1 Hz) |
| Reference level | –80 dBm to +20 dBm |
| Resolution bandwidths | 100 Hz to 3 MHz in 1/3 sequence |
| Video bandwidths | 10 Hz to 3 MHz in 1/3 sequence |

## Specifications in brief

| | |
|---|---|
| Sweep time | |
| Span >0 Hz | 20 ms to 1000 s |
| Span = 0 Hz, resolution bandwidth = 3 MHz | 200 µs to 100 s |
| I/Q demodulation bandwidth | 10 MHz |
| Detectors | auto peak, max peak, min peak, sample, RMS |
| Trigger functions | free run, video, ext. pos. edge, ext. neg. edge |
| **Interfaces** | |
| RF input | N connector (female), 50 Ω |
| Tracking generator output | N connector (female), 50 Ω |
| 10 MHz reference/ trigger input | BNC connector (female) |
| TS-ASI output | BNC connector (female), 75 Ω |
| Accessories control | 7-pole connector (female) , 1 × at top of instrument, 1 × at side |
| LAN interface | LAN (Ethernet 10/100BaseT) |
| USB interface | USB 1.1 |
| Memory card | SD card |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| Handheld TV Analyzer | | |
| Up to 3.6 GHz | R&S®ETH | 2114.1508.04 |
| Up to 8 GHz | R&S®ETH | 2114.1508.08 |
| Up to 3.6 GHz, with tracking generator | R&S®ETH | 2114.1508.14 |
| Up to 8 GHz, with tracking generator | R&S®ETH | 2114.1508.18 |
| **Equipment supplied with base unit** | | |
| Li-ion battery, plug-in power supply, LAN cable (2 m), USB cable, quick start guide, CD with R&S®ETH View PC software and documentation | | |
| **Hardware options** | | |
| RF Preselection up to 3.6 GHz | R&S®ETH-K1 | 2114.1608.04 |
| RF Preselection up to 8 GHz | R&S®ETH-K1 | 2114.1608.08 |
| **Software options** | | |
| DVB-T/H Test Receiver | R&S®ETH-K140 | 2114.1708.02 |
| Remote Control for R&S®ETH | R&S®ETH-K40 | 2114.1814.02 |

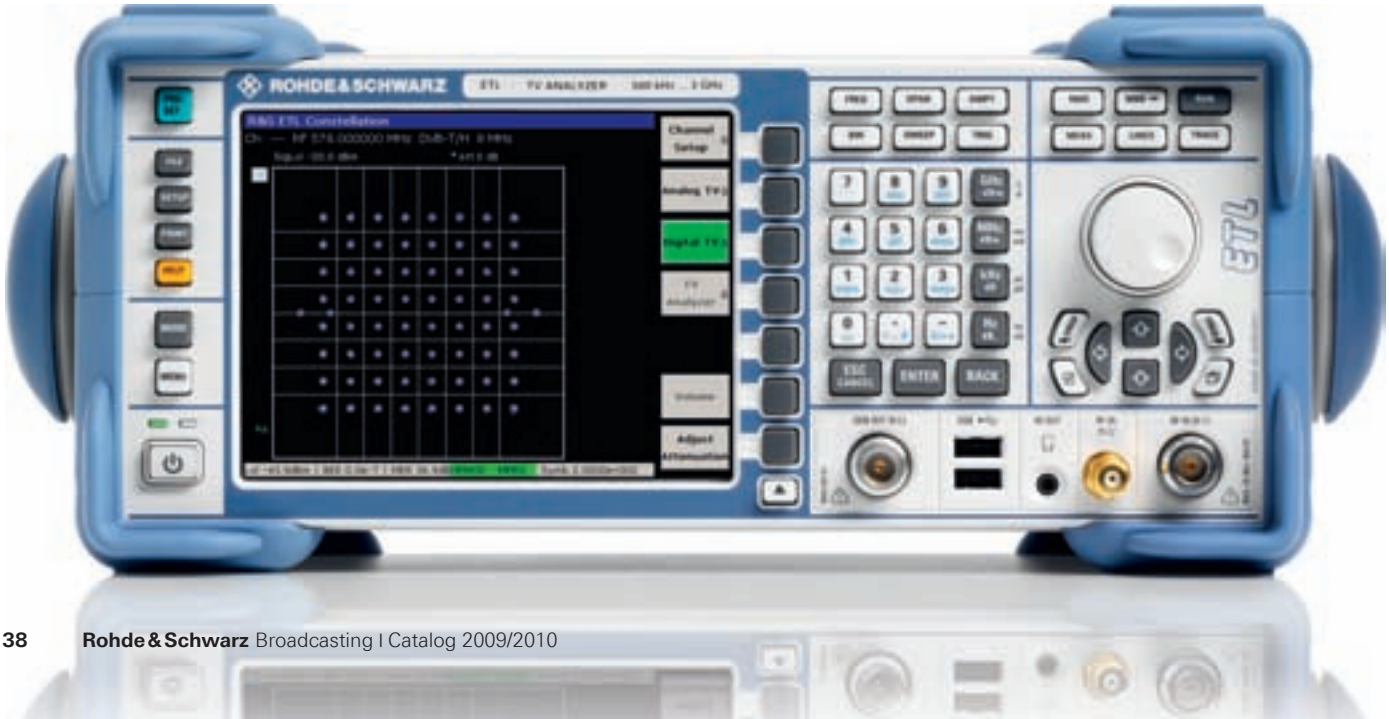
# R&S®ETL TV Analyzer

Universal multistandard platform for the analysis of TV and mobile TV signals

- Multistandard-compatible
- Software- and chip-based demodulators
- All demodulators operating in realtime
- Baseband outputs
- Wide range of TV signal analysis functions
- Integrated spectrum analysis functions
- MPEG-2 analysis and monitoring (optional)
- Optimal for portable and stationary use

The R&S®ETL TV analyzer is a universal multistandard platform for the analysis of TV signals. It combines TV test receiver and spectrum analyzer functionality in a single unit while providing high measurement accuracy. An innovative instrument concept allows new TV standards to be implemented on a software and hardware basis. Both digital (e.g. DVB-T/H) and analog TV standards can thus be integrated in a single instrument. The R&S®ETL uses realtime demodulation throughout.

The R&S®ETL TV analyzer platform has been mainly designed for the commissioning, installation and servicing of TV transmitters, for carrying out coverage measurements on terrestrial TV networks and for performing measurements on cable headends. Using only a single unit, broadcast transmitters or CATV systems can be installed easily and with high precision and maintained cost-effectively. Due to its compact and robust design, the R&S®ETL is suitable for mobile applications, which greatly simplifies network coverage measurements.



## Wide frequency range

- Frequency range 500 kHz to 3 GHz
- Conventional broadcasting frequencies
- L and S bands, which are steadily gaining in importance, also covered

## Multistandard-compatible

- Digital standards DVB-T/H, ATSC/8VSB, DTMB (China), T-DMB/DAB, DVB-C (J.83/A/C), J.83/B, ISDB-T, ISDB-C
- Analog TV standards

## Demodulation in realtime for complete signal analysis

- BER measurements
- Demodulated analog signals as well as digital MPEG transport streams available for further processing

## Versatile measurements for ATV and DTV

- Constellation diagrams displayed in very fine detail and building up at very high speed
- Signal parameter measurements displayed together with the results of signal analysis in clear-cut tables
- Video scope function enabling further analysis in user-selectable video lines
- C/N, CSO and CTB measurements especially for CATV applications
- Preselection including additional 75 Ω input (option)
- Spectrum measurements
- Shoulder distance in accordance with ETSI TR 101 290
- Channel and adjacent-channel power measurements using a single instrument.
- Frequency counter
- Noise and phase noise markers
- MPEG analysis and monitoring
- MPEG-2/H.264 decoder
- TV picture display

## Specifications in brief

| | |
|---|---|
| Frequency range | 500 kHz to 3 GHz |
| Frequency accuracy | $1 \times 10^{-6}$ |
| With R&S®FSL-B4, OCXO | $1 \times 10^{-7}$ |
| Phase noise | typ. –103 dBc (1 Hz) at 10 kHz from carrier, 500 MHz |
| **Displayed average noise level** | |
| Preamplifier OFF | 50 MHz to 3 GHz: ≤–140 dBm (1 Hz) |
| Preamplifier ON | 500 MHz: typ. –162 dBm (1 Hz)<br>3 GHz: typ. –158 dBm (1 Hz) |
| TOI | typ. +18 dBm |
| **TV analysis** | |
| Preselector | R&S®ETL-B203, internal, optional |
| RF input | N connector, 50 Ω, additional F connector, 75 Ω with R&S®ETL-B203 |
| ATV standards | B/G, I, D/K, K1, M, N |
| Prerequisite for DVB-T/H | R&S®ETL-K240 |
| Prerequisite for ATSC/8VSB | R&S®ETL-K220 |
| Prerequisite for DVB-C (J.83/A/C) | R&S®ETL-K210 with R&S®ETL-B210 or R&S®ETL-B216 |
| Prerequisite for DTMB | R&S®ETL-B215 or R&S®ETL-B216 |
| Prerequisite for T-DMB/DAB | R&S®ETL-K250 |
| **Spectrum analysis** | |
| **Resolution bandwidths** | |
| Standard | 300 Hz to 10 MHz in 1/3 sequence, additionally 20 MHz with zero span |
| With R&S®FSL-B7 | 10 Hz to 10 MHz in 1/3 sequence, additionally 1 Hz (with FFT filter) |
| Video bandwidths | 10 Hz to 10 MHz |
| I/Q demodulation bandwidth | 20 MHz |
| Detectors | pos/neg peak, auto peak, RMS, quasi-peak, average, sample |
| Level measurement uncertainty | <0.5 dB |
| Tracking generator | included in base unit |
| Frequency range | 1 MHz to 3 GHz |
| Output level | –20 dBm to 0 dBm |
| **MPEG analysis and monitoring** | |
| Prerequisite for MPEG analysis | R&S®ETL-B280 with R&S®ETL-K282 |
| Broadcasting standards | DVB, ATSC, SCTE |
| TS input | 1 (+1 internal) |
| Mode | ASI, SMPTE310M |
| Max. data rate across all inputs | 128 Mbit/s |
| **Video and audio decoding** | |
| Presentation of TV picture on R&S®ETL screen | |
| Prerequisite for analog TV | R&S®ETL-B280 |
| Prerequisite for DTV (SD) | R&S®ETL-B280 with R&S®ETL-B281 |
| Video formats | MPEG-2 (MP@ML), H.264/AVC (MP) |
| Audio formats | MPEG-1/MPEG-2 layer I |
| HDTV and Dolby | R&S®ETL-K281 |
| Video formats | MPEG-2 (MP@HL), H.264/AVC (MP) |
| Audio formats | Dolby Digital AC-3 |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| TV Analyzer, 500 kHz to 3 GHz, with tracking generator | R&S®ETL | 2112.0004.13 |
| **Accessories supplied** | | |
| Power cable, quick start guide and CD-ROM (with operating manual) | | |
| **Hardware options** | | |
| Additional Interface DTV [1) 3)] | R&S®ETL-B201 | 2112.0304.02 |
| RF Preselector [2)] | R&S®ETL-B203 | 2112.0327.02 |
| Hard Disk 80 Gbyte | R&S®ETL-B209 | 2112.0291.02 |
| Digital Demodulator for Single Carrier [2)] | R&S®ETL-B210 | 2112.0104.02 |
| Digital Demodulator for DTMB [2)] | R&S®ETL-B215 | 2112.0156.02 |
| Digital Demodulator for Single Carrier and DTMB [2)] | R&S®ETL-B216 | 2112.0162.02 |
| DC Power Supply 11 V to 19 V [1)] | R&S®ETL-B230 | 2112.0256.02 |
| Li-Ion Battery Pack 10 A with Battery Charger | R&S®ETL-B235 | 2112.0262.02 |
| MPEG Processing Board [2) 4)] | R&S®ETL-B280 | 2112.0362.02 |
| Video and Audio Hardware Decoder [2) 5)] | R&S®ETL-B281 | 2112.0356.02 |
| OCXO Reference Frequency [1)] | R&S®FSL-B4 | 1300.6008.02 |
| Additional Interfaces [1) 6)] | R&S®FSL-B5 | 1300.6108.02 |
| Narrow Resolution Filters [2)] | R&S®FSL-B7 | 1300.5601.02 |
| GPIB Interface [1)] | R&S®FSL-B10 | 1300.6208.02 |
| **Firmware/software options** | | |
| Analog TV Video Analysis | R&S®ETL-K202 | 2112.0433.02 |
| Analog TV Video Generator Multistandard | R&S®ETL-K203 | 2112.0440.02 |
| Measurement Log [7)] | R&S®ETL-K208 | 2112.0579.02 |
| DVB-C Firmware [8)] | R&S®ETL-K210 | 2112.0404.02 |
| ATSC/8VSB Firmware | R&S®ETL-K220 | 2112.0456.02 |
| ATSC/8VSB Frequency Offset [9)] | R&S®ETL-K221 | 2112.0462.02 |
| DVB-T/H Firmware | R&S®ETL-K240 | 2112.0556.02 |
| DVB-T/H SFN Frequency Offset [10)] | R&S®ETL-K241 | 2112.0562.02 |
| T-DMB/DAB Firmware | R&S®ETL-K250 | 2112.0533.02 |
| T-DMB/DAB Frequency Offset [11)] | R&S®ETL-K251 | 2112.0540.02 |
| HDTV and Dolby Upgrade [12)] | R&S®ETL-K281 | 2112.0604.02 |
| MPEG Analysis/Monitoring [5)] | R&S®ETL-K282 | 2112.0610.02 |
| In-Depth Analysis [13)] | R&S®ETL-K283 | 2112.0627.02 |
| Data Broadcast Analysis [13)] | R&S®ETL-K284 | 2112.0633.02 |
| TS Template Monitoring [13)] | R&S®ETL-K285 | 2112.0640.02 |
| AM/FM/φM Measurement Demodulator | R&S®FSL-K7 | 1301.9246.02 |
| Power Sensor Support [14)] | R&S®FSL-K9 | 1301.9530.02 |
| **Recommended extras** | | |
| Documentation of R&S®ETL Calibration Values | R&S®ETL-DCV | 2082.0490.31 |
| 19" Rackmount Adapter | R&S®ZZA-S334 | 1109.4487.00 |
| Lemo Triax connector (mono) with connecting cable (open) | | 2067.7451.00 |
| Soft Carrying Bag | R&S®FSL-Z3 | 1300.5401.00 |
| Protective Hard Cover | R&S®EVS-Z6 | 5201.7760.00 |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| Matching Pads 75 Ω | | |
| L section | R&S®RAM | 0358.5414.02 |
| Series resistor 25 Ω | R&S®RAZ | 0358.5714.02 |
| L section, N to BNC | R&S®FSH-Z38 | 1300.7740.02 |
| SWR Bridge 5 MHz to 3 GHz | R&S®ZRB2 | 0373.9017.52 |
| SWR Bridge 40 kHz to 4 GHz, 50 Ω | R&S®ZRC | 1039.9492.52 |
| SWR Bridge 40 kHz to 2.5 GHz, 75 Ω | R&S®ZRC | 1039.9492.72 |
| Mouse with USB Interface, optical | R&S®PSL-Z10 | 1157.7060.03 |
| Keyboard with USB Interface (US assignment) | R&S®PSL-Z2 | 1157.6870.04 |
| Spare F Adapter, female/female | R&S®FSHTV-Z61 | 2111.7111.02 |
| **Power sensors supported by R&S®FSL-K9** | | |
| **USB Adapter** (required for using power sensors with the R&S®ETL, if the R&S®FSL-B5 is not installed) | | |
| Active | R&S®NRP-Z3 | 1146.7005.02 |
| Passive | R&S®NRP-Z4 | 1146.8001.02 |
| **Average Power Sensors** | | |
| 10 MHz to 8 GHz, 200 mW | R&S®NRP-Z11 | 1138.3004.02 |
| 10 MHz to 18 GHz, 200 mW | R&S®NRP-Z21 | 1137.6000.02 |
| 10 MHz to 18 GHz, 2 W | R&S®NRP-Z22 | 1137.7506.02 |
| 10 MHz to 18 GHz, 15 W | R&S®NRP-Z23 | 1137.8002.02 |
| 10 MHz to 18 GHz, 30 W | R&S®NRP-Z24 | 1137.8502.02 |
| 9 kHz to 6 GHz, 200 mW | R&S®NRP-Z91 | 1168.8004.02 |
| **Thermal Power Sensors** | | |
| 0 Hz to 18 GHz, 100 mW | R&S®NRP-Z51 | 1138.0005.02 |
| 0 Hz to 40 GHz, 100 mW | R&S®NRP-Z55 | 1138.2008.02 |
| **Wideband Power Sensor** | | |
| 50 MHz to 18 GHz, 100 mW | R&S®NRP-Z81 | 1137.9009.02 |
| **Service options** | | |
| One-Year Repair Service following the warranty period | R&S®RO2ETL | please contact your local sales office |
| Two-Year Repair Service following the warranty period | R&S®RO3ETL | |
| Four-Year Repair Service following the warranty period | R&S®RO5ETL | |
| Two-Year Calibration Service | R&S®CO2ETL | |
| Three-Year Calibration Service | R&S®CO3ETL | |
| Five-Year Calibration Service | R&S®CO5ETL | |

1) Retrofittable by customer.
2) Retrofittable by service.
3) SER-DAT out, SER-CLK out, I in, Q in, IF out (4.571428 MHz) (same slot as R&S®FSL-B5).
4) Only for R&S®ETL with serial no. >100500.
5) Requires R&S®ETL-B280.
6) Video out, IF out, noise source control, AUX port, R&S®NRP-Zxx power sensor (same slot as R&S®ETL-B201).
7) Requires at least one digital TV option.
8) Requires R&S®ETL-B210 or R&S®ETL-B216.
9) Requires R&S®ETL-K220
10) Requires R&S®ETL-K240.
11) Requires R&S®ETL-K250.
12) Requires R&S®ETL-B281.
13) Requires R&S®ETL-K282.
14) Requires R&S®FSL-B5 or R&S®NRP-Z3/4.

# R&S®EFA TV Test Receiver Family

Comprehensive analysis/demodulation/monitoring of digital and analog TV signals

- Standard test receiver
- High-end test receiver
- High-end demodulator
- Areas of application: production, single frequency network installation and adjustment, monitoring, coverage, research and development, service
- Comprehensive measurement and monitoring functions
- Simple, user-friendly operation
- Modular design – easy retrofitting of options
- IEC/IEEE bus and RS-232-C interface

The R&S®EFA TV test receiver and demodulator family offers outstanding performance features and excellent transmission characteristics. The instruments provide high-precision reception and demodulation of digitally modulated TV signals as well as of vestigial sideband AM signals (analog TV signals). They measure a comprehensive range of transmission parameters and are therefore ideal for measurement and monitoring applications in cable networks, TV transmitter stations and development labs.

## Digital TV

The R&S®EFA's powerful digital signal processing provides fast and thorough analysis of the received digitally modulated TV signal. The MPEG-2 transport stream is permanently available for decoding as well as for video and audio reproduction. Due to its realtime analysis capability, the high number of measured values necessary for the complex calculation and display processes are made available for subsequent mathematical/statistical processing in an extremely short and as yet unequalled time. Because of its high-speed data acquisition, the R&S®EFA is the ideal choice not only for R&D but also for production environments where short measurement cycles are essential.

## Analog TV

The analog R&S®EFA models provide high-precision demodulated baseband signals (vision and sound) for measurements in various applications (TV transmitters, cable headends, coverage measurements, R&D). At the same time, all relevant RF parameters are monitored at high speed and represented in a logical manner. User-configurable alarm messages permit unattended monitoring of the received signals as well as switchover to alternative links in the event of a failure.

The high-end demodulator version is used for on-site measurements on TV transmitters. This version offers particularly low-distortion demodulation of the broadcast signal. It is perfectly suited for these types of measurements; its low measurement uncertainty permits optimal alignment as well as permanent quality control of transmitters.

## Standard test receiver

- Selective receiver
- Typical use in the field where adjacent channels need to be filtered
- High-end synthesizer with low phase noise
- Excellent price/performance ratio

## High-end test receiver

- Outstanding SNR and improved intermodulation characteristics
- Rejection of image frequency and IF
- Two additional selective RF inputs (50 Ω and 75 Ω)
- Extended frequency range from 4.5 MHz to 1000 MHz (R&S®EFA-B3 option)

## High-end demodulator

- Wideband input (non-selective receiver), tunable
- Typically used for transmitter testing
- Outstanding SNR, excellent intermodulation characteristics
- High-end synthesizer with extremely low phase noise

## The complete R&S®EFA family at a glance

| | | |
|---|---|---|
| **Standard test receiver**<br>I Model .40: digital TV, DVB-T | **Standard test receivers**<br>I Model .60: digital TV, DVB-C<br>I Model .12: analog TV, standard B/G<br>I Model .78: analog TV, standard D/K or I | **Standard test receivers**<br>I Model .50: digital TV, ATSC/8VSB<br>I Model .70: digital TV, ITU-T J.83/B<br>I Model .90: analog TV, standard M/N |
| **High-end test receiver**<br>I Model .43 incl. R&S®EFA-B3 option: digital TV, DVB-T | **High-end test receivers**<br>I Model .63 incl. R&S®EFA-B3 option: digital TV, DVB-C<br>I Model .33 incl. R&S®EFA-B3 option: analog TV, standard B/G<br>I Model .89 incl. R&S®EFA-B3 option: analog TV, standard D/K or I | **High-end test receivers**<br>I Model .53 incl. R&S®EFA-B3 option: digital TV, ATSC/8VSB<br>I Model .73 incl. R&S®EFA-B3 option: digital TV, ITU-T J.83/B<br>I Model .93 incl. R&S®EFA-B3 option: analog TV, standard M/N |
| **High-end demodulator**<br>I Model .43: digital TV, DVB-T | **High-end demodulators**<br>I Model .63: digital TV, DVB-C<br>I Model .33: analog TV, standard B/G<br>I Model .89: analog TV, standard D/K or I | **High-end demodulators**<br>I Model .53: digital TV, ATSC/8VSB<br>I Model .73: digital TV, ITU-T J.83/B<br>I Model .93: analog TV, standard M/N |

## R&S®EFA models (ATSC/8VSB – ITU-T J.83/B – M/N analog TV) and options

| | | Standard test receivers | | | | High-end demodulators | | | | High-end test receivers | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Models** | **.50** | **.60** | **.70** | **.90** | **.53** | **.63** | **.73** | **.93** | **.53** | **.63** | **.73** | **.93** | Slots needed |
| **Option** | **Designation** | 8VSB | DVB-C | J.83/B | M/N | 8VSB | DVB-C | J.83/B | M/N | 8VSB | DVB-C | J.83/B | M/N | |
| R&S®EFA-B3 | RF Preselection | – | – | – | – | ○ | ○ | ○ | ○ | ◇ | ◇ | ◇ | ◇ | 1 |
| R&S®EFA-B4 | MPEG-2 Decoder | – | ○ | ○ | ○ [1] | – | ○ | ○ | ○ [1] | – | ○ | ○ | ○ [1] | 1 |
| R&S®EFA-B6 | Video Distributor | – | – | – | – | ○ [2] | ○ [2] | ○ [2] | ○ | ○ [2] | ○ [2] | ○ [2] | ○ | 0 |
| R&S®EFA-B11 | 6 MHz SAW Filter | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | 0 |
| R&S®EFA-B13 | 8 MHz SAW Filter | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | 0 |
| R&S®EFA-B14 | 2 MHz SAW Filter | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | 0 |
| R&S®EFA-B20 | Digital Demodulator Platform | ✓ | ✓ | ✓ | ○ [3] | ✓ | ✓ | ✓ | ○ [3] | ✓ | ✓ | ✓ | ○ [3] | 1 |
| R&S®EFA-B30 | M/N NTSC/BTSC Demodulator | ○ | ○ | ○ | ✓ | ○ | ○ | ○ | ✓ | ○ | ○ | ○ | ✓ | 1 |
| **Firmware** | | | | | | | | | | | | | | |
| R&S®EFA-K21 | DVB-C/J.83/A/C (QAM) | ○ | ✓ | ○ | ○ | ○ | ✓ | ○ | ○ | ○ | ✓ | ○ | ○ | |
| R&S®EFA-K22 | ATSC/8VSB Firmware | ✓ | ○ | ○ | ○ | ✓ | ○ | ○ | ○ | ✓ | ○ | ○ | ○ | |
| R&S®EFA-K23 | J.83/B Firmware | ○ | ○ | ✓ | ○ | ○ | ○ | ✓ | ○ | ○ | ○ | ✓ | ○ | |
| R&S®EFA-K25 | FIR Coefficient Readout | ○ [4] | ○ [4] | ○ [4] | ○ [4] | ○ [4] | ○ [4] | ○ [4] | ○ [4] | ○ [4] | ○ [4] | ○ [4] | ○ [4] | |

**Each base unit has three free slots to take up options.**
✓ included in base unit ◇ must be ordered with base unit ○ available – not applicable

[1] Can be retrofitted if R&S®EFA-B20 is built in.
[2] Requires R&S®EFA-B4 or R&S®EFA-B30
[3] Must be ordered with min. one firmware option (R&S®EFA-K21 or -K22 or -K23).
[4] Requires R&S®EFA models .50/53 or R&S®EFA-B20 + R&S®EFA-K22.

## R&S®EFA models (DVB-T) and options

| | | Standard test receivers | | | High-end demodulators | | | High-end test receivers | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Models** | **.40** | **.12** | **.78** | **.43** | **.33** | **.89** | **.43** | **.33** | **.89** | Slots needed |
| **Option** | **Designation** | DVB-T | B/G | D/K or I | DVB-T | B/G | D/K or I | DVB-T | B/G | D/K or I | |
| R&S®EFA-B2 | NICAM Demodulator (standard B/G or D/K) | – | ○ | ○ | – | ○ | ○ | – | ○ | ○ | 1 |
| R&S®EFA-B2 | NICAM Demodulator (standard I) | – | – | ○ | – | – | ○[2] | – | – | ○ | 1 |
| R&S®EFA-B3 | RF Selection | – | – | – | ○ | ○ | ○ | ◇ | ◇ | ◇ | 1 |
| R&S®EFA-B4 | MPEG-2 Decoder | ○ | ○[1] | ○[1] | ○ | ○[1][2] | ○[1][2] | ○ | – | – | 1 |
| R&S®EFA-B6 | Video Distributor | – | – | – | ○[3] | ○ | ○ | ○[3] | ○ | ○ | 0 |
| R&S®EFA-B7 | Switchable Sound Trap (standard B/G) | – | ○ | – | – | ○ | – | – | ○ | – | 1 |
| R&S®EFA-B10 | OFDM Demodulator | ✓ | ○[7] | ○[7] | ✓ | ○[7] | ○[7] | ✓ | ○[7] | ○[7] | 1 |
| R&S®EFA-B11 | 6 MHz SAW Filter | ○[1][4][5] | ○[1][4][5] | ○[1][4][5] | ○[1][4][5] | ○[1][4][5] | ○[1][4][5] | ○[1][4][5] | ○[1][4][5] | ○[1][4][5] | 0 |
| R&S®EFA-B12 | 7 MHz SAW Filter | ○[1][4][5] | ○[1][4][5] | ○[1][4][5] | ○[1][4][5] | ○[1][4][5] | ○[1][4][5] | ○[1][4][5] | ○[1][4][5] | ○[1][4][5] | 0 |
| R&S®EFA-B13 | 8 MHz SAW Filter | ○[4] | ○[4][6] | ○[4][6] | ○[4] | ○[4][6] | ○[4][6] | ○[4] | ○[4][6] | ○[4][6] | 0[4][6] |
| R&S®EFA-K10 | SFN Frequency Offset Measurement Firmware | ○ | ○[6] | ○[6] | ○ | ○[6] | ○[6] | ○ | ○[6] | ○[6] | 0 |

**Each base unit has three free slots to take up options.**
✓ included in base unit ◇ must be ordered with base unit ○ available – not applicable

[1] Can be retrofitted if R&S®EFA-B10 or R&S®EFA-B20 is built in.
[2] Cannot be retrofitted if R&S®EFA-B3 is built in.
[3] Requires R&S®EFA-B4.
[4] Max. 3 SAW filters.
[5] R&S®EFA models .60/63 or R&S®EFA-B20: R&S®EFA-B11 and R&S®EFA-B12 cannot be retrofitted in parallel.
[6] Can be retrofitted if R&S®EFA-B10 is built in.
[7] Only R&S®EFA-B10 or -B20 possible (same slot needed).

## R&S®EFA models (DVB-C – B/G analog TV – D/K or I analog TV) and options

| | | Standard test receivers | | | High-end demodulators | | | High-end test receivers | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Models** | **.12** | **.60** | **.78** | **.33** | **.63** | **.89** | **.33** | **.63** | **.89** | Slots needed |
| **Option** | **Designation** | B/G | DVB-C | D/K or I | B/G | DVB-C | D/K or I | B/G | DVB-C | D/K or I | |
| R&S®EFA-B2 | NICAM Demodulator (standard B/G or D/K) | ○ | – | ○ | ○ | – | ○ | ○ | – | ○ | 1 |
| R&S®EFA-B2 | NICAM Demodulator (std. I) | – | – | ○ | – | – | ○ | – | – | ○ | 1 |
| R&S®EFA-B3 | RF Selection | – | – | – | ○ | ○ | ○ | ◇ | ◇ | ◇ | 1 |
| R&S®EFA-B4 | MPEG-2 Decoder | ○ [1] | ○ | ○ [1] | ○ [1] [2] | ○ | ○ [1] [2] | – | ○ | – | 1 |
| R&S®EFA-B6 | Video Distributor | – | – | – | ○ | ○ [3] | ○ | ○ | ○ [3] | ○ | 0 |
| R&S®EFA-B7 | Switchable Sound Trap (standard B/G) | ○ | – | – | ○ | – | – | ○ | – | – | 1 |
| R&S®EFA-B11 | 6 MHz SAW Filter | ○ [1] [4] [5] | ○ [1] [4] [5] | ○ [1] [4] [5] | ○ [1] [4] [5] | ○ [1] [4] [5] | ○ [1] [4] [5] | ○ [1] [4] [5] | ○ [1] [4] [5] | ○ [1] [4] [5] | 0 |
| R&S®EFA-B12 | 7 MHz SAW Filter | ○ [1] [4] [5] | ○ [1] [4] [5] | ○ [1] [4] [5] | ○ [1] [4] [5] | ○ [1] [4] [5] | ○ [1] [4] [5] | ○ [1] [4] [5] | ○ [1] [4] [5] | ○ [1] [4] [5] | 0 |
| R&S®EFA-B13 | 8 MHz SAW Filter | ○ [4] [8] | – | ○ [4] [8] | ○ [4] [8] | – | ○ [4] [8] | ○ [4] [8] | – | ○ [4] [8] | 0 |
| R&S®EFA-B13 | 8 MHz SAW Filter | ○ [4] [9] | ○ [4] | ○ [4] [9] | ○ [4] [9] | ○ [4] [9] | ○ [4] [9] | ○ [4] [9] | ○ [4] [5] | ○ [4] [5] [9] | 0 |
| R&S®EFA-B14 | 2 MHz SAW Filter | ○ [4] [9] | ○ [4] | ○ [4] [9] | ○ [4] [9] | ○ [4] [9] | ○ [4] [9] | ○ [4] [9] | ○ [4] | ○ [4] [9] | 0 |
| R&S®EFA-B10 | OFDM Demodulator | ○ [6] | – | ○ [6] | ○ [6] | – | ○ [6] | ○ [6] | – | ○ [6] | 1 |
| R&S®EFA-B20 | Digital Demodulator Platform | ○ [6] [7] | ✓ | ○ [6] [7] | ○ [6] [7] | ✓ | ○ [6] [7] | ○ [6] [7] | ✓ | ○ [6] [7] | 1 |
| **Firmware** | | | | | | | | | | | |
| R&S®EFA-K10 | SFN Frequency Offset Measurement | ○ [8] | – | ○ [8] | ○ [8] | – | ○ [8] | ○ [8] | – | ○ [8] | 0 |
| R&S®EFA-K21 | DVB-C / J.83/A/C (QAM) | ○ [9] | ✓ | ○ [9] | ○ [9] | ✓ | ○ [9] | ○ [9] | ✓ | ○ [9] | 0 |
| R&S®EFA-K22 | ATSC/8VSB Firmware | ○ [9] | ○ [9] | ○ [9] | ○ [9] | ○ [9] | ○ [9] | ○ [9] | ○ [9] | ○ [9] | 0 |
| R&S®EFA-K23 | J.83/B Firmware | ○ [9] | ○ [9] | ○ [9] | ○ [9] | ○ [9] | ○ [9] | ○ [9] | ○ [9] | ○ [9] | 0 |
| R&S®EFA-K25 | FIR Coefficient Readout | ○ [10] | ○ [10] | ○ [10] | ○ [10] | ○ [10] | ○ [10] | ○ [10] | ○ [10] | ○ [10] | 0 |

**Each base unit has three free slots to take up options.**
✓ included in base unit ◇ must be ordered with base unit ○ available – not applicable

[1] Can be retrofitted if R&S®EFA-B10 or R&S®EFA-B20 is built in.
[2] Cannot be retrofitted if R&S®EFA-B3 is built in.
[3] Requires R&S®EFA-B4.
[4] Max. 3 SAW filters.
[5] R&S®EFA models .60/63 or R&S®EFA-B20: R&S®EFA-B11 and R&S®EFA-B12 cannot be retrofitted in parallel.
[6] Only R&S®EFA-B10 or -B20 possible (same slot needed).
[7] Must be ordered with min. one firmware option (R&S®EFA-K21 or -K22 or -K23).
[8] Can be retrofitted if R&S®EFA-B10 is built in.
[9] Can be retrofitted if R&S®EFA-B20 is built in.
[10] Can be retrofitted if R&S®EFA-B20 and R&S®EFA-K22 are built in.

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| **DTV** | | |
| DVB-T Test Receiver, selective, constellation diagram, MPEG-2 data stream output | R&S®EFA40 | 2067.3004.40 |
| DVB-T Test Demodulator, broadband, constellation diagram, MPEG-2 data stream output | R&S®EFA43 | 2067.3004.43 |
| ATSC/8VSB Test Receiver, selective, constellation diagram, MPEG-2 data stream output | R&S®EFA50 | 2067.3004.50 |
| ATSC/8VSB Test Demodulator, broadband, constellation diagram, MPEG-2 data stream output | R&S®EFA53 | 2067.3004.53 |
| DVB-C Test Receiver, selective, 4/16/32/64/128/256QAM, MPEG-2 data stream output, constellation diagram | R&S®EFA60 | 2067.3004.60 |
| DVB-C Test Demodulator, broadband, 4/16/32/64/128/256QAM, MPEG-2 data stream output, constellation diagram | R&S®EFA63 | 2067.3004.63 |
| ITU-T J.83/B Test Receiver, selective, 4/16/32/64/128/256QAM, MPEG-2 data stream output, constellation diagram | R&S®EFA70 | 2067.3004.70 |
| ITU-T J.83/B Test Demodulator, broadband, 4/16/32/64/128/256QAM, MPEG-2 data stream output, constellation diagram | R&S®EFA73 | 2067.3004.73 |
| **ATV** | | |
| TV Test Receiver, standard B/G, dual sound, IF 38.9 MHz, RF 45 MHz to 860 MHz, selective | R&S®EFA12 | 2067.3004.12 |
| TV Test Demodulator, standard B/G, dual sound, IF 38.9 MHz, RF 45 MHz to 1 GHz, broadband | R&S®EFA33 | 2067.3004.33 |
| TV Test Receiver, standard D/K, or I (mono), IF 38.9 MHz, RF 45 MHz to 860 MHz, selective | R&S®EFA78 | 2067.3004.78 |
| TV Test Demodulator, standard D/K or I (mono), IF 38.9 MHz, RF 45 MHz to 1 GHz, broadband | R&S®EFA89 | 2067.3004.89 |
| TV Test Receiver, standard M/N, mono, selective, RF 45 MHz to 860 MHz, IEEE bus | R&S®EFA90 | 2067.3004.90 |
| TV Test Demodulator, standard M/N (mono), broadband, RF 45 MHz to 1 GHz, IEEE bus | R&S®EFA93 | 2067.3004.93 |
| **Accessories supplied** | | |
| Lemo Triax adapter to XLR stereo (only when audio signals are available), power cable, operating manual | | |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| **Hardware options** | | |
| NICAM Demodulator std. B/G, D/K | R&S®EFA-B2 | 2067.3610.02 |
| NICAM Demodulator standard I | R&S®EFA-B2 | 2067.3610.04 |
| RF Selection for demodulator | R&S®EFA-B3 | 2067.3627.02 |
| MPEG-2 Decoder | R&S®EFA-B4 | 2067.3633.02 |
| Video Distributor | R&S®EFA-B6 | 2067.3656.02 |
| Switchable Sound Trap (only R&S®EFA12/33) | R&S®EFA-B7 | 2067.3710.02 |
| OFDM Demodulator (for analog TV units) | R&S®EFA-B10 | 2067.3740.02 |
| Digital Demodulator Platform (for analog TV units) | R&S®EFA-B20 | 2067.3585.02 |
| Standard M/N Demodulator (for digital units) | R&S®EFA-B30 | 2067.3556.02 |
| 6 MHz SAW Filter (for digital units) | R&S®EFA-B11 | 2067.3691.00 |
| 7 MHz SAW Filter (for digital units) | R&S®EFA-B12 | 2067.3591.00 |
| 8 MHz SAW Filter (for DVB-T digital units) | R&S®EFA-B13 | 2067.3579.02 |
| 8 MHz SAW Filter (for DVB-C/ATSC/J.83/B units) | R&S®EFA-B13 | 2067.3579.03 |
| 2 MHz SAW Filter (for digital units) | R&S®EFA-B14 | 2067.3562.00 |
| **Firmware options** | | |
| SFN Frequency Offset Measurement | R&S®EFA-K10 | 2067.9454.02 |
| DVB-C Firmware (for R&S®EFA5x/7x or R&S®EFA-B20) | R&S®EFA-K21 | 2067.4000.02 |
| ATSC/8VSB Firmware (for R&S®EFA6x/7x or R&S®EFA-B20) | R&S®EFA-K22 | 2067.4017.02 |
| J.83/B Firmware (for R&S®EFA5x/6x or R&S®EFA-B20) | R&S®EFA-K23 | 2067.4023.02 |
| FIR Coefficient Readout Firmware (for R&S®EFA5x or R&S®EFA-B20 and R&S®EFA-K22) | R&S®EFA-K25 | 2067.4046.02 |
| **Recommended extras** | | |
| Measurement Server System | R&S®EFA-NET | on request |
| R&S®EFA-SCAN Measurement Software | R&S®EFA-K1 | 2067.9202.02 |
| Documentation of R&S®EFA Calibration Values | R&S®EFA-DCV | 2082.0490.09 |
| 19" Adapter | R&S®ZZA-93 | 0396.4892.00 |
| Lemo Triax connector (mono) with connecting cable (open) | | 2067.7451.00 |
| Service Manual | R&S®ERST.2 | 2068.0950.24 |
| Carrying Bag for 19" units, 3 HU, depth 460 mm | R&S®ZZT-314 | 1001.0523.00 |

Note: Please fill in configuration sheet (available from your local sales office) so that your test receiver/demodulator can be tailored to your requirements.

# R&S®EFA-K1 Measurement Software EFA-SCAN

Fast recording and documentation of measurement values for the R&S®EFA digital test receivers

- Repeated measurements in any number of loops
- Use for R&S®EFA .2x/4x/5x/6x/7x models
- PC connection via RS-232-C, IEC/IEEE bus, TCP/IP
- Runs on any PC under Windows

Recording entire measurement sequences (e.g. at a cable headend) can be very time-consuming, which means that users immediately start looking for a solution that will save them time and effort. Such a solution has now been developed specifically for the digital models .2x, .4x, .5x, .6x and .7x of the R&S®EFA test receiver family – it is called R&S®EFA-K1.

The software runs on any PC under Windows. The connection between the PC and the R&S®EFA test receiver can be set up via the RS-232-C interface or the IEC/IEEE bus. Another option is the use of a terminal server to establish the connection via LAN/WAN.

## Easy operation

- A sequence of registers in the entry dialog specifies the steps that need to be carried out one after the other
- Clearly arranged dialog window helps users defining the measurement task at hand
- User defined measurement parameter handling:
  - Only to be displayed
  - Only stored to a file
  - Displayed and stored

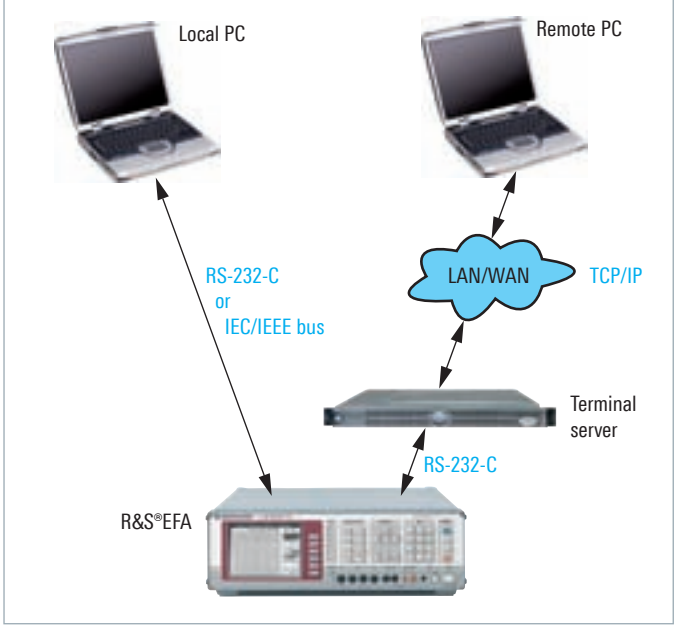
## Two measurement modes

- Measurements are started at a keystroke
- Snapshot mode
  - Snapshot mode processes previously defined frequency list just once
- Run mode
  - Run mode is cyclically performed until the measurements are explicitly stopped
  - Measurement values thus obtained are displayed in tables for each frequency

## Convenient data storage

- Easy storage of measurement values in CSV format
- Comma-separated values
- Commonly used file CSV format enables data to be ported to Excel or a database, for example

**Connecting options between PC and R&S®EFA**




**Ordering information**

| Designation | Type | Order No. |
|---|---|---|
| Measurement Software EFA-SCAN | R&S®EFA-K1 | 2067.9202.02 |

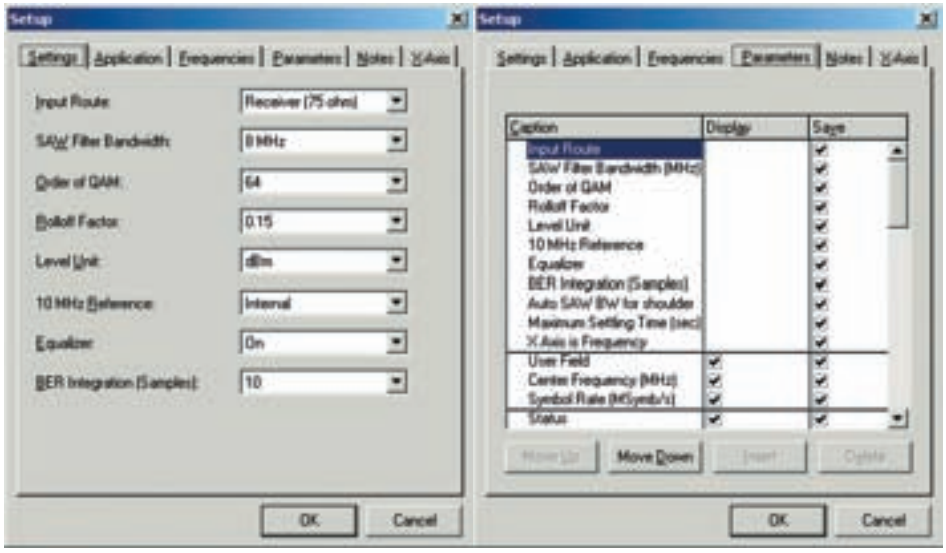
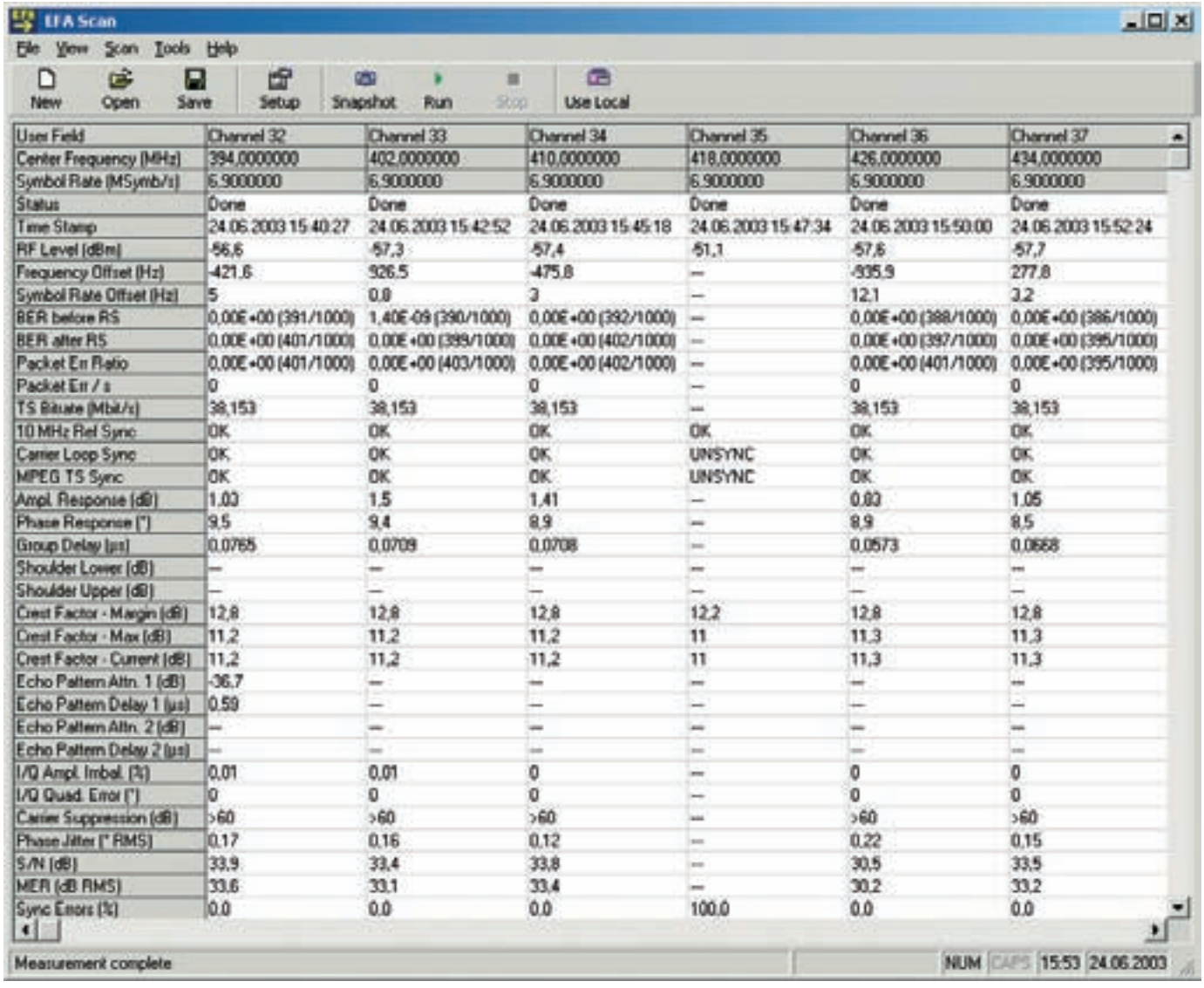



Fig left: R&S EFA 6x default setting.
Fig right: Parameter list for R&S EFA 6x.

Table for displaying the measurement values (in this case, R&S®EFA6x).




| User Field | Channel 32 | Channel 33 | Channel 34 | Channel 35 | Channel 36 | Channel 37 |
|---|---|---|---|---|---|---|
| Center Frequency (MHz) | 394.0000000 | 402.0000000 | 410.0000000 | 418.0000000 | 426.0000000 | 434.0000000 |
| Symbol Rate (MSymb/s) | 6.9000000 | 6.9000000 | 6.9000000 | 6.9000000 | 6.9000000 | 6.9000000 |
| Status | Done | Done | Done | Done | Done | Done |
| Time Stamp | 24.06.2003 15:40:27 | 24.06.2003 15:42:52 | 24.06.2003 15:45:18 | 24.06.2003 15:47:34 | 24.06.2003 15:50:00 | 24.06.2003 15:52:24 |
| RF Level (dBm) | -56,6 | -57,3 | -57,4 | -51,1 | -57,6 | -57,7 |
| Frequency Offset (Hz) | -421.6 | 926.5 | -475.8 | – | -935.9 | 277.8 |
| Symbol Rate Offset (Hz) | 5 | 0.0 | 3 | – | 12.1 | 3.2 |
| BER before RS | 0.00E+00 (391/1000) | 1.40E-09 (390/1000) | 0.00E+00 (392/1000) | – | 0.00E+00 (388/1000) | 0.00E+00 (386/1000) |
| BER after RS | 0.00E+00 (401/1000) | 0.00E+00 (399/1000) | 0.00E+00 (402/1000) | – | 0.00E+00 (397/1000) | 0.00E+00 (395/1000) |
| Packet Err Ratio | 0.00E+00 (401/1000) | 0.00E+00 (403/1000) | 0.00E+00 (402/1000) | – | 0.00E+00 (401/1000) | 0.00E+00 (395/1000) |
| Packet Err / s | 0 | 0 | 0 | – | 0 | 0 |
| TS Bitrate (Mbit/s) | 38,153 | 38,153 | 38,153 | – | 38,153 | 38,153 |
| 10 MHz Ref Sync | OK | OK | OK | OK | OK | OK |
| Carrier Loop Sync | OK | OK | OK | UNSYNC | OK | OK |
| MPEG TS Sync | OK | OK | OK | UNSYNC | OK | OK |
| Ampl. Response (dB) | 1.03 | 1.5 | 1.41 | – | 0.83 | 1.05 |
| Phase Response (°) | 9.5 | 9.4 | 8.9 | – | 8.9 | 8.5 |
| Group Delay (µs) | 0.0765 | 0.0709 | 0.0708 | – | 0.0573 | 0.0668 |
| Shoulder Lower (dB) | – | – | – | – | – | – |
| Shoulder Upper (dB) | – | – | – | – | – | – |
| Crest Factor - Margin (dB) | 12,8 | 12,8 | 12,8 | 12,2 | 12,8 | 12,8 |
| Crest Factor - Max (dB) | 11,2 | 11,2 | 11,2 | 11 | 11,3 | 11,3 |
| Crest Factor - Current (dB) | 11,2 | 11,2 | 11,2 | 11 | 11,3 | 11,3 |
| Echo Pattern Attn. 1 (dB) | -36.7 | – | – | – | – | – |
| Echo Pattern Delay 1 (µs) | 0.59 | – | – | – | – | – |
| Echo Pattern Attn. 2 (dB) | – | – | – | – | – | – |
| Echo Pattern Delay 2 (µs) | – | – | – | – | – | – |
| I/Q Ampl. Imbal. (%) | 0.01 | 0.01 | 0 | – | 0 | 0 |
| I/Q Quad. Error (°) | 0 | 0 | 0 | – | 0 | 0 |
| Carrier Suppression (dB) | >60 | >60 | >60 | – | >60 | >60 |
| Phase Jitter (° RMS) | 0.17 | 0.16 | 0.12 | – | 0.22 | 0.15 |
| S/N (dB) | 33.9 | 33.4 | 33.8 | – | 30.5 | 33.5 |
| MER (dB RMS) | 33.6 | 33.1 | 33.4 | – | 30.2 | 33.2 |
| Sync Errors (%) | 0.0 | 0.0 | 0.0 | 100.0 | 0.0 | 0.0 |

# R&S®ETX-T DTV Monitoring Receiver

Realtime monitoring, demodulation and analysis of DVB-T/H signals via LAN

- Cost-effective DVB-T/H monitoring receiver
- Frequency scan mode
- Optional SFN monitoring
- High MER performance
- Realtime remote monitoring
- Easy integration into SNMP management systems
- High reliability
- Optional realtime MPEG-2 analysis
- Remote control via SNMP and HTTP

The R&S®ETX-T is a cost-effective monitoring receiver in compliance with the DVB-T/H standard. It is designed to help broadcasters to maintain the quality level of their networks. The R&S®ETX-T performs realtime monitoring of the most sensitive parameters of digital transmitters such as output level, MER or BER. Optionally, the demodulated MPEG-2 transport stream is analyzed to check the syntax integrity (1st, 2nd and 3rd priority errors as defined in ETSI TR 101 290) as well as to monitor data rates and MIP consistency in single frequency networks (SFN).

For the specific task of monitoring SFN transmitter networks, the R&S®ETX-K10 SFN monitoring option can be added to the R&S®ETX-T. The embedded SNMP agent allows broadcasters to directly integrate the R&S®ETX-T into their network management system. For further analysis, a standard web browser can be used to access the embedded HTTP server.

The scan mode makes it possible to scan a user-defined frequency list. This list defines a separate parameter set for each scanned frequency, e.g. receiver settings and thresholds of measured parameters. The history function graphically displays the selected parameters such as synchronization, level, MER and BER. In conjunction with the scan mode, this functions yields a global site overview at a glance.

### Realtime RF analysis

Simultaneously with demodulation, the R&S®ETX-T can measure the key parameters of the RF modulation: RF level, MER and BER. RF and MPEG-2 synchronization flags are also available. The measurement results are then shared by the SNMP agent and the HTTP server for remote administration and by the USER port for signaling.

## Options

### R&S®ETX-B11/-B12/-B13 SAW filters

A SAW filter is required to suppress adjacent channels. Each SAW filter is optimized for specific applications. Three different SAW filters (6/7/8 MHz) for the DVB-T/H bandwidths are available.

### R&S®ETX-K10 SFN monitoring

The option enables the R&S®ETX-T to precisely monitor for compliance with the SFN conditions. First, all transmitters involved must transmit at exactly the same frequency with the correct level for each frequency. Second, the delay conditions defined for the guard interval that has been selected must be complied with during transmission. If one transmitter violates these conditions, the R&S®ETX-T immediately issues an alarm.

### R&S®ETX-B2 MPEG-2 realtime analysis

This option is fully compliant with ETSI TR 101 290. It analyzes the protocol of the demodulated MPEG-2 transport stream in realtime.

### R&S®ETX-B3 MPEG-2 realtime analysis and decoding

This option provides all the functions of the R&S®ETX-B2 and additionally offers an MPEG-2 decoder (to PAL, SECAM or NTSC analog video) for on-site visualization by means of an external composite video monitor.

## Remote monitoring

### Via SNMP

The embedded SNMP agent allows to send all error messages (traps) referred to the RF channel under survey through the network. Thus, RF and MPEG-2 synchronization, level, MER and BER are continuously monitored in realtime using the fixed thresholds. In addition, all important settings of the R&S®ETX-T can be configured via the SNMP agent using the MIB tree (supplied as standard).

### Via HTTP

For in-depth RF and MPEG-2 analysis, the user can access the embedded HTTP server. The GUI has been optimized to include the latest web browser functions and can be customized to each site.

## Specifications in brief

| | |
|---|---|
| **RF input** | selective |
| Frequency range | 48 MHz to 862 MHz |
| Level range [1] | |
| Preamplifier ON | –75 dBm to +20 dBm |
| Preamplifier OFF | –80 dBm to +13 dBm |
| Noise figure | |
| Preamplifier ON | typ. 12 dB |
| Preamplifier OFF | typ. 7 dB |
| Image frequency rejection | ≥70 dB (VHF) and ≥50 dB (UHF) |
| **Local oscillator** | |
| Frequency error int. reference | $\leq 2 \times 10^{-6}$ |
| SSB phase noise (RF = 860 MHz) | |
| At 1 kHz | typ. –82 dBc (1 Hz) |
| At 10 kHz | typ. –90 dBc (1 Hz) |
| **System performance** | |
| MER [2] | ≥38 dB |
| SNR [2] | ≥39 dB |
| **Interfaces** | |
| MPEG-2 TS parallel output | LVDS (188 bytes) |
| MPEG-2 TS ASI output | serial MPEG-2 transport stream; 75 Ω |
| Ethernet | 10/100 Mbit, RS-232-C |
| **Channel bandwidth**<br>6 MHz, 7 MHz, 8 MHz (all code rates, all hierarchical modes, 4/16/64QAM and 2K/8K FFT in line with EN300 744 supported) | |
| **Measurements**<br>Signal power, carrier frequency offset, symbol rate offset, MPEG-2 TS bit rate, BER (bit error ratio) before and after, Reed-Solomon decoder, BER before Viterbi decoder, MER (modulation error ratio), SNR (signal/noise ratio), phase jitter, shoulder attenuation (referred to ETR 290) | |
| **Graphical displays**<br>Constellation diagram, frequency spectrum, MER(f), impulse response (ghost pattern), history (MER, level, BER, sync, data error) | |
| **Alarm messages**<br>Signal power, MPEG-2 synchronization, MER, BER before Viterbi decoder, BER before Reed-Solomon decoder, MPEG-2 data error | |
| **Alarm storage**<br>Alarm message with date and time, more than 10000 messages | |

[1] For quasi-error-free MPEG-2 transport stream.
[2] Signal power >–40 dBm.

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| DTV Monitoring Receiver, DVB realtime demodulation and analysis (SNMP + HTTP) | R&S®ETX-T | 2068.0109.40 |
| **Options** | | |
| MPEG-2 Realtime Analysis | R&S®ETX-B2 | 2068.0415.02 |
| MPEG-2 Realtime Analysis with Decoder Output | R&S®ETX-B3 | 2068.0450.02 |
| 6 MHz SAW Filter | R&S®ETX-B11 | 2068.0421.02 |
| 7 MHz SAW Filter | R&S®ETX-B12 | 2068.0438.02 |
| 8 MHz SAW Filter | R&S®ETX-B13 | 2068.0444.02 |
| Documentation of R&S®ETX-T Calibration Values | R&S®ETX-DCV | 2082.0490.28 |
| SFN Monitoring Option | R&S®ETX-K10 | 2068.0480.02 |
| 19" Adapter 3 HU 1/1 | R&S®ZZA-93 | 0396.4892.00 |
| **Service options** [1] | | |
| One-Year Repair Service following the warranty period | R&S®RO2ETX-T | please contact your local sales office |
| Two-Year Repair Service following the warranty period | R&S®RO3ETX-T | |
| Four-Year Repair Service following the warranty period | R&S®RO5ETX-T | |
| Two-Year Calibration Service | R&S®CO2ETX-T | |
| Three-Year Calibration Service | R&S®CO3ETX-T | |
| Five-Year Calibration Service | R&S®CO5ETX-T | |

[1] Can only be ordered in connection with the purchase of an instrument.

# R&S®DVM Family DTV Monitoring and Analysis

## All-in-one solutions from a single source

- Minimal installation effort due to low space requirements and combination of various functions in one instrument
- Minimal training required due to intuitive operating concept
- Cost-effective and future-ready modular design
- Portable and simple operation due to small, lightweight design and integrated display (R&S®DVM400)

The R&S®DVM family of instruments combines the tools needed for all monitoring and analysis applications in the area of digital television signal generation and distribution. An extensive range of analysis tools is available to support the development and testing of digital television equipment such as multiplexers, encoders, modulators and associated components.

The R&S®DVM family consists of four base units and one expansion unit, all of which have extremely compact designs. All four base units can be configured in accordance with customer requirements and expanded whenever necessary.

Multiple RF, IP and transport stream signals can be monitored and analyzed simultaneously. For example, up to four RF signals can be monitored in a single height unit at the same time.

Extensive testing can be carried out on a variety of data services such as videotext, subtitles, system software updates (SSU) and DVB-H signals including electronic service guide (ESG). Video and audio elementary streams (MPEG-2, MPEG-4/AVC/H.264, AAC and AC-3) are analyzed using special software tools.

A hardware decoder processes SD and HD signals coded with either MPEG-2 or MPEG-4/AVC/H.264 to enable the fast and simple analysis of various video formats. Using the qPSNR analysis, the encoding quality of these video signals is also tested and visualized in realtime.

## DVM family at a glance

### R&S®DVM400 – universal and portable

- Broadest scope of functions – ideal for development and maintenance
- Monitoring/analysis of transport streams and contents
- Monitoring, analysis and demodulation of RF signals of various standards
- Monitoring, analysis and transcoding of IPTV signals (Gigabit Ethernet)
- Powerful generator and recorder options with extensive TS libraries and TS multiplexer software
- Simultaneous operation of multiple functions
- Small and lightweight, therefore ideal for portable applications

### R&S®DVM100/R&S®DVM100L – the space saver

- Ideal for network operators and program providers
- Monitoring/analysis of transport streams and contents
- Monitoring, analysis and demodulation of RF signals [1] of various standards
- Monitoring of up to 20 signals in one system when expanded with the R&S®DVM120

### R&S®DVM50 – the starter package

- Particularly cost-effective solution for all monitoring and analysis tasks, whether in the lab, for service applications or unattended in the field
- Monitoring/analysis of transport streams and contents
- Monitoring, analysis and demodulation of RF signals of various standards
- Operation via external PC

### R&S®DVM120 – the expansion unit

- Add-on to the R&S®DVM100, R&S®DVM100L and R&S®DVM400 for simultaneous monitoring of more than four signals in one system
- Integration into the base unit user interface

[1] R&S®DVM100L only.

## Benefits and key features

### Variety of interfaces for high flexibility

- Support for different types of interfaces
- Low space requirements – simultaneous utilization of different interfaces

### Security due to extensive range of monitoring functions

- Detailed monitoring and error logging
- Complete monitoring of all important RF characteristics
- R&S®DVM400: complete monitoring of up to 512 TS IP connections
- Monitoring of transport stream characteristics in accordance with TR 101290 and other advanced criteria
- Monitoring of additional characteristics using templates
- Simple recording and archiving of transport stream segments by means of the TS Capture function

### Effective operation due to detailed configuration options

- Individually configurable measurements
- Permanent or temporary suppression of error messages with Hiding of Events function
- Protection against unauthorized use with Protection Management function
- Monitoring of multiple signals through a single input with Scheduler Suite

### Powerful network functions

- Operation via an integrated web server
- Integration in network management systems via the built-in SNMP interface
- Transmission of transport stream elements or programs in the network using the Streaming function
- Simple data exchange using FTP
- Firewall-protected access

### Extensive analysis and visualization functions

- In-depth TS analysis including PCR and PTS
- Analysis of DVB-H signals, including ESG
- Detailed data service analysis
- Analysis of video encoding quality (qPSNR analysis)
- Detailed elementary stream analysis using separate software tools

### Fast program identification and video quality assessment

- Extensive functions decoding

### Transport stream recording and generation

- The R&S®DVM400 offers additional functions for recording and generating transport streams

| Base units | | | | | Expansion unit |
|---|---|---|---|---|---|
| | **R&S®DVM50** [1] | **R&S®DVM100** | **R&S®DVM100L** | **R&S®DVM400** | **R&S®DVM120** |
| |  |  |  |  |  |
| Height | 1 HU | 1 HU | 1 HU | 4 HU | 1 HU |
| Number of transport streams that can be monitored in parallel | 1 to 4 | 1 to 4 | 1 to 4 | 1 to 4 | 1 to 4 (with RF inputs)<br>1 to 8 (without RF inputs) |
| Number of RF signals that can be demodulated and monitored in parallel | 1 to 4 | – | 1 to 2 | 1 to 4 | 1 to 4 |
| Expansion by the R&S®DVM120 for a total of | – | 20 TS and 16 RF inputs | 20 TS and 18 RF inputs | 20 TS and 20 RF inputs | – |
| Local operation | PC required | via external monitor, external keyboard and mouse | via external monitor, external keyboard and mouse | integrated color display, keys and rotary knob; if necessary, external mouse and keyboard | via base units |
| Remote operation via web server | yes | yes | yes | yes | via base units |
| SNMP (incl. traps) | yes | yes | yes | yes | via base units |
| Alarm relays | – | yes | yes | yes | via base units |
| TS monitoring and analysis including TS capture | yes | yes | yes | yes | yes |
| ES and data service analysis | yes | yes | yes | yes | yes |
| Streaming function | via PC interface | yes | yes | yes | via base units |
| Software decoder | yes | yes | yes | yes | yes |
| Hardware decoder with various interfaces | yes | yes | yes | yes | yes |
| Recorder and generator options | – | – | – | yes | – |
| Gigabit Ethernet/IP interface, monitoring functions and transcoding | – | – | – | yes | – |
| Reference clock input | – | – | – | yes | – |
| SPI input and output | – | – | – | yes | – |

[1] The operation of the R&S®DVM50 requires a PC. Some of the functions specified are only available via the PC.

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| **Base units** | | |
| MPEG-2 Monitoring System | R&S®DVM50 | 2085.1900.03 |
| Accessories: quick start guide in printed format, operating manual on CD, power cable, crossed patch cable, CD with firmware | | |
| MPEG-2 Monitoring System | R&S®DVM100 | 2085.1600.03 |
| Accessories: quick start guide in printed format, operating manual on CD, power cable, crossed patch cable, CD with firmware, connector for relay contacts | | |
| MPEG-2 Monitoring System | R&S®DVM100L | 2112.7050.02 |
| Accessories: quick start guide in printed format, operating manual on CD, power cable, crossed patch cable, CD with firmware, connector for relay contacts | | |
| Digital Video Measurement System | R&S®DVM400 | 2085.1800.03 |
| Accessories: quick start guide in printed format, operating manual on CD, power cable, crossed patch cable, CD with firmware, connector for relay contacts, mouse | | |
| **Expansion unit** | | |
| MPEG-2 Monitoring System | R&S®DVM120 | 2085.1700.03 |
| Accessories: power cable, crossed patch cable | | |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| **Transport stream monitoring and analysis** | | |
| MPEG Analysis Board | R&S®DVM-B1 | 2085.3283.02 |
| MPEG Analysis Board | R&S®DVM400-B1 | 2085.5505.02 |
| TS Monitoring, activation of one channel | R&S®DVM-K1 | 2085.5211.02 |
| TS Capture, recording by MPEG analysis board | R&S®DVM-K2 | 2085.5234.02 |
| In-Depth Analysis | R&S®DVM-K10 | 2085.5228.02 |
| In-Depth Analysis | R&S®DVM50-K10 | 2085.5434.02 |
| TS Template Monitoring | R&S®DVM-K12 | 2085.5328.02 |
| **Data service and elementary stream analysis** | | |
| qPSNR Analysis, video coding realtime analysis | R&S®DVM-K31 | 2085.5457.02 |
| Data Broadcast Analysis | R&S®DVM-K11 | 2085.5311.02 |
| Elementary Stream Analyzer, MPEG-2 ES analysis | R&S®DV-ESA | 2085.8904.02 |
| H.264 Analyzer | R&S®DVM-K200 | 2112.7850.02 |
| Dolby AC-3 Audio, option for H.264 analyzer | R&S®DVM-K201 | 2112.7867.02 |
| Maintenance for 12 Months, option for H.264 analyzer | R&S®DVM-K209 | 2112.7873.02 |
| **Video and audio decoding** | | |
| Video and Audio Hardware Decoding<br>Video: SDTV, MPEG-2, H.264<br>Audio: MPEG-1/2 | R&S®DVM-B30 | 2085.5570.02 |
| Video and Audio Hardware Decoding<br>Video: SDTV, MPEG-2, H.264<br>Audio: MPEG-1/2 | R&S®DVM400-B30 | 2085.5540.02 |
| HD/SD–SDI Video Output | R&S®DVM-K30 | 2085.5440.02 |
| HDTV and Dolby Decoding Upgrade | R&S®DVM-K32 | 2085.5486.02 |
| **RF monitoring, analysis and demodulation** | | |
| RF Carrier Board | R&S®DVM-B500 | 2085.5634.02 |
| RF Carrier Board and Decoder Extension | R&S®DVM400-B500 | 2085.5563.02 |
| RF Carrier Board Extension | R&S®DVM400-B504 | 2085.5670.02 |
| Demodulator Module | R&S®DVM-B50 | 2085.5605.02 |
| DVB-C, J.83/A/C Demodulation | R&S®DVM-K501 | 2112.7815.02 |
| J.83/B Demodulation | R&S®DVM-K502 | 2112.7821.02 |
| ATSC/8VSB Demodulation | R&S®DVM-K503 | 2112.7838.02 |
| High-Quality MER Measurements for R&S®DVM-B50 and R&S®DVM-B53 | R&S®DVM-K509 | 2112.7844.02 |
| DVB-S/DVB-S2 Receiver Module | R&S®DVM-B51 | 2085.5611.02 |
| DVB-T/DVB-H Receiver Module, 2K and 8K mode | R&S®DVM-B52 | 2085.5657.02 |
| **IPTV monitoring, analysis and transcoding (R&S®DVM400 only)** | | |
| Gigabit Ethernet Interface Module | R&S®DVM400-B40 | 2085.5557.03 |
| **Transport stream generation, recording and playback (R&S®DVM400 only)** | | |
| TS Generator (GTS) | R&S®DVM400-B2 | 2085.5511.02 |
| Upgrade TS Recorder (TRP), up to 90 Mbit/s | R&S®DVM400-B3 | 2085.5528.03 |
| Upgrade TS Recorder (TRP), up to 214 Mbit/s | R&S®DVM400-B4 | 2085.5534.03 |
| HDTV Sequences | R&S®DV-HDTV | 2085.7650.02 |
| H.264 Stream Library | R&S®DV-H264 | 2085.9052.02 |
| DVB-H Stream Library | R&S®DV-DVBH | 2085.8704.02 |
| Test Card M Sequences | R&S®DV-TCM | 2085.7708.02 |
| Advanced Stream Combiner™, dongle for USB interface | R&S®DV-ASC | 2085.8804.03 |
| **Rack installation kits** | | |
| 19" Adapter, 1 HU, 1/1 for design 2000 housing for R&S®DVM50/100/100L/120 | R&S®ZZA-111 | 1096.3254.00 |
| 19" Adapter for design 2000 housing, 4U, 7/8 T250 for R&S®DVM400 | R&S®ZZA-S03 | 1105.6756.00 |
| **Extras** | | |
| Memory Extension, to 2 Gbyte | R&S®DVM-B200 | 2085.5592.02 |
| Keyboard with USB Interface (US assignment) | R&S®PSL-Z2 | 1157.6870.03 |
| Mouse with USB Interface, optical | R&S®PSL-Z10 | 1157.7060.02 |
| Documentation of R&S®DVM50/100/120/400 Calibration Values | R&S®DVM-DCV | 2082.0490.29 |
| Operating manual, printed format | – | 2085.1839.12 |

# R&S®DVQ Digital Video Quality Analyzer

Always in the picture about picture quality

- Realtime measurement
- No reference signal required
- SSCQE scaling of quality levels
- Monitoring of picture freeze, picture loss and sound loss
- Program decoding
- Integrated MPEG-2 decoder
- Histogram representation of quality levels
- Recording of quality profile (long-term)
- Internal event and error report and statistics
- Optional decoding of CA programs

The increasing use of digital, data-compressed TV signals calls for monitoring and assessment of the picture quality. Picture quality assessment is very strongly influenced by the subjective perception of the human eye. The R&S®DVQ is a tool that ideally satisfies both requirements. It determines the picture quality in relation to digital compression and evaluates the results in line with the subjective criteria of visual perception.

Using the R&S®DVQ digital video quality analyzer, the assessment of picture quality in line with subjective criteria becomes an objective realtime measurement method. This method is based on the analysis of video data and can thus also be used where no reference video material is available. To this end, the optional R&S®DVQ-B1 quality explorer™ PC software is available, allowing complete display and analysis of all coding data as well as convenient remote control of the R&S®DVQ and display of the recorded quality data.

### Wide application range

- Quality monitoring in distribution networks
- Program quality assessment
- Development, evaluation and setting of operational hardware
- Testing of set-top boxes

### Measurement

- Realtime measurement
- No reference signal required
- Comparative quality measurements
- Completely independent quality analysis for each signal

### Monitoring

- Monitoring of picture freeze, picture loss and sound loss
- Internal event and error report and statistics
- Program decoding

### Representation of quality levels

- Bargraph
- Numeric display
- Histogram representation of quality levels
- Long-term recording of quality profile
- SSCQE scaling of quality levels

## Convenient operation

- Clearly arranged LCD
- Keypad control with fast-access keys for the main menus and softkeys for the submenus
- Displayed contents are inserted into the decoded picture at the video output
- Logging of quality ratings together with the associated picture contents by means of a connected recorder
- Full remote-control capability via RS-232-C or Ethernet
- Quality Monitor™ software
  - Free-of-charge extra for remote control of the R&S®DVQ and reading of measured values

## Options

### R&S®DVQ-B1 Quality Explorer™ software

- Installation on an external PC
- Connected to the R&S®DVQ via RS-232-C or Ethernet
- For in-depth display, analysis and decoding of the coded video data in MPEG-2 format

### SMPTE310M interface R&S®DV-B310 option

- Serial interface for ATSC in line with the SMPTE310M standard
- Replaces the TS/ASI input on the R&S®DVQ's front panel

## Specifications in brief

| | |
|---|---|
| **Signal inputs** | |
| MPEG-2 transport stream | in line with ISO/IEC13818-1 |
| Length of data packets | 188/204/208 byte |
| Synchronous parallel | SPI-LVDS, in line with DVB-A010 |
| Data rate | up to 80 Mbit/s |
| Asynchronous serial | 270 Mbit/s (ASI, in line with DVB-A010) |
| Data rate | up to 72 Mbit/s |
| Synchronous serial | SSI, in line with SMPTE310M (R&S®DV-B310 option) |
| Data rate | 19.392658 Mbit/s, ± 500 Hz |
| Video serial digital | 270 Mbit/s (SDI, in line with ITU-R 601/656 or SMPTE259M) |
| Audio serial digital | AES/EBU |
| **Integrated MPEG-2 decoder** | |
| Supported formats | |
| Video | MPEG-2 422P@ML, MPEG-2 MP@ML, MPEG-2 SP@ML |
| Audio | MPEG-1 layer I or II, MPEG-2 layer I or II, Dolby AC-3 (stereo downmix) |
| **Signal outputs** | |
| MPEG-2 transport stream | in line with ISO/IEC13818-1 |
| Asynchronous serial | 270 Mbit/s (ASI, in line with DVB-A010), looped through from input |
| Video CCVS | PAL, SECAM, NTSC, MPEG-2 transport stream |
| Video serial digital | 270 Mbit/s (SDI, in line with ITU-R 601/656 or SMPTE259M |
| Audio | unbalanced, not floating |
| Level (full scale) | 6/9/12/15 dBu ± 0.5 dB |
| Frequency response (60 Hz to 15 kHz) | ±0.5 dB relative to 1 kHz, into 600 Ω |
| S/N ratio | >70 dB, unweighted |
| THD | >70 dB |
| **Operation** | |
| Manual control | front-panel keys with LCD, output of test results on LCD as well as text inserted in video output signal |
| Remote control | RS-232-C interface or Ethernet |
| **Interfaces** | |
| Serial | RS-232-C |
| Parallel | Centronics |
| Ethernet | RJ-45, 10BaseT, 10 Mbit/s |

## Specifications in brief

| | |
|---|---|
| Relay outputs | 12 with any allocation to events, ORed in case of allocation to several events |
| **Test parameters** | |
| Events | sound loss left, sound loss right, picture loss, picture freeze, quality below (user-selectable) threshold |
| **Recording** | |
| Statistics | error seconds of events according to type, display selectable according to type |
| Report | listing of events according to time, optional filtering according to type, display per entry: time, duration, PID, type |
| Video data analysis | temporal activity, spatial activity, digital video quality level, unweighted (R&S®DVQL-U), separately for luminance and chrominance (Y, Cb, Cr), digital video quality level, weighted (R&S®DVQL-W), total level corresponding to subjective assessment |
| **Display** | |
| Current values | bargraph, numeric values |
| Recorded values | time profile, histogram |
| Time frame for recording | 5/10/30 s, 1/5/10/30 min, 1/2/5 h single-shot or continuous |
| Reference measurement, delay | ±5 s, automatically detected |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| Digital Video Quality Analyzer | R&S®DVQ | 2079.6003.03 |
| **Accessories supplied** Power cable, operating manual, audio adapter (LEMO Triax to XLR), modem bypass cable | | |
| **Options** | | |
| Quality Explorer™ Software | R&S®DVQ-B1 | 2079.7151.02 |
| Quality Monitor™ Software | available free of charge at www.rohde-schwarz.com | |
| SMPTE310 Input | R&S®DV-B310 | 2085.7543.02 |
| Documentation of R&S®DVQ Calibration Values | R&S®DVQ-DCV | 2082.0490.20 |
| **Recommended extras** | | |
| Common Interface Adapter TS out | R&S®SFQ-Z17 | 2081.9364.02 |
| 19" Rack Adapter (2 height units) for installation with handles (rack-mount without handles on request) | R&S®ZZA-211 | 1096.3260.00 |
| Service Manual | | 2079.7951.24 |

# R&S®DVQM Multichannel Digital Video Quality Analyzer

## Always in the picture about picture quality in all channels

The R&S®DVQM is the multichannel version of the R&S®DVQ digital video quality analyzer. The R&S®DVQM can combine the performance of up to 12 R&S®DVQs. The resulting large variety of configurations allows the R&S®DVQM to be optimally adapted to different requirement profiles.

The R&S®DVQM in conjunction with the R&S®DVSG digital video signal generator and, optionally, the R&S®DVM MPEG-2 monitoring system forms a complete monitoring system with recording capability even for very rare disturbances. The relay outputs of the R&S®DVQM and the R&S®DVM are connected to the trigger input of the R&S®DVSG, whose elaborate trigger characteristics make it possible to save a transport stream section of arbitrary length before and after an error event for subsequent detailed analysis.

The measurement method is based on the analysis of video data. No reference pictures are required. Instead of lengthy observations carried out by a test person, unknown program material can automatically be checked for its picture quality (e.g. satellite uplink).

### Analyzer characteristics

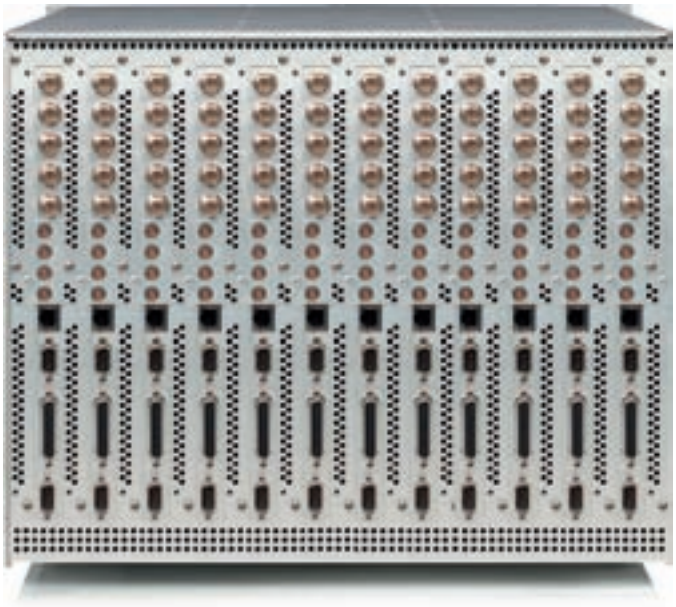
- Each analyzer board can be used to monitor all the relevant parameters of the video and audio elementary streams of the selected program
- User-definable threshold values for determination of Go/NoGo scenarios
- Monitoring of picture freeze, picture loss and audio loss
- Monitoring of audio loss, separately for R/L channels
- Monitoring of AC-3-coded audio streams
- Optional (R&S®DVQM-B4) monitoring of video quality with SSCQE scaling of quality levels

### Long-term recording and evaluation of quality parameters

- Quality assessment that is closer to reality than that of short standardized test sequences
- Unique combination of realtime capability and independence from a reference signal

### Quality monitoring in distribution networks

- Monitoring during program transmission and in realtime
- Detection of quality degradations and failures at an early stage so that remedial measures can be taken in time
- Suitable for use wherever MPEG-2-coded video data is transmitted or received since no reference signal is required for analysis
- Usable at the gateway between two different networks for documenting the picture quality versus time
- Network compatibility of the R&S®DVQM ensures optimum integration into monitoring systems

## Windows software supplied with the R&S®DVQM

- R&S®DTV NetView
  - Easy detection and clear display of errors
  - Easy configuration of all devices connected
  - Excellent overview of all the devices contained in the system
- Quality Monitor™ software for continuous display and recording of measurement results
  - Spatial and temporal activities
  - Data rate
  - R&S®DVQL-W quality levels

## Options

### R&S®DVQ-B1 Quality Explorer™

- In-depth analysis of an MPEG-2 video elementary stream monitored by an analyzer board

### R&S®DVQM-B2 analyzer board

- Additional analyzer board for monitoring a further channel
- Corresponds to the two analyzer boards contained in the base unit
- Activation of the video quality analysis for this board via the R&S®DVQM-B4 option

### R&S®DVQM-B4 video quality analysis

- Enhances the analyzer board to include determination of the picture quality
- Patented weighting algorithm allows continuous analysis of the video quality and furnishes measurement results adapted to human perception
- Results below a defined quality level automatically generate an alarm message and a report entry

## Specifications in brief

| | |
|---|---|
| **Signal inputs** | |
| MPEG-2 transport stream | in line with ISO/IEC 13818-1 |
| Length of data packets | 188/204 byte |
| Asynchronous serial | 270 Mbit/s (ASI, in line with DVB-A010) |
| Data rate | up to 70 Mbit/s |
| Video serial digital | 270 Mbit/s (SDI, in line with ITU-R 601/656 or SMPTE259M) |
| Audio serial digital | AES/EBU |
| **Signal outputs** | |
| MPEG-2 transport stream | in line with ISO/IEC 13818-1 |
| Asynchronous serial | 270 Mbit/s (ASI, in line with DVB-A010) |
| Video CCVS | PAL, SECAM, NTSC, MPEG-2 transport stream |
| Video serial digital | 270 Mbit/s (SDI, in line with ITU-R 601/656 or SMPTE259M) |
| Audio unbalanced | |
| Audio left, audio right | 6/9/12/15 dBu ±0.5 dB |
| Audio serial digital | AES/EBU |
| **Interfaces** | |
| Remote control | RS-232-C, SCPI commands |
| Printer output | Centronics |
| Remote control | Ethernet 10BaseT, 10 Mbit/s |
| Relay outputs | 12 with any allocation to events, ORed in case of allocation to several events |
| **Test parameters** | |
| TS sync | duration and hysteresis |
| Video sync | duration |
| Audio sync | duration |
| Picture freeze | duration and temporal activity |
| Picture loss | duration, spatial activity and picture freeze |
| Quality below threshold | threshold value (only with option R&S®DVQM-B4) |
| Sound loss left | duration and volume |
| Sound loss right | duration and volume |
| **Display** | On-screen display with selectable parameters: statistics, report, program, measure details, LEDs |
| **Reference measurement** | |
| Signal inputs | SDI and MPEG-TS |
| Delay | ±5 s max., automatically detected |

## Specifications in brief

| | |
|---|---|
| **Measurement system configuration** | |
| R&S®DVQM/DVQ/DVSG and R&S®DVM (R&S®DVSG and R&S®DVM for monitoring transport stream syntax) | |
| Designation | user-selectable names for all defined devices and transport streams |
| Device configuration | creation of a hierarchy by combining devices and assigning them to the defined transport streams and by assigning the analyzer boards to the R&S®DVQM |
| **Display** | |
| Tree navigator | tree structure of configured devices (assignment to transport streams) |
| Statistics view | signaling of measurement results (R&S®DVQM and R&S®DVQ) by means of color codes, number of errors occurred (R&S®DVSG/DVM) |
| Report view | list of all report entries of all configured devices (max. 2000) |
| **Storage of measurement results** | |
| Data | report entries of all configured devices |
| Max. file size | user-defined |
| Automatic storage | continuous saving of data on hard disk (user-configurable interval), new file name for each day (optional) |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| **Multichannel Digital Video Quality Analyzer** | | |
| Base unit with two analyzer boards (R&S®DVQM-B2) + R&S®DTV NetView | R&S®DVQM | 2088.0004.02 |
| **Options** | | |
| Additional Analyzer Board (max. 10 R&S®DVQM-B2 per R&S®DVQM) | R&S®DVQM-B2 | 2088.0027.02 |
| Video Quality Analysis for R&S®DVQM-B2 (activates digital video quality determination for an R&S®DVQM-B2 analyzer board) | R&S®DVQM-B4 | 2088.0062.02 |
| Quality Explorer™ (only one license required for several analyzer boards) | R&S®DVQ-B1 | 2079.7151.02 |

# R&S®DVQ-B1 Quality Explorer™

## Comprehensive quality and MPEG-2 elementary stream analysis

- Comprehensive content analysis of MPEG-2-coded video elementary streams in any format
- Automatic detection of coding errors
- Logging of quality parameters with graphical display and storage to data media
- Clear presentation of analysis results
- User-friendly operation
- Installation under Windows operating system
- Usage without the R&S®DVQ possible

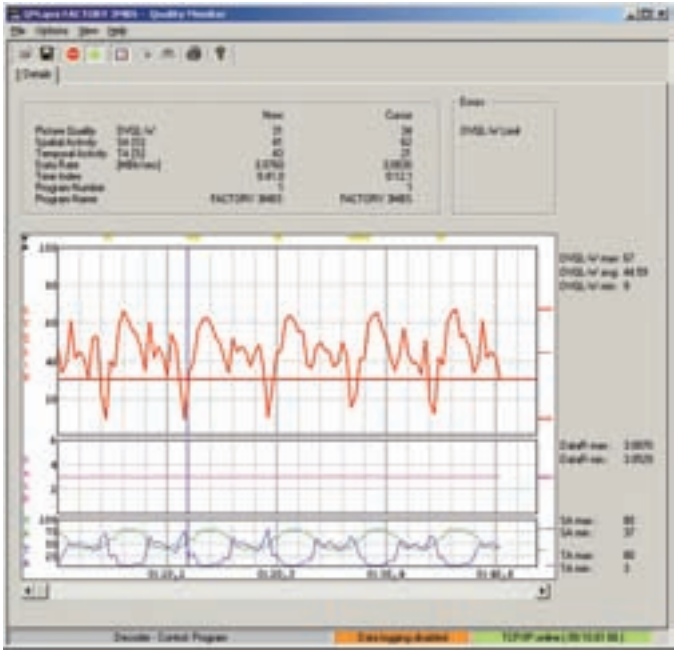
R&S®DVQ-B1 Quality Explorer™ is a software package that performs comprehensive analysis of MPEG-2-coded transport streams. It can be used either on an external PC connected to the R&S®DVQ or fully independently of the R&S®DVQ for elementary stream analysis from data media (e.g. hard disk, CD-ROM).

R&S®DVQ-B1 comprises two independent tools: the Quality Monitor™ reads the quality parameters provided by the R&S®DVQ digital video quality analyzer in realtime via the remote control interface. It displays the quality levels graphically as a histogram. Archiving on data storage media is also possible.

The elementary stream analyzer analyzes the content of MPEG-2-coded video elementary streams. For this purpose, the R&S®DVQ has a 32 Mbit internal buffer memory for the elementary stream to be analyzed. The elementary stream buffered in the R&S®DVQ can also be stored as a PC file. Alternatively, elementary streams available as PC files can be analyzed. Therefore, Quality Explorer™ can be used on other instrument platforms without the R&S®DVQ. Full remote control of the R&S®DVQ is provided by a library routine (DLL) supplied with the software and the Quality Monitor™ user interface.

The software runs under Windows on any PC or laptop connected to the R&S®DVQ via an RS-232-C or Ethernet interface. The easy-to-operate software as well as the clear presentation of the analysis results in windows of variable size, ensure speed and success right from the start.

Quality Monitor™ for realtime logging and graphical display of quality levels determined by the R&S®DVQ.



### Specifications in brief

| | |
|---|---|
| **Elementary stream analyzer** | |
| MPEG-2 formats | |
| Profile | MP (main profile 4:2:0) 422P (4:2:2 profile) |
| Aspect ratios | any, e.g. 4:3, 14:9, 16:9 |
| Picture formats | any SDTV and HDTV format |
| **System requirements** | PC or laptop, Windows operating system, RS-232-C or Ethernet interface, CD-ROM drive, Centronics interface |

### Ordering information

| Designation | Type | Order No. |
|---|---|---|
| Quality Explorer™ | R&S®DVQ-B1 | 2079.7151.02 |
| Equipment supplied | CD-ROM with setup program, serial cable for connecting R&S®DVQ to the PC, dongle for the Centronics interface of the PC, operating manual | |

# R&S®UAF Video Analyzer

Perfection in video analysis: fast, precise, reliable

- Standards B/G, D/K, I, M
- User-selectable test signal
- Memory card, printer interface
- Full-field measurements
- Three signal inputs
- 29 video parameters
- Limit monitoring

Due to its characteristics, the R&S®UAF video analyzer meets all requirements as regards high measurement accuracy for the studio and fast measurements down to a few seconds. User-friendly operation and a clear-cut display with graphics support provide straightforward measurements.

The core of the digital section is a microprocessor plus an arithmetic coprocessor. The signal analysis comprises 25 video and test line parameters and covers all important levels as well as linear and nonlinear distortion such as 2T K rating, frequency response and hum. Optionally, 50 Hz tilt, 200 ns overshoot, NICAM and dual-sound intermodulation can be measured.

The user can select the position of the test lines over the entire picture area and in the field blanking interval; storage of up to eight test configurations is possible.

Due to its variable integration time, the R&S®UAF can be adapted to all test conditions. Using the shortest integration time of less than 1 s, the R&S®UAF is ideal for all alignments. In case of very noisy signals, stable results can be obtained by increasing the integration time to 2.5 s, 5 s and 10 s.

## Ideal for quality and production control

- The R&S®UAF also handles the Y/C S-VHS component signals
- Distorted test signals do not affect the operation of the R&S®UAF

## Customer-defined test programs

- Using a plug-in memory card, customer-defined test programs can be loaded and test results stored on the card
- Memory card permits storage of complete instrument setups

## Operation

The keypad to the left of the display permits the setup menus of the R&S®UAF to be selected directly. Such a menu is inserted as a window above the normal result display. Thus, it is possible to use the softkeys for changing general settings such as input, synchronization, printer mode, etc.

- Clear overview of functions ensures ease of operation
- Each parameter is assigned its own key
- Associated LEDs above the keys blink if the limit values are exceeded
- "Option" function allows further test parameters, e.g. external level or future extensions, to be called up

## Special modes

- Difference measurement
  - Signal errors at the input of the DUT can be eliminated
- Reference measurement
  - Only one input of the R&S®UAF is connected to the DUT, the first test cycle being stored as the reference
- Automatic test sequence
  - AUTORUN menu permits test sequences to be programmed on the R&S®UAF front panel
  - Sequences are executed automatically and can be repeated cyclically

## Specifications in brief

| | | |
|---|---|---|
| **Signal inputs** | 3 video inputs; 75 Ω loop-through filters, 3 × CCVS or 1 × Y/C and 1 × CCVS, adjustable | |
| Level | 1 V ($V_{pp}$) ± 6 dB | |
| Return loss up to 10 MHz | ≥40 dB | |
| Decoupling of inputs up to 10 MHz | ≥85 dB | |
| Synchronization, internal | optionally from 1 of the 3 inputs | |
| Sync pulse level | 300 mV ± 6 dB | |
| Synchronization, external | loop-through filter | |
| Nominal level | 2 V/4 V ($V_{pp}$) into 75 Ω | |
| SIS | permissible | |
| **Test parameter** | **Measurement range** | **Error limits at nominal** |
| Luminance bar amplitude | –100 % to +100 % | ±0.3 % |
| Black level distortion | –20 % to +40 % | ±0.3 % |
| Tilt of luminance bar | –40 % to +40 % | ±0.3 % |
| 2T pulse amplitude | –50 % to +50 % | ±0.5 % |
| 2T K factor | 0 % to +10 % | ±0.7 % |
| Luminance nonlinearity | 0 % to +50 % | ±0.5 % |
| Residual picture carrier | 0 % to +30 % | ±0.3 % |
| Sync pulse amplitude | | |
| Reference = signal | –50 % to +50 % | ±0.5 % |
| Reference = nominal | –80 % to +100 % | ±0.5 % |
| Color subcarrier gain | | |
| ITU-R 331 | –50 % to +50 % | ±1 % |
| ITU-R 17 | –50 % to +50 % | ±1 % |
| Chrominance/luminance intermodulation | | |
| ITU-R 331 | –50 % to +50 % | ±0.3 % |
| ITU-R 17 | –50 % to +50 % | ±1 % |
| Chrominance/luminance delay | –500 ns to +500 ns | ±5 ns |
| Differential gain | | |
| Positive/negative | –50 % to +50 % | ±0.3 % |
| Peak-to-peak | 0 % to +100 % | ±0.5 % |
| Differential phase | | |
| Positive/negative | –50° to +50° | ±0.3° |
| Peak-to-peak | 0° to +100° | ±0.5° |
| Nonlinearity of color subcarrier gain | | |
| Positive/negative | –50 % to +50 % | ±0.7 % |
| Peak-to-peak | 0 % to +100 % | ±1 % |
| Nonlinearity of color subcarrier phase | | |
| Positive/negative | –50 × to +50 × | ±0.7° |
| Peak-to-peak | 0° to +100° | ±1° |
| Burst amplitude | | |
| Reference = signal | –50 % to +50 % | ±1 % |
| Reference = nominal | –80 % to +80 % | ±1 % |
| Multi-burst amplitude | –80 % to +50 % | ±1 % |
| Luminance signal/noise ratio | 25 dB to 80 dB | ±1 dB |
| Intermodulation between color subcarrier and sound carrier | 30 dB to 70 dB | ±1 dB |
| Hum | 6 dB to 60 dB | ±1 dB |
| DC measurement | –5 V to +5 V | ±10 mV |
| Incidental carrier phase modulation | –7° to +45° | ±1° |
| Basic amplitude of video data | –50 % to +50 % | ±1 % |

## Specifications in brief

| | | |
|---|---|---|
| 50 Hz tilt (optional) | 0 % to 40 % | ±0.5 % |
| 200 ns overshoot (optional) | –20 % to +40 % | ±0.3 % |
| Noise voltage | | |
| Measurement mode | rms | |
| Filter | 200 kHz highpass and video filter integrated, weighting filter and color subcarrier trap can be connected | |
| Inherent S/N ratio | >83 dB | |
| Reference | luminance bar or 700 mV nominal, selectable | |
| Differential gain/phase | | |
| Evaluation | 4 or 5 steps (selectable) | |
| Hum | | |
| Measurement mode | peak-to-peak | |
| Filter | 1 kHz lowpass integrated | |
| Reference | luminance bar or 700 mV nominal, selectable | |
| **Indication** | LC display | |
| Display mode, selectable | numeric, 1 parameter, numeric, 3 parameters, numeric with bar display | |
| Language | German, English, French or Italian | |
| **Interfaces and outputs** | | |
| Remote control | IEEE488.2 | |
| Printer | Centronics | |
| Memory card | storage of measured values, limit values and parameter definitions, device setups and user-defined test routines | |
| Monitor output | clamped test signal (input signal ±1 %, 75 Ω) | |
| Zero reference control | 2.5 V ($V_{pp}$) ±10 % into 75 Ω, position and duration adjustable | |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| **Video Analyzer** | | |
| Standard B/G | R&S®UAF | 2013.0807.02 |
| Standard D/K | R&S®UAF | 2028.5780.02 |
| Standard M | R&S®UAF | 2028.5774.02 |
| Standard I | R&S®UAF | 2028.5768.05 |
| Other standards | on request | |
| **Accessories supplied** | | |
| 4 × 75 Ω terminations, 32 kbyte memory card | | |
| **Options** | | |
| 50 Hz tilt, 200 ns Overshoot | R&S®UAF-B1 | 2028.6406.02 |
| S/N Extension 552 kHz (NICAM) | R&S®UAF-B2 | 2028.6412.02 |
| S/N Extension 242 kHz (dual sound) | R&S®UAF-B3 | 2028.6429.02 |
| Documentation of R&S®UAF Calibration Values | R&S®UAF-DCV | 2082.0490.05 |
| **Recommended extras** | | |
| Memory Card 32 kbyte | R&S®ZZM-32 | 2005.4394.02 |
| Memory Card 512 kbyte | R&S®ZZM-512 | 2013.1684.24 |

# R&S®VSA Video Measurement System

Compact platform for video signal analysis: measurements of all relevant video parameters

- DC to 9 MHz
- Five instruments in one: video and FFT analyzer, three-channel oscilloscope, vectorscope, monitor, system controller

The R&S®VSA video measurement system combines the functions of a video analyzer, vectorscope, oscilloscope, monitor and controller (PC) in a 19" desktop. The instrument features convenient operation as well as high measurement accuracy and speed. The compact design makes it also suitable for mobile applications.

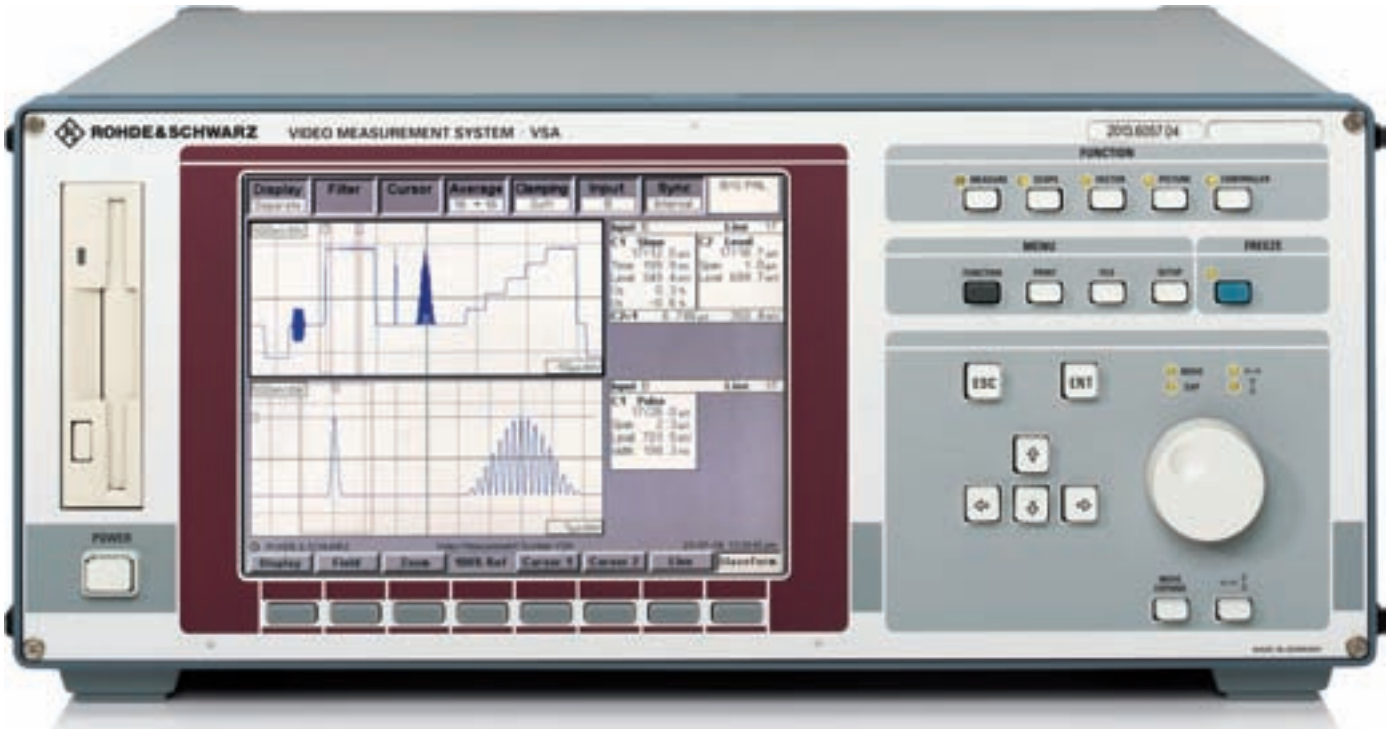
The large number of integrated functions and system interfaces make the R&S®VSA an essential tool for measurements and system applications in all fields of video. In addition to the versatile measurement capabilities provided, the modular software and hardware configuration offers sufficient capacity for future expansions.

## Fields of applications

- Laboratory and service
- Automatic test and monitoring systems
- Production and quality assurance

## Features

- Four loop-through video signal inputs with analog 9 MHz bandwidth
- DOS- and Windows-compatible PC with IEC/IEEE bus controller
- Multitasking operating system
- Connectors for external keyboard and color monitor
- Color graphic LC display
- Two serial interfaces
- SCPI remote control via IEC/IEEE or serial interface
- Printer interface
- 3.5" floppy disk drive (DOS format) for result transfer and software options
- Hard disk
- Modular design with hardware and software options



## Specifications in brief

| | |
|---|---|
| **Frequency range, standard** | 0 Hz to 9 MHz, B/G, I, D/K, PAL |
| Interfaces | |
| Remote control | IEC625-2/IEEE488.2, 2 × RS-232-C |
| Printer | parallel interface (Centronics) |
| External monitor, keyboard | VGA, 640 × 480 pixel, PC AT keyboard |
| Display | color or monochrome |

| Measurement parameters | Unit | Range | Res. | Max. error |
|---|---|---|---|---|
| **Amplitude and delay** | | | | |
| Luminance bar amplitude (abs) | mV | 0 to 1400 | 0.1 | ±2.0 |
| Luminance bar amplitude (nom) | % | –100 to +100 | 0.1 | ±0.3 |
| Sync amplitude (abs) | mV | 60 to 600 | 0.1 | ±2.0 |
| Sync amplitude (nom) | % | –80 to +100 | 0.1 | ±0.5 |
| Sync amplitude (bar) | % | –50 to +50 | 0.1 | ±0.5 |
| Burst amplitude (abs) | mV | 60 to 600 | 0.1 | ±3.0 |
| Burst amplitude (nom) | % | –80 to +100 | 0.1 | ±1.0 |
| Burst amplitude (bar) | % | –50 to +50 | 0.1 | ±1.0 |
| C/L gain (modulated pulse) | % | –50 to +50 | 0.1 | ±1.0 |
| C/L delay (modulated pulse) | ns | –500 to +500 | 1 | ±5 |
| C/L gain (modulated bar) | %/bar | –50 to +50 | 0.1 | ±1.0 |
| Average picture level | %/bar | 0 to 200 | 0.1 | ±3.0 |
| DC level X1 | mV | –2000 to +2000 | 0.1 | ±3.0 |
| Residual picture carrier | % | 0 to +30 | 0.1 | ±0.3 |
| Black level | % | 50 to 90 | 0.1 | ±0.3 |
| **Linear distortions** | | | | |
| Baseline distortion | %/bar | –40 to +40 | 0.1 | ±0.3 |
| 2T pulse amplitude | %/bar | –50 to +50 | 0.1 | ±0.5 |
| 2T k factor | % | 0 to 10 | 0.1 | ±0.5 |
| 2T half-amplitude duration | ns | 100 to 400 | 1 | ±3 |
| Tilt | % | –40 to +40 | 0.1 | ±0.3 |
| Short/field-time distortion | % | –40 to +40 | 0.1 | ±0.3 |
| **Nonlinear distortions** | | | | |
| C/L intermodulation (pulse) | %/bar | –50 to +50 | 0.1 | ±1.0 |
| C/L intermodulation, step 1/2/3 | %/bar | –50 to +50 | 0.1 | ±0.3 |
| C NL gain, pos/neg | % | 0 to +50/–50 | 0.1 | ±0.7 |
| C NL gain, pp | % | 0 to 100 | 0.1 | ±1.0 |
| C NL phase, pos/neg | ° | 0 to +50/–50 | 0.1 | ±0.7 |
| C NL phase, pp | ° | 0 to 100 | 0.1 | ±1.0 |
| Luminance NL | % | 0 to 50 | 0.1 | ±0.5 |
| Luminance NL, step 1/2/3/4/5 | % | 50 to 100 | 0.1 | ±0.5 |
| Diff. gain, ref | %/bar | –50 to +50 | 0.1 | ±0.3 |
| Diff. gain, pos/neg | % | 0 to +50/–50 | 0.1 | ±0.3 |
| Diff. gain, pp | % | 0 to 100 | 0.1 | ±0.5 |
| Diff. gain, step 1/2/3/4/5 | % | –50 to +50 | 0.1 | ±0.3 |
| Diff. phase, pos/neg | ° | 0 to +50/–50 | 0.1 | ±0.3 |
| Diff. phase, pp | ° | 0 to 100 | 0.1 | ±0.5 |
| Diff. phase, step 1/2/3/4/5 | ° | –50 to +50 | 0.1 | ±0.3 |
| **Frequency response** | | | | |
| Multiburst flag (abs) | mV | 0 to 1000 | 0.1 | ±2.0 |
| Multiburst flag (nom) | % | –100 to +50 | 0.1 | ±0.3 |
| Multiburst flag (bar) | % | –100 to +50 | 0.1 | ±0.3 |
| Multiburst 0.5/1/2/4/4.8/5.8 | % | –100 to +50 | 0.1 | ±1.0 |
| Multiburst 0.5/1/2/4/4.8/5.8 | dB | –40 to +6 | 0.01 | ±0.1 |
| Multiburst national flag (abs) | mV | 0 to 1000 | 0.1 | ±2.0 |
| Multiburst nat. flag (nom/bar) | %/n/b | –100 to +50 | 0.1 | ±0.3 |
| Multiburst nat. 0.5/1.5/3.0/4.4 | % | –100 to +50 | 0.1 | ±1.0 |
| Multiburst nat. 0.5/1.5/3.0/4.4 | dB | –40 to +6 | 0.01 | ±0.1 |
| Sin(x)/x amplitude, pos/neg | dB/grat | –100 to +100 | 0.01 | ±0.3 |
| Sin(x)/x group delay, pos/neg | ns/grat | –1000 to +1000 | 1.0 | ±20 |
| Spectrum, pos/neg | dB/grat | –100 to +100 | 0.01 | ±0.3 |
| **Noise measurements** | | | | |
| Lum. noise, unw (abs) | mV | 0 to 50 | 0.1 | ±1.0 |
| Lum. noise, unw (nom/bar) | dB | 25 to 75 | 0.1 | ±1.0 |
| Lum. noise, lumw (abs) | mV | 0 to 50 | 0.1 | ±1.0 |
| Lum. noise, lumw (nom/bar) | dB | 25 to 80 | 0.1 | ±1.0 |
| Lum. noise, chrw (abs) | mV | 0 to 50 | 0.1 | ±1.0 |
| Lum. noise, chrw (nom/bar) | dB | 25 to 80 | 0.1 | ±1.0 |
| Hum (abs) | mV | 0 to 700 | 1 | ±5 |
| Hum (nom/bar) | | 0 to 55 | 0.1 | ±1.0 |
| C/SND intermodulation (abs) | mV | 0 to 50 | 0.1 | ±1.0 |
| C/SND intermodulation (nom/bar) | dB | 30 to 70 | 0.1 | ±1.0 |
| SND/SND intermodulation (abs) | mV | 0 to 50 | 0.1 | ±1.0 |
| SND/SND intermodulation (nom/bar) | dB | 30 to 70 | 0.1 | ±1.0 |
| Chroma noise AM | dB | 0 to –80 | 0.1 | ±1.0 |
| Chroma noise PM | dB | –25 to –70 | 0.1 | ±1.0 |
| **Timing measurements** | | | | |
| Field period, first/sec. field | ms | 20000 ±30 | 0.001 | ±0.005 |
| FP full field | ms | 40000 ±50 | 0.001 | ±0.005 |
| Equalizing pulse duration | ms | 1.35 to 3.35 | 0.001 | ±0.002 |
| Serration pulse duration | ms | 2.70 to 6.70 | 0.001 | ±0.002 |
| Line period | ms | 60 to 68 | 0.001 | ±0.002 |
| Line blanking (nom/bar) | ms | 7 to 65 | 0.001 | ±0.05 |
| Sync duration | ms | 2.7 to 6.7 | 0.001 | ±0.002 |
| Sync slope, neg/pos | ms | 70 to 1000 | 1 | ±5 |
| Burst position | ms | 4.7 to 6.0 | 0.001 | ±0.01 |
| Burst duration | ms | 1.5 to 3.0 | 0.001 | ±0.01 |
| SC/H, line/average | ° | –90 to +90 | 1 | ±4 |
| SC/H, pos p/neg p/pp | ° | –90 to +90 | 1 | ±4 |
| PAL phase, line/average | ° | 0 to 180 | 1 | ±4 |
| PAL phase, pos p/neg p/pp | ° | 0 to 180 | 1 | ±4 |
| SC frequency | Hz | 4433 618 ±100 | 0.05 | ±1 |
| **Jitter measurements** | | | | |
| Field jitter, pos p/neg p/pp | ms | 0 to 30 | 0.001 | ±0.005 |
| Field jitter, std. deviation | ms | 0 to 30 | 0.001 | ±0.005 |
| Line jitter, pos p/neg p/pp | ns | 0 to 4000 | 1 | ±5 |
| Line jitter, std. deviation | ns | 0 to 4000 | 1 | ±5 |
| **Teletext measurements** | | | | |
| Basic amplitude (abs) | mV | 0 to 1400 | 1 | ±10 |
| Basic amplitude (nom/bar) | % | –100 to +100 | 0.1 | ±2.0 |
| Decoding/timing margin | % | 0 to 100 | 0.1 | ±2.0 |
| Run-in bits | | 6 to 24 | – | - |
| Data timing | ms | 10 to 14 | 0.001 | ±0.01 |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| Video Measurement System | R&S®VSA | 2013.6057.04 |
| **Option** | | |
| Documentation of R&S®VSA Calibration Values | R&S®VSA-DCV | 2082.0490.08 |

# Content Chapter 2
# TV Transmitters



To meet modern TV transmission requirements, Rohde&Schwarz TV transmitters support all current major digital and analog standards. Actually available digital standards for example are DVB-T, DVB-H, ATSC, ATSC Mobile DTV, MediaFLO™, ISDB-$T_B$ and DTMB.

# Rohde & Schwarz – Your Competent Partner for World-wide TV Broadcast Technology

TV technology made economical and future-proof thanks to new concepts. Rohde & Schwarz is the leading manufacturer of TV transmitters. Our success is based on over 60 years of expertise in the broadcast transmitter business and on the innovative strength of our employees.

## Our principles

- We offer our customers leading-edge technology in terms of quality, reliability and innovation
- We develop and manufacture in our own plants
- We offer our customers highly profitable operation of their transmitters through competitive investment costs, low operating costs and high adaptability to future requirements
- We ensure availability of local technical support and fast servicing since we set great store by a long-term cooperation with the transmitter networks operators
- In designing new product lines, we make use of our customers' experience and requirements and of the synergies with other fields of activities of Rohde & Schwarz

## Number 1 in digital TV and mobile TV

Rohde & Schwarz is able to offer convincing products especially for digital television since early days and is involved in practically all nationwide operating networks and all major trial networks.

Similar in the new mobile TV application. Rohde & Schwarz is a leading manufacturer when it comes to important standards such as DVB-H, MediaFLO™, ATSC Mobile DTV and T-DMB.

System solutions covering everything from start to finish – advanced, application-oriented and economical. Experts from Rohde & Schwarz will advise you in all matters of TV transmitter and measurement systems. They stand for optimum project management through to scheduled commissioning and smooth startup of broadcasting operations.

## Installation and commissioning

Rohde & Schwarz installation teams ensure scheduled installation, proper alignment and startup of your TV transmitter system. We can also handle the entire transport organization, including any site-specific transport problems.

## On-the-job training

Qualified technicians and engineers of the Rohde & Schwarz training center in Munich will train your operating personnel on TV transmitter systems which correspond to your type of transmitter. Training in the Rohde & Schwarz training center in Munich will be followed by a practical briefing of your staff at the transmitter site.

### Service bridging the whole life cycle

The Rohde&Schwarz service concept offers you the security of competent staff who can be contacted at any time for your queries. Usually, questions being answerded can quickly be solved by remote diagnosis. At least 95 % of all service-relevant parts are always available through our service department. We have a permanent stock of more than 60000 spare parts and modules so that we can supply you with spare parts even when your transmitter has been operating for as long as 10 years.

Rohde&Schwarz offers a wide spectrum of TV transmitters – the custom-tailored solution for every application.

### Digital terrestrial television

The propagation of digital TV signals via terrestrial transmitter networks is a simple and versatile alternative to TV reception via cable or satellite. Mobile TV reception is thus possible without degrading of quality.

### Mobile TV

In ever more countries, mobile radio operators want to offer their customers reception of TV contents on their handhelds. All digital TV transmitters from Rohde&Schwarz can be expanded for these services.

### Exciters

All TV transmitters from Rohde&Schwarz provide highest transmission quality. Convenient monitoring via versatile interfaces and expandability to new standards cover all conceivable needs.

### High-power transmitters

Rohde&Schwarz offers TV transmitter families both for the VHF and the UHF band: high-gain power transistors as well as ultramodern production methods open up new designs for power amplifiers and power couplers. Thanks to its modular design, this TV transmitter family allows virtually all power classes from 3.5 kW to 30 kW analog or 1.3 kW to 17 kW digital as well as many and diverse standby concepts to be implemented.

### Medium-power transmitters

The air-cooled medium-power LDMOS transmitter families from 750 W to 3 kW for analog TV and from 300 W to 2 kW for digital TV are suitable for regional coverage. The simple cooling concept and modular design makes the medium-power transmitters from Rohde&Schwarz ideal for these tasks. These transmitters are available for band III (VHF) and band IV/V (UHF).

### Digital low-power transmitters

Low-power transmitters are required in digital television for closing coverage gaps as well as for data networks with cellular structure. Rohde&Schwarz provides compact solutions for digital VHF and UHF networks.

### Transposer

The R&S®XLx8000 transposer/gap filler complements the low-power digital TV transmitter family from Rohde&Schwarz. The unit receives off-air signals directly from the main transmitter and rebroadcasts them either at the same frequency (SFN gap filler) or at a new frequency (MFN transposer). Complex signal feed and modulation are therefore not required. The network coverage of digital TV transmitter systems can thus be easily expanded in line with demands and according to region.

### Rohde&Schwarz transmitters for practically all worldwide standards

Rohde&Schwarz supplies transmitters both for the US standard ATSC and for the DVB-T standard that originally came from Europe and now is being used worldwide. Additionally regional standards like the Chinese DTMB and the Brazilian ISDB-$T_B$ are supported. The same applies to the standards for mobile TV such as DVB-H, MediaFLO™, ATSC Mobile DTV and T-DMB. Rohde&Schwarz is the only manufacturer worldwide to offer a complete product range for transmission and test and measurement equipment of all modern standards from a single source.

### Analog television

The transmitters and transposers from Rohde&Schwarz are available for practically all worldwide standards (except standard L). For long-term safeguarding of capital investments, all analog transmitters can very easily be upgraded to digital TV.

# Transmitters in Containers and Prefabricated Cabins

In times of project roll-outs new ways have to be found for the construction of transmitter buildings

## Economic benefits

- Fast planning
- Short project implementation time
- Buildings and entire technical equipment from a single source
  - Optimum coordination
  - A single partner to deal with
  - Smooth handling
  - Few customer personnel involved
  - Scheduled costs adhered to
- Functional building; lifetime more than 20 years
- Adaptation of buildings to surrounding landscape
- Variable configuration
- Problem-free expansion when required

## Equipment supplied and services

- All overground construction work for the two-storey transmitter building including foundation
- Installation of TV and VHF FM transmitters as well as transmitter test and monitoring equipment
- Installation of antenna diplexers and coupling networks
- Installation of all power supply facilities and associated connections (power distribution, water- and air-cooling equipment, etc.)
- Commissioning of liquid cooling in the building
- Air conditioning of rooms (transmitter, transmission equipment and operator's room)
- Installation of fire and intrusion protection facilities
- Complete interior fittings
- Turnkey container transmitters

Flexible use of suitable transport facilities, eg lorry or helicopter.

Transport of a 10 kW TV transmitter in container to San Salvatore station (Switzerland).

## Equipment and services supplied

- Installation of transmitters and associated cooling system
- Two standard containers
  - 10‘: approx. 2.9 m × 2.3 m × 2.3 m
  - 20‘: approx. 5.9 m × 2.3 m × 2.3 m
- Full consideration of customer requirements
- Temperature-controlled rooms through air conditioning system
- Installation of all power supply facilities and associated connections
- Installation of fire and intrusion protection facilities
- Faster installation through flexible use of transport means such as lorries or helicopters
- Commissioning of the system and on-site training of operating personnel

## Expandability

- Power supply from diesel generators
- Flexibility for disaster recovery

## Problem-free operation

- Full remote control through data transmission
- Fast channel change through synthesizer oscillators in the exciters and broadband output stages
- Transportable solution for disaster recovery

Main network transmitter station Remda/Saalfeld (Germany): two-storey transmitter building.

DVB container transmitter, 4 kW version.

Overall view with transmitter mast.

DVB container transmitters, 4 kW version.

# R&S®NH/NV8600 UHF High-Power Transmitter Family

Liquid-cooled UHF high-power transmitters for digital and analog TV

- 1.3 kW to 11.8 kW for DVB-T, DVB-H, MediaFLO™, ISDB-$T_B$ and DTMB
- 1.8 kW to 16.5 kW for ATSC and ATSC Mobile DTV
- 3.5 kW to 30 kW for analog TV
- Frequency range 470 MHz to 862 MHz

The liquid-cooled R&S®NH/NV8600 UHF high-power transmitter family has been designed for the digital TV standards (DVB-T, DVB-H, ATSC, ATSC Mobile DTV, MediaFLO™, ISDB-$T_B$ and DTMB) as well as for the analog TV standards (B/G, D/K, M/N, I), color coding standards (SECAM, PAL, NTSC) and sound coding standards (FM mono, dual-sound/stereo IRT and NICAM). LDMOS transistor-based amplifiers ensure high output power while requiring only minimum space. All components are fully broadband from 470 MHz to 862 MHz (UHF bands IV/V) for both the analog and digital standards.

The transmitters with an output power from 9 kW for ATSC, 6 kW for DVB-T or 15 kW for analog TV are accommodated in only one rack 600 mm in width. This means space requirements are at a minimum, since also components such as the harmonics filter and the color subcarrier trap for analog TV are accommodated in the transmitter rack.

The transmitters include the following components:
- Exciter
- Power amplifier
- Transmitter control unit
- Transmitter rack
- Liquid cooling system

The R&S®NH/NV8600 family of UHF transmitters is based on a design concept that is common to all Rohde&Schwarz sound and TV transmitters of the R&S®Nx8000 family. This means that the transmitter control unit and the bus system for internal and external communications are identical throughout.

### R&S®Sx800 multistandard TV exciter for digital or analog signal processing

- Exciter can be converted from analog to digital at any time
- Easy software upgrade to DVB-H or ATSC Mobile DTV
- Various standby configurations
- Easy servicing due to modular design and plug-ins
- For operation in single-frequency networks, a MIP decoder enables automatic delay compensation
- Digital signal processing provides maximum stability and easy precorrection

### Liquid-cooled broadband R&S®VH8600A1 power amplifier

- For analog and digital signals without requiring any adjustment
- With innovative amplifier controller, which is used for all sound and TV transmitters of the R&S®Nx8000 family
- Output power control makes for long life for the individual transistors
- Each amplifier module is self-monitoring and self-protecting
- Based on LDMOS technology
- All amplifier modules can easily be replaced during operation

### Innovative R&S®NetCCU®800 transmitter control unit

- The R&S®NetCCU®800 clearly shows the current status of the transmitter system on a color display
- Transmitter remote control and monitoring via SNMP and/or HTTP interface
- All parameters required for diagnostics can be retrieved locally as well as remotely
- In-depth diagnostics through new bus system
- Only two height units

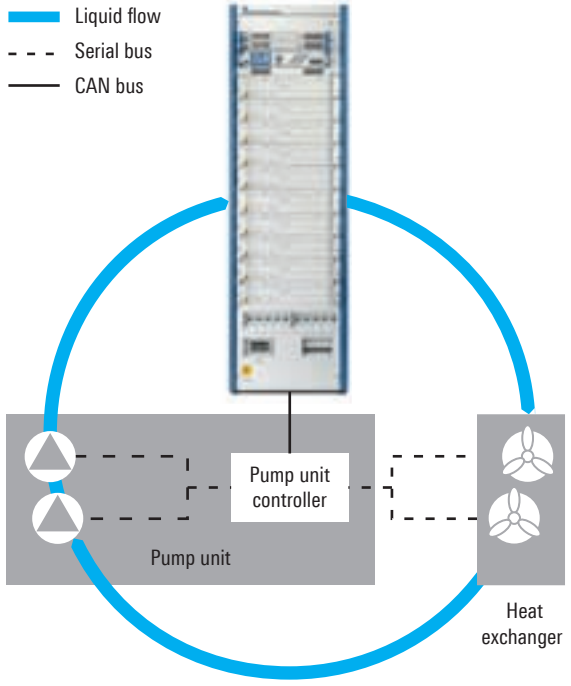
### Transmitter rack with integrated cooling

- Only one rack needed for transmitters with an output power from 9 kW (ATSC), 6 kW (DVB-T) or 15 kW (ATV)
- Only for higher power, further racks fitted with the necessary amplifier plug-ins and couplers are required
- Minimum space requirements, also components such as harmonics filter and color subcarrier trap for ATV are accommodated in the transmitter rack
- Bandpass filter for DVB-T or ATSC is mounted outside of the transmitter rack
- With transmitters in combined operation up to 10 kW, bandpass filter is installed in the transmitter rack; for higher power, the filter is mounted externally
- Connectors for modulation lines, remote control interface, etc, are located on the top of the transmitter rack
- Connectors for cooling system can be either on the top or bottom
- Tubing used throughout the cooling system is of uniform cross-section to avoid different flow rates and thus also blocking

### Cooling system

- Standard cooling system (external unit) comprises a pumping unit for each transmitter rack
- Pumping unit consists of two pumps operating in series, thus providing full redundancy
- A cooler is installed outside the transmitter room for each pumping unit
- Coolers each fitted with two fans operating in active standby, likewise for reasons of redundancy
- Transmitter control unit regulates the speed of the pumps and fans is in the coolers
- AntifrogenN used as cooling agent

**Cooling system block diagram**



## Common data for the R&S®NH/NV8600

| | |
|---|---|
| Frequency range | 470 MHz to 862 MHz |
| Power supply | 3 × 400 V ±15%, 47 Hz to 63 Hz |
| Max. installation altitude | 2000 m above sea level (up to 3000 m on request) |
| Indoor temperature range | +1 °C to +45 °C |
| Outdoor temperature range | –30 °C to +50 °C |
| Permissible relative humidity | 95 %, without condensation |
| **Inputs** | |
| Analog | 2 × video (BNC, 75 Ω), 2 × audio (XLR, 3-contact) |
| DVB-T/-H | 4 × ASI (in pairs, prepared for hierarchical modulation) |
| ATSC | 2 × SMPTE 310 (BNC, 75 Ω) |
| **Local control** | |
| Color display and keys | front-panel operation via graphical user interface (GUI) |
| RJ-45 | PC operation via standard web browser |
| **Remote control** | |
| RJ-45 | IEC 864-2 via Ethernet, standard |
| RJ-45 | network management interface (web server and/or SNMP agent), optional |
| Parallel interface | floating contacts for messages and commands, optional |
| BITBUS | bus interface in line with IEC 864-2, optional |
| **Analog TV** | |
| TV standards | B, G, D, K, M, N, I |
| Color transmission | PAL, NTSC, SECAM |
| Sound transmission | dual-sound coding in line with IRT or FM single sound and NICAM 728 (–13 dB/–20 dB) or FM single sound (–10 dB) |
| **DVB-T/-H** | coding and modulation in line with EN300744/EN302304 |
| IFFT mode | 2k and 8k, 4k for DVB-H on request |
| Useful symbol duration | 224 µs (2k), 896 µs (8k), or 448 µs (4k) |
| Modulation | QPSK, 16QAM, or 64QAM |
| Guard interval | 1/4, 1/8, 1/16, or 1/32 of useful symbol duration |
| Inner code rate | 1/2, 2/3, 3/4, 5/6, or 7/8 |
| Hierarchical coding | option on request |
| **ATSC** | in line with Doc. A53/1995 |
| Modulation | 8VSB |
| Symbol rate | 10.76 MHz |
| Data rate | 19.39 Mbit/s |
| Trellis coding | 2/3 |
| Reed-Solomon encoder | 207/187/10 |

## Specifications of the R&S®NV8600 (digital TV)

| R&S® | NV8602 | NV8603 | NV8604 | NV8605 | NV8606 | NV8608 | NV8610 | NV8612 | NV8616 | NV8620 |
|---|---|---|---|---|---|---|---|---|---|---|
| RF output power | | | | | | | | | | |
| OFDM TV [1) 2)] | 1.3 kW | 1.9 kW | 2.6 kW | 3.1 kW | 3.7 kW | 5 kW | 6.1 kW | 7.2 kW | 9.7 kW | 11.8 kW |
| ATSC [1) 3)] | 1.8 kW | 2.7 kW | 3.7 kW | 4.4 kW | 5.2 kW | 7 kW | 8.5 kW | 10.1 kW | 13.6 kW | 16.5 kW |
| RF connectors | | | | | | | | | | |
| OFDM TV | EIA 1 5/8" | EIA 1 5/8" | EIA 1 5/8" | EIA 1 5/8" | EIA 1 5/8" | EIA 3 1/8" | EIA 3 1/8" | EIA 3 1/8" | EIA 3 1/8" | EIA 3 1/8" |
| ATSC | EIA 1 5/8" | EIA 1 5/8" | EIA 1 5/8" | EIA 1 5/8" | EIA 3 1/8" | EIA 3 1/8" | EIA 3 1/8" | EIA 3 1/8" | EIA 3 1/8" | EIA 3 1/8" |
| Number of amplifiers | 2 | 3 | 4 | 5 | 6 | 8 | 10 | 12 | 16 | 20 |
| Cooling | liquid-cooled | | | | | | | | | |
| Dimensions (W × H × D) | 600 mm × 2000 mm × 1100 mm (23.6 in × 78.7 in × 43.3 in) | | | | | | 1200 mm × 2000 mm × 1100 mm (47.2 in × 78.8 in × 43.3 in) | | | |
| Reference frequency | 10 MHz, 0.1 V to 5 V ($V_{pp}$) or TTL, BNC | | | | | | | | | |
| Bandwidth | 5 MHz, 6 MHz, 7 MHz, 8 MHz for DVB-T/-H; 6 MHz for ATSC | | | | | | | | | |
| Reference pulse | 1 Hz, TTL, BNC | | | | | | | | | |

[1)] Other power ratings on request.
[2)] Average power specification: at <510 MHz approx. 10% lower power, at >662 MHz approx. 5% higher power.
[3)] Average power specification: at <510 MHz approx. 5% lower power, at >662 MHz approx. 6% higher power.

## Specifications of the R&S®NH8600 (analog TV combined)

| | R&S®NH8602 | R&S®NH8603 | R&S®NH8604 | R&S®NH8606 | R&S®NH8612 | R&S®NH8620 |
|---|---|---|---|---|---|---|
| RF output power [1] | 3.5 kW | 5 kW | 7.5 kW | 10 kW | 20 kW | 30 kW |
| Number of vision/sound amplifiers | 2 | 3 | 4 | 6 | 12 | 20 |
| Cooling | liquid-cooled | | | | | |
| Dimensions (W × H × D) | 600 mm × 2000 mm × 1100 mm (23.6 in × 78.7 in × 43.3 in) | | | | 1200 mm × 2000 mm × 1100 mm (47.2 in × 78.8 in × 43.3 in) | |
| RF connectors | EIA 1 5/8" | EIA 1 5/8" | EIA 1 5/8" | EIA 3 1/8" | EIA 3 1/8" | EIA 4 1/2" |
| Reference frequency | 10 MHz, 0.1 V to 5 V ($V_{pp}$) or TTL, BNC | | | | | |
| Bandwidth | 6 MHz, 7 MHz, 8 MHz | | | | | |

## Ordering information

| Designation | Type | Order No. [1] |
|---|---|---|
| **UHF transmitter (digital TV)** | | |
| 1.3 kW DVB-T/-H, 1.8 kW ATSC | R&S®NV8602 | 2101.4103.01 |
| 1.9 kW DVB-T/-H, 2.7 kW ATSC | R&S®NV8603 | 2101.4155.01 |
| 2.6 kW DVB-T/-H, 3.7 kW ATSC | R&S®NV8604 | 2101.4203.01 |
| 3.1 kW DVB-T/-H, 4.4 kW ATSC | R&S®NV8605 | 2101.4255.01 |
| 3.7 kW DVB-T/-H, 5.2 kW ATSC | R&S®NV8606 | 2101.4303.01 |
| 5 kW DVB-T/-H, 7 kW ATSC | R&S®NV8608 | 2101.4403.01 |
| 6.1 kW DVB-T/-H, 8.5 kW ATSC | R&S®NV8610 | 2101.4503.01 |
| 7.2 kW DVB-T/-H, 10.1 kW ATSC | R&S®NV8612 | 2101.4555.01 |
| 9.7 kW DVB-T/-H, 13.6 kW ATSC | R&S®NV8616 | 2101.4603.01 |
| 11.8 kW DVB-T/-H, 16.5 kW ATSC | R&S®NV8620 | 2101.4655.01 |
| **UHF transmitter (analog TV)** | | |
| 3.5 kW Analog | R&S®NH8602 | 2101.5100.01 |
| 5 kW Analog | R&S®NH8603 | 2101.5151.01 |
| 7.5 kW Analog | R&S®NH8604 | 2101.5200.01 |
| 10 kW Analog | R&S®NH8606 | 2101.5300.01 |
| 20 kW Analog | R&S®NH8612 | 2101.5551.01 |
| 30 kW Analog | R&S®NH8620 | 2101.5651.01 |

[1] The order numbers are for reference only. The actual order numbers of the system depend on the configuration.

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www.sales.rohde-schwarz.com

# R&S®NM/NW7000 VHF High-Power Transmitter Family

Liquid-cooled VHF high-power transmitters for digital and analog TV

- 900 W to 7.2 kW for DVB-T/H, MediaFLO™, DTMB
- 1.5 kW to 11.5 kW for ATSC/ATSC Mobile DTV
- 4 kW to 20 kW for analog TV
- Frequency range 170 MHz to 230 MHz

The liquid-cooled R&S®NM/NW7000 VHF high-power transmitter family has been designed for the digital TV standards (DVB-T, DVB-H, MediaFLO™, ATSC, and ATSC Mobile DTV) as well as for the analog TV standards (B/G, D/K, M/N, I), color coding standards (SECAM, PAL, NTSC) and sound coding standards (FM mono, dual-sound/stereo IRT and NICAM). MOSFET transistor-based amplifiers ensure high output power while requiring only minimum space. All components are fully broadband from 170 MHz to 230 MHz (VHF band III) for both the digital and analog standards.

The transmitters with a maximum output power of 3.6 kW for OFDM TV, 5.8 kW for ATSC/ATSC Mobile DTV or 10 kW for analog TV are accommodated in only one rack 630 mm in width. This means space requirements are at a minimum since also components such as the harmonics filter, the vision/sound diplexer and the color subcarrier trap for analog TV are accommodated in the transmitter rack.

The transmitters include the following components:
- Exciter
- Power amplifier(s)
- Transmitter control unit
- Transmitter rack
- Liquid cooling system

### R&S®Sx700 TV exciter with integrated control unit

- Encoder for DVB-T/H, ATSC or analog TV
- For operation in single-frequency networks, a MIP decoder enables automatic delay compensation
- Digital signal processing provides maximum stability and easy precorrection
- Operates as a transmitter control unit and provides all control functions
- Clearly shows the current status of the transmitter system on a display
- All transmitter and/or amplifier parameters required for diagnostics can be retrieved
- A NICAM module (analog transmitter) and a GPS module (digital transmitter and analog transmitter) can be installed as options

### Liquid-cooled broadband R&S®VM602A1 power amplifier

- For analog and digital signals without requiring any adjustment
- Each amplifier module is self-monitoring and self-protecting
- Based on MOSFET technology
- High linearity, excellent efficiency and compact design.
- Low junction temperature (around +120 °C) makes for long life for the individual transistors
- Each amplifier has its own integrated power supply, thus cooled by the liquid cooling system
- Practically no heat dissipated in the rack since the air circulates within the amplifier module by means of a radial blower
- Residual heat is conveyed to the cooling system via a heat exchanger
- Power supplies are fed with AC supply voltage, ie no auxiliary voltage supplies are required

### Transmitter rack with integrated cooling

- Only one rack needed for transmitters with an output power from 3.6 kW (DVB-T/H), 5.8 kW (ATSC) or 10 kW (ATV)
- Only for higher power, further racks fitted with the necessary amplifier plug-ins and couplers are required
- Minimum space requirements, also components such as harmonics filter, the vision/sound diplexer and color sub-carrier trap for ATV are accommodated in the transmitter rack
- For combined operation the bandpass filter is mounted external
- Connectors for modulation lines, remote control interface, etc, are located on the top of the transmitter rack
- Connectors for cooling system can be either on the top or bottom
- Tubing used throughout the cooling system is of uniform cross-section to avoid different flow rates and thus also blocking

### Cooling system

- Standard cooling system (external unit) comprises a pumping unit for each transmitter rack
- Pumping unit consists of two pumps operating in series, thus providing full redundancy
- A cooler is installed outside the transmitter room for each pumping unit
- Coolers each fitted with two fans operating in active standby, likewise for reasons of redundancy
- Transmitter control unit regulates the speed of the pumps and fans is in the coolers
- AntifrogenN used as cooling agent

| Common data for the R&S®NM/NW7000 | |
|---|---|
| Frequency range | 170 MHz to 230 MHz |
| Power supply | 3 × 400 V ±15%, 50 (60) Hz ±2% |
| Max. installation altitude | 2000 m above sea level (>2000 m on request) |
| Indoor temperature range | +4°C to +45°C |
| Outdoor temperature range | –30°C to +50°C |
| Permissible relative humidity | 95%, without condensation |
| **Inputs** | |
| Analog | 2 × video (BNC, 75 Ω), 2 × audio (XLR, 3-contact) |
| DVB-T/H | 4 × ASI (in pairs, prepared for hierarchical modulation) |
| ATSC | 2 × SMPTE310 (BNC, 75 Ω) |
| **Local control** | |
| Display and keys | front-panel operation |
| RS-232-C | PC operation via graphical user interface (GUI) |
| **Remote control** | |
| RJ-45 | SNMP interface and/or TCP/IP web server, optional |
| Parallel interface | floating contacts for messages and commands, optional |
| **Analog TV** | |
| TV standards | B, G, D, K, M, N, I |
| Color transmission | PAL, NTSC, SECAM |
| Sound transmission | dual-sound coding in line with IRT or FM single sound and NICAM 728 (–13 dB/–20 dB) or FM single sound (–10 dB) or broadband input for BTSC |
| **DVB-T/-H** | coding and modulation in line with EN300744 |
| IFFT mode | 2k and 8k |
| Useful symbol duration | 224 µs (2k), 896 µs (8k) |
| Modulation | QPSK, 16QAM, or 64QAM |
| Guard interval | 1/4, 1/8, 1/16, or 1/32 of useful symbol duration |
| Inner code rate | 1/2, 2/3, 3/4, 5/6, or 7/8 |
| Hierarchical coding | option on request |
| **ATSC** | in line with Doc. A53/1995 |
| Modulation | 8VSB |
| Symbol rate | 10.76 MHz |
| Data rate | 19.39 Mbit/s |
| Trellis coding | 2/3 |
| Reed-Solomon encoder | 207/187/10 |

| Specifications of the R&S®NW7000 (digital TV) | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **R&S®NW7090** | **R&S®NW7140** | **R&S®NW7230** | **R&S®NW7270** | **R&S®NW7360** | **R&S®NW7550** | **R&S®NW7720** |
| RF output power [1) 2)] (DVB-T/H) | 900 W | 1.4 kW | 2.3 kW | 2.7 kW | 3.6 kW | 5.5 kW | 7.2 kW |
| RF output power [1) 3)] (ATSC) | 1.5 kW | 2.2 kW | 3.7 kW | 4.4 kW | 5.8 kW | 8.8 kW | 11.5 kW |
| Number of amplifiers | 2 | 3 | 5 | 6 | 8 | 12 | 16 |
| Cooling | liquid-cooled | | | | | | |
| Dimensions (W × H × D) | 630 mm × 2167 mm × 1200 mm (24.8 in × 85.3 in × 47.2 in) | | | | | 1260 mm × 2167 mm × 1200 mm (49.6 in × 85.3 in × 47.2 in) | |
| RF connectors | EIA 1 $^5/_8$" | | | | | EIA 3 $^1/_8$" | |
| Reference frequency | 1 MHz, 5 MHz or 10 MHz, 0.1 V to 5 V ($V_{pp}$) or TTL, BNC | | | | | | |
| Bandwidth | 5 MHz, 7 MHz for DVB-T, 6 MHz for ATSC | | | | | | |
| Reference pulse | 1 Hz, TTL, BNC | | | | | | |

1) Other power ratings on request.
2) Average power specification: at <510 MHz approx. 10% lower power, at >662 MHz approx. 5% higher power.
3) Average power specification: at <510 MHz approx. 5% lower power, at >662 MHz approx. 6% higher power.

## Type specific data of the R&S®NM7000 transmitter family (analog TV, split)

| | R&S®NM7050 | R&S®NM7100 | R&S®NM7200 |
|---|---|---|---|
| Number of R&S®VM602A1 amplifiers (vision) | 3 | 5 | 10 |
| Number of R&S®VM602A1 amplifiers (sound) | 1 | 1 | 2 |
| HF output power | | | |
| Vision synchronous peak | 5 kW | 10 kW | 20 kW |
| Sound 1 | 250 W | 500 W | 1000 W |
| Sound 2 | 50 W | 100 W | 200 W |
| Cooling | liquid-cooled | | |
| Dimensions (W × H × D) | | | |
| Single version: 2167 mm (85.3 in) × 1200 mm (47.5 in) × | 630 mm (24.8 in) | 630 mm (24.8 in) | 1260 mm (49.6 in) |
| RF output connectors | EIA 1 5/8" | EIA 3 1/8" | |
| Reference frequency | 1 MHz, 5 MHz or 10 MHz, 0.1 V to 5 V ($V_{pp}$) or TTL, BNC | | |

## Specifications of R&S®NM7000C VHF TV transmitter (analog TV, 3.5 kW to 20 kW, combined)

| Type | R&S®NM7040C | R&S®NM7080C |
|---|---|---|
| Number of amplifiers R&S®VM602A1 (vision/sound) | 4 | 8 |
| Output power at TX output without output filter | | |
| With dual sound –13 dB/–20 dB | 5 kW | 10 kW |
| Dimensions TX (W × H × D) | | |
| Single versions: 2167 mm × 1200 mm × | 630 mm (24.8 in) | 630 mm (24.8 in) |
| A versions: 2167 mm × 1200 mm × | – | 1843 mm (72.6 in) |
| RF output connector | EIA 1 5/8" | EIA 3 1/8" |

## Ordering information

| Designation | Type | Order No. [1] |
|---|---|---|
| **VHF TV transmitter (digital TV)** | | |
| 900 W (DVB-T/H), 1.5 kW (ATSC) | R&S®NW7090 | 2089.1004.01 |
| 1.4 kW (DVB-T/H), 2.2 kW (ATSC) | R&S®NW7140 | 2089.1104.01 |
| 2.3 kW (DVB-T/H), 3.7 kW (ATSC) | R&S®NW7230 | 2089.1204.01 |
| 2.7 kW (DVB-T/H), 4.4 kW (ATSC) | R&S®NW7270 | 2089.1304.01 |
| 3.6 kW (DVB-T/H), 5.8 kW (ATSC) | R&S®NW7360 | 2089.1404.01 |
| 5.5 kW (DVB-T/H), 8.8 kW (ATSC) | R&S®NW7550 | 2089.1504.01 |
| 7.2 kW (DVB-T/H), 11.5 kW (ATSC) | R&S®NW7720 | 2089.1604.01 |
| **VHF TV transmitter (analog TV, split)** | | |
| 5 kW | R&S®NM7050 | 2089.0108.01 |
| 10 kW | R&S®NM7100 | 2089.0308.01 |
| 20 kW | R&S®NM7200 | 2089.0508.01 |
| **VHF TV transmitter (analog TV, combined)** | | |
| 5 kW | R&S®NM7040C | 2088.9101.01 |
| 10 kW | R&S®NM7080C | 2088.9201.01 |

[1] The order numbers are for reference only. The actual order numbers of the system depend on the configuration.

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# R&S®NH/NV8300 UHF Medium-Power Transmitter Family

Air-cooled UHF medium-power transmitters for digital and analog TV

- 300 W to 1.8 kW for DVB-T, DVB-H, MediaFLO™, ISDB-$T_B$ and DTMB
- 450 W to 1.8 kW for ATSC and ATSC Mobile DTV
- 750 W to 2.8 kW for analog TV
- Frequency range 470 MHz to 862 MHz

The air-cooled R&S®NH/NV8300 UHF medium-power transmitter family has been designed for digital TV standards (DVB-T, DVB-H, ATSC, ATSC Mobile DTV, MediaFLO™, ISDB-$T_B$ and DTMB) as well as for analog TV standards (B/G, K, M/N, I), color coding standards (SECAM, PAL, NTSC) and sound coding standards (FM mono, dual-sound/stereo IRT and NICAM). LDMOS transistor-based amplifiers ensure high output power while requiring only minimum space.

All components are fully broadband from 470 MHz to 862 MHz (UHF bands IV/V) for both the digital and analog standards. The available output power ranges from 300 W to 1.8 kW (OFDM TV), 450 W to 1.8 kW (ATSC/ ATSC Mobile DTV) for digital TV as well as from 750 W to 2.8 kW for analog TV (combined).

The transmitters include the following components:
- Exciter
- Power amplifier(s)
- Transmitter control unit
- Transmitter rack with cooling system

The R&S®NH/NV8300 family of UHF transmitters is based on a design concept that is common to all Rohde&Schwarz sound and TV transmitters of the R&S®Nx8000 family. This means that the transmitter control unit and the bus system for internal and external communications are identical throughout.

## R&S®Sx800 multistandard TV exciter for digital or analog signal processing

- The exciter can be converted from analog to digital at any time
- Easy software upgrade to DVB-H
- Various standby configurations
- Easy servicing due to modular design and plug-ins
- For operation in single-frequency networks, a MIP decoder enables automatic delay compensation
- Digital signal processing provides maximum stability and easy precorrection

## Air-cooled broadband R&S®VH8300A1 power amplifier

- For digital and analog signals without requiring any adjustment
- With innovative amplifier controller, which is used for all sound and TV transmitters of the R&S®Nx8000 family
- Output power control makes for long life for the individual transistors
- Each amplifier module is self-monitoring and self-protecting
- Based on LDMOS technology
- All amplifier modules can easily be replaced during operation

## Innovative R&S®NetCCU®800 transmitter control unit

- The R&S®NetCCU®800 clearly shows the current status of the transmitter system on a color display
- Transmitter remote control and monitoring via SNMP and/or HTTP interface
- All parameters required for diagnostics can be retrieved locally as well as remotely
- In-depth diagnostics through new bus system
- Only two height units

## Transmitter rack with integrated cooling

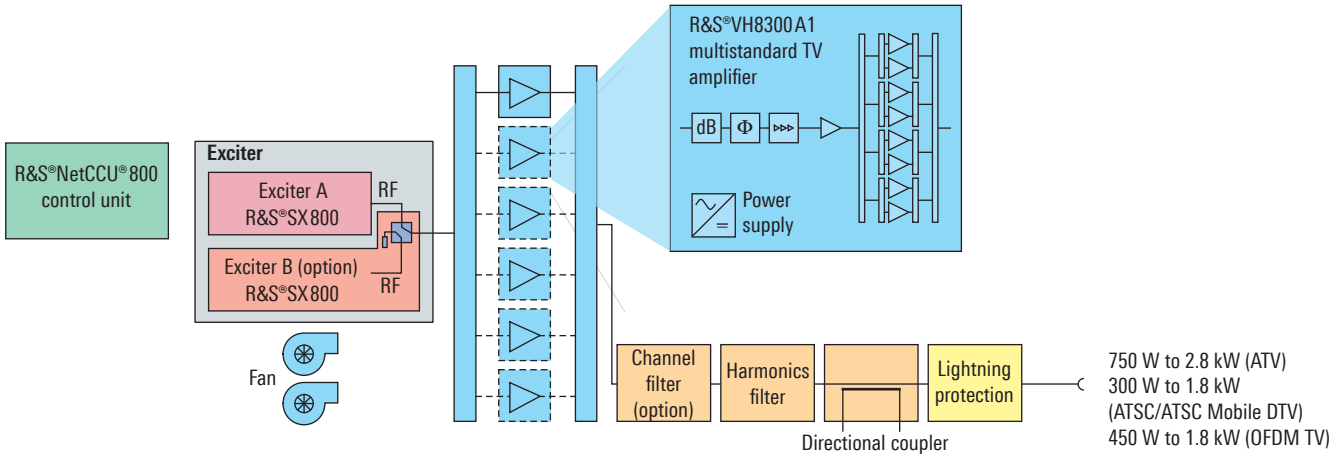
- Same 19" rack (depth 800 mm) used for all power classes
- One rack accommodates up to six amplifier modules
- Contains two built-in fans that operate in active standby
- Various air ducting configurations
- Effective cooling only with small amounts of air; this considerably reduces the cooling system's power consumption and noise generation

## Cooling system

Possible configurations: all degrees of freedom


The inlet air can be taken from the bottom, the top or from the rear of the transmitter; the outlet air can be expelled at the bottom or at the top of the transmitter.

## Block diagram of an R&S®NH/NV8300 TV transmitter



## Specifications common to the R&S®NH/NV8300

| | |
|---|---|
| Frequency range | 470 MHz to 862 MHz |
| Power supply | |
| 3-phase operation | 3 × 400 V AC ±15%; 47 Hz to 63 Hz |
| L1 – N, single-phase operation | 230 V AC ±15%, 50/60 Hz, 47 Hz to 63 Hz |
| L1 – L2, single-phase operation | 240 V AC +10%/–15%, 50/60 Hz, 47 Hz to 63 Hz |
| Max. installation altitude | 2000 m above sea level (>2000 m on request) |
| Operating temperature range | +1°C to +45°C |
| Permissible relative humidity | 95%, without condensation |
| Dimensions (W × H × D) | 600 mm × 2000 mm × 800 mm (23.6 in × 78.7 in × 31.5 in) |
| RF connector | $1\,^{5}/_{8}$ EIA |
| **Synchronization** | |
| Reference frequency | 10 MHz, 0.1 V to 5 V ($V_{pp}$) or TTL, BNC |
| Reference pulse | 1 Hz, TTL, BNC |
| **Local control** | |
| Color display and keys | front-panel operation via graphical user interface (GUI) |
| RJ-45 | PC operation via standard web browser |
| **Remote control** | |
| RJ-45 | IEC 864-2 via Ethernet, standard |
| RJ-45 | network management interface (web server and/or SNMP agent), optional |
| Parallel interface | floating contacts for messages and commands, optional |
| Bit bus | bus interface, in line with IEC 864-2, optional |

## Specifications of the R&S®NV8300 for DVB-T/H (in line with EN 300744/EN 302304)

| | R&S®NV8301 | R&S®NV8302 | R&S®NV8303 | R&S®NV8304 | R&S®NV8305 | R&S®NV8306 |
|---|---|---|---|---|---|---|
| Number of amplifiers | 1 | 2 | 3 | 4 | 5 | 6 |
| RF output power [1] | 300 W | 600 W | 900 W | 1.2 kW | 1.5 kW | 1.8 kW |
| Rate of air flow | 8.5 m³/min | 11 m³/min | 15 m³/min | 17 m³/min | 17 m³/min | 17 m³/min |
| Inputs (DVB-T/-H) | 4 × ASI | | | | | |
| Coding and modulation | in line with EN 300744, EN 302304 (optional) | | | | | |
| Modulation | QPSK, 16QAM or 64QAM | | | | | |
| Guard interval | 1/4, 1/8, 1/16 or 1/32 of useful symbol duration | | | | | |
| IFFT mode | 2k and 8k, 4k (optional) | | | | | |
| Inner code rate | 1/2, 2/3, 3/4, 5/6 or 7/8 | | | | | |
| Useful symbol duration | 224 µs (2k) or 896 µs (8k), 448 µs (4k, optional) | | | | | |

## Specifications of the R&S®NV8300 for ATSC/ATSC Mobile DTV (in line with Doc. 53/1995)

| | R&S®NV8301 | R&S®NV8302 | R&S®NV8303 | R&S®NV8304 |
|---|---|---|---|---|
| Number of amplifiers | 1 | 2 | 3 | 4 |
| RF output power [2] | 450 W | 900 W | 1.35 kW | 1.8 kW |
| Rate of air flow | 8.5 m³/min | 11 m³/min | 15 m³/min | 17 m³/min |
| Inputs (ATSC) | 2 × SMPTE + 2 × ASI | | | |
| Modulation | 8VSB | | | |
| Symbol rate | 10.76 MHz | | | |
| Data rate | 19.39 Mbit/s | | | |
| Trellis coding | 2/3 | | | |
| Reed-Solomon encoding | 207/187/10 | | | |

## Specifications of the R&S®NH8300 for analog TV

| | R&S®NH8301 | R&S®NH8302 | R&S®NH8303 | R&S®NH8304 |
|---|---|---|---|---|
| Number of amplifiers | 1 | 2 | 3 | 4 |
| RF output power (dual sound) | 750 W | 1.5 kW | 2.25 kW | 2.8 kW |
| Rate of air flow | 8.5 m³/min | 11 m³/min | 15 m³/min | 17 m³/min |
| Reference frequency | 10 MHz, 0.1 V to 5 V ($V_{pp}$) or TTL, BNC | | | |
| TV standards | B, G, K, M, N, I | | | |
| Color transmission | PAL, NTSC, SECAM | | | |
| Inputs (video) | 2 × video | | | |
| Inputs (audio) | without NICAM: 2 × AF with NICAM: 2 × AF + 1 × AF for third language; standard M/N: 1 × AF + 1 × BTSC (BNC) | | | |
| Sound transmission | dual-sound coding in line with IRT, FM single-sound and NICAM 728 (–13 dB/–20 dB) (optional); FM single-sound (–10 dB), BTSC input | | | |

[1] Average power specification: at <510 MHz approx. 10% lower power, at >662 MHz approx. 5% higher power.
[2] Average power specification: at <510 MHz approx. 5% lower power, at >662 MHz approx. 6% higher power.

## Ordering information

| Designation | Line source | Type | Order No. |
|---|---|---|---|
| **UHF transmitter (digital TV)** | | | |
| 300 W DVB-T/-H, 450 W ATSC | three-phase | R&S®NV8301 | 2098.0307.01[1] |
| 600 W DVB-T/-H, 900 W ATSC | three-phase | R&S®NV8302 | 2098.0059.01[1] |
| 900 W DVB-T/-H, 1.35 kW ATSC | three-phase | R&S®NV8303 | 2098.0107.01[1] |
| 1.2 kW DVB-T/-H, 1.8 kW ATSC | three-phase | R&S®NV8304 | 2098.0159.01[1] |
| 1.5 kW DVB-T/-H | three-phase | R&S®NV8305 | 2098.0207.01[1] |
| 1.8 kW DVB-T/-H | three-phase | R&S®NV8306 | 2098.0259.01[1] |
| 300 W DVB-T/-H, 450 W ATSC | single-phase | R&S®NV8301 | 2105.0054.01 |
| 600 W DVB-T/-H, 900 W ATSC | single-phase | R&S®NV8302 | 2105.0102.01 |
| 900 W DVB-T/-H, 1.35 kW ATSC | single-phase | R&S®NV8303 | 2105.0154.01 |
| 1.2 kW DVB-T/-H, 1.8 kW ATSC | single-phase | R&S®NV8304 | 2105.0202.01 |
| 1.5 kW DVB-T/-H | single-phase | R&S®NV8305 | 2105.0254.01 |
| 1.8 kW DVB-T/-H | single-phase | R&S®NV8306 | 2105.0302.01 |
| **UHF transmitter (analog TV)** | | | |
| 750 W | three-phase | R&S®NH8301 | 2098.1503.01[1] |
| 1.5 kW | three-phase | R&S®NH8302 | 2098.1555.01[1] |
| 2.25 kW | three-phase | R&S®NH8303 | 2098.1603.01[1] |
| 2.8 kW | three-phase | R&S®NH8304 | 2098.1655.01[1] |
| 750 W | single-phase | R&S®NH8301 | 2105.0554.01 |
| 1.5 kW | single-phase | R&S®NH8302 | 2105.0602.01 |
| 2.25 kW | single-phase | R&S®NH8303 | 2105.0654.01 |
| 2.8 kW | single-phase | R&S®NH8304 | 2105.0702.01 |

[1] The order numbers are for reference only. The actual order numbers of the system depend on the configuration.

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# R&S®NM/NW8200 VHF Medium-Power Transmitter Family

Air-cooled transmitters for digital and analog TV

- 330 W to 2 kW for DVB-T, DVB-H, MediaFLO™, ISDB-$T_B$ and DTMB
- 500 W to 2 kW for ATSC and ATSC Mobile DTV
- 750 W to 3 kW for analog TV
- Frequency range 170 MHz to 250 MHz

The air-cooled R&S®NM/NW8200 VHF medium-power transmitter family has been designed for the digital TV standards (DVB-T, DVB-H, MediaFLO™, ATSC, ATSC Mobile DTV, ISDB-$T_B$ and DTMB) as well as for the analog TV standards (B/G, D/K, M/N, I), color coding standards (SECAM, PAL, NTSC) and sound coding standards (FM mono, dual-sound/stereo IRT and NICAM). MOSFET transistor-based amplifiers ensure high output power while requiring only minimum space.

All components are fully broadband from 170 MHz to 250 MHz (VHF band III) for both the digital and analog standards. The transmitters include the components exciter, power amplifier(s), transmitter control unit and transmitter rack with cooling system.

The transmitters include the following components:
- Exciter
- Power amplifier(s)
- Transmitter control unit
- Transmitter rack with cooling system

The R&S®NM/NW8200 family of UHF transmitters is based on a design concept that is common to all Rohde&Schwarz sound and TV transmitters of the R&S®Nx8000 family. This means that the transmitter control unit and the bus system for internal and external communications are identical throughout.

## R&S®Sx800 multistandard TV exciter for digital or analog signal processing

- The exciter can be converted from analog to digital at any time
- Easy software upgrade to DVB-H
- Various standby configurations
- Easy servicing due to modular design and plug-ins
- For operation in single-frequency networks, a MIP decoder enables automatic delay compensation
- Digital signal processing provides maximum stability and easy precorrection

## Air-cooled broadband R&S®VM8350A1 power amplifier

- For digital and analog signals without requiring any adjustment
- With innovative amplifier controller, which is used for all sound and TV transmitters of the R&S®Nx8000 family
- Output power control makes for long life for the individual transistors
- Each amplifier module is self-monitoring and self-protecting
- Based on MOSFET technology
- All amplifier modules can easily be replaced during operation

## Innovative R&S®NetCCU®800 transmitter control unit

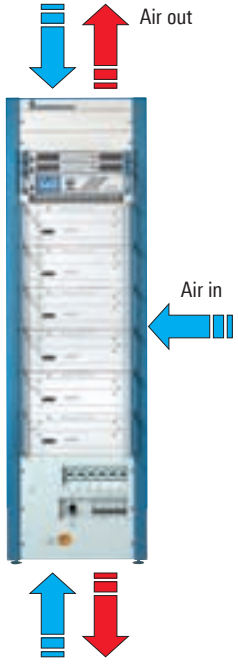
- The R&S®NetCCU®800 clearly shows the current status of the transmitter system on a color display
- Transmitter remote control and monitoring via SNMP and/or HTTP interface
- All parameters required for diagnostics can be retrieved locally as well as remotely
- In-depth diagnostics through new bus system
- Only two height units

## Transmitter rack with integrated cooling

- Same 19" rack (depth 800 mm) used for all power classes
- One rack accommodates up to six amplifier modules
- Contains two built-in fans that operate in active standby
- Various air ducting configurations
- Effective cooling only with small amounts of air; this considerably reduces the cooling system's power consumption and noise generation

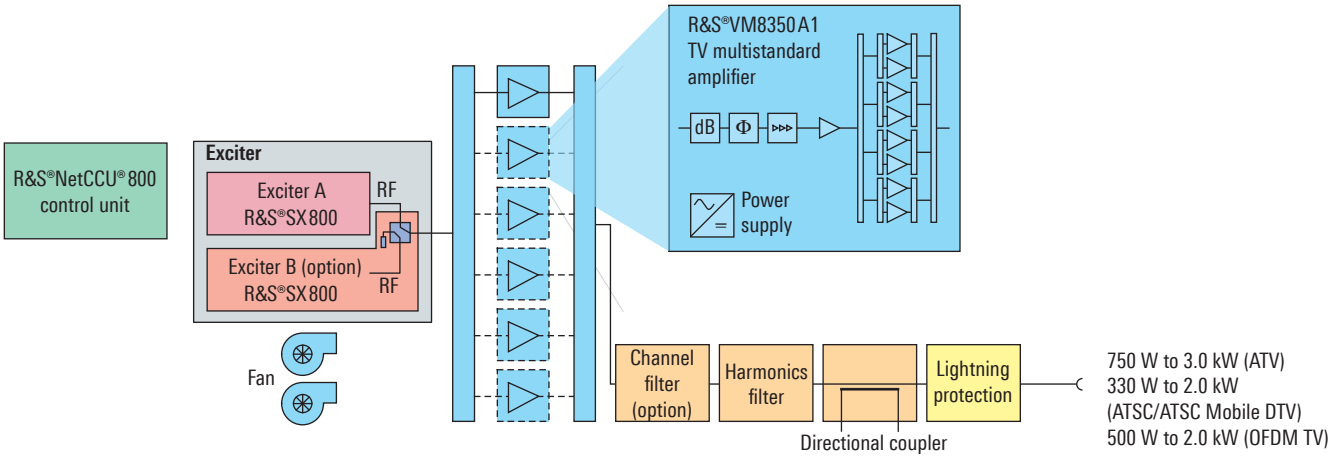
## Cooling system

Possible configurations: all degrees of freedom




The inlet air can be taken from the bottom, the top or from the rear of the transmitter; the outlet air can be expelled at the bottom or at the top of the transmitter.

## Block diagram of an R&S®NM/NW8200 TV transmitter



| Specifications common to the R&S®NM/NW8200 | |
|---|---|
| Frequency range | 170 MHz to 250 MHz |
| Power supply , 3-phase operation | 3 × 400 V AC ±15 %; 47 Hz to 63 Hz |
| Max. installation altitude | 2000 m above sea level (>2000 m on request) |
| Operating temperature range | +1 °C to +45 °C |
| Permissible relative humidity | 95 %, without condensation |
| Dimensions (W × H × D) | 600 mm × 2000 mm × 800 mm (23.6 in × 78.7 in × 31.5 in) |
| RF connector | $1\,^{5}/_{8}$ EIA |
| **Synchronization** | |
| Reference frequency | 10 MHz, 0.1 V to 5 V ($V_{pp}$) or TTL, BNC |
| Reference pulse | 1 Hz, TTL, BNC |
| **Local control** | |
| Color display and keys | front-panel operation via graphical user interface (GUI) |
| RJ-45 | PC operation via standard web browser |
| **Remote control** | |
| RJ-45 | IEC 864-2 via Ethernet, standard |
| RJ-45 | network management interface (web server and/or SNMP agent), optional |
| Parallel interface | floating contacts for messages and commands, optional |
| Bit bus | bus interface, in line with IEC 864-2, optional |

| Specifications of the R&S®NW8200 for DVB-T/-H (in line with EN 300744/EN 302304) | | | | | | |
|---|---|---|---|---|---|---|
| | **R&S®NW8201** | **R&S®NW8202** | **R&S®NW8203** | **R&S®NW8204** | **R&S®NW8205** | **R&S®NW8206** |
| Number of amplifiers | 1 | 2 | 3 | 4 | 5 | 6 |
| RF output power | 330 W | 660 W | 1 kW | 1.3 kW | 1.65 kW | 2 kW |
| Rate of air flow | 8.5 m³/min | | | 17 m³/min | | |
| Inputs (DVB-T/-H) | 4 × ASI | | | | | |
| Coding and modulation | in line with EN 300744, EN 302304 (optional) | | | | | |
| Modulation | QPSK, 16QAM or 64QAM | | | | | |
| Guard interval | 1/4, 1/8, 1/16 or 1/32 of useful symbol duration | | | | | |
| IFFT mode | 2 k and 8 k, 4 k (optional) | | | | | |
| Inner code rate | 1/2, 2/3, 3/4, 5/6 or 7/8 | | | | | |
| Useful symbol duration | 224 µs (2 k) or 896 µs (8 k), 448 µs (4 k, optional) | | | | | |

| Specifications of the R&S®NW8200 for ATSC/ATSC Mobile DTV (in line with Doc. 53/1995) | | | | |
|---|---|---|---|---|
| | **R&S®NW8201** | **R&S®NW8202** | **R&S®NW8203** | **R&S®NW8204** |
| Number of amplifiers | 1 | 2 | 3 | 4 |
| RF output power | 500 W | 1 kW | 1.5 kW | 2 kW |
| Rate of air flow | 8.5 m³/min | | 17 m³/min | |
| Inputs (ATSC) | 2 × SMPTE + 2 × ASI | | | |
| Modulation | 8VSB | | | |
| Symbol rate | 10.76 MHz | | | |
| Data rate | 19.39 Mbit/s | | | |
| Trellis coding | 2/3 | | | |
| Reed-Solomon encoding | 207/187/10 | | | |

## Specifications of the R&S®NM8200 for analog TV

| | R&S®NM8201 | R&S®NM8202 | R&S®NM8203 | R&S®NM8204 |
|---|---|---|---|---|
| Number of amplifiers | 1 | 2 | 3 | 4 |
| RF output power (dual sound) | 750 W | 1.5 kW | 2.25 kW | 3 kW |
| Rate of air flow | 8.5 m³/min | | 17 m³/min | |
| Reference frequency | 10 MHz, 0.1 V to 5 V ($V_{pp}$) or TTL, BNC | | | |
| TV standards | B, G, K, M, N, I | | | |
| Color transmission | PAL, NTSC, SECAM | | | |
| Inputs (video) | 2 × video | | | |
| Inputs (audio) | without NICAM: 2 × AF with NICAM: 2 × AF + 1 × AF for third language; standard M/N: 1 × AF + 1 × BTSC (BNC) | | | |
| Sound transmission | dual-sound coding in line with IRT, FM single-sound and NICAM 728 (–13 dB/–20 dB) (optional); FM single-sound (–10 dB), BTSC input | | | |

## Ordering information

| Designation | Type | Order No. [1] |
|---|---|---|
| **UHF transmitter (digital TV)** | | |
| 330 W DVB-T/-H, 500 W ATSC/ATSC Mobile DTV | R&S®NW8201 | 2098.0307.01 |
| 660 W DVB-T/-H, 1 kW ATSC/ATSC Mobile DTV | R&S®NW8202 | 2098.0059.01 |
| 1 kW DVB-T/-H, 1.5 kW ATSC/ATSC Mobile DTV | R&S®NW8203 | 2098.0107.01 |
| 1.3 kW DVB-T/-H, 2 kW ATSC/ATSC Mobile DTV | R&S®NW8204 | 2098.0159.01 |
| 1.65 kW DVB-T/-H, 2 kW ATSC/ATSC Mobile DTV | R&S®NW8205 | 2098.0207.01 |
| 2 kW DVB-T/-H, 2 kW ATSC/ATSC Mobile DTV | R&S®NW8206 | 2098.0259.01 |
| **UHF transmitter (analog TV)** | | |
| 750 W | R&S®NM8201 | 2098.1503.01 |
| 1.5 kW | R&S®NM8202 | 2098.1555.01 |
| 2.25 kW | R&S®NM8203 | 2098.1603.01 |
| 3 kW | R&S®NM8204 | 2098.1655.01 |

[1] The order numbers are for reference only. The actual order numbers of the system depend on the configuration.

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# R&S®SCx8000 UHF Low/Medium-Power Transmitter Family

## Compactness and cost-effectiveness unique in its power class

- UHF transmitters for TV from 200 W to 600 W
- Compact and cost-effective transmitter family offering the high quality that Rohde&Schwarz stands for
- New redundancy concepts for economical use of available space
- High efficiency for reduced energy costs
- Set&go function providing system precorrection

The R&S®SCx8000 UHF low-power transmitter family offers compactness and cost-effectiveness unique in its power class. Designed for professional TV broadcast networks, the R&S®SCx8000 features intelligent redundancy concepts for the exciter and the amplifier and allows easy switchover from analog to digital transmission. The transmitters are innovative, robust, failsafe and easy to put into operation. This makes them ideal for use at remote sites and in outdoor applications.

The R&S®SCx8000 transmitter family covers the analog TV standards and the ATSC, ATSC Mobile DTV, DVB-T/-H and MediaFLO™ digital TV standards. The transmitters can be switched from analog to digital transmission. The R&S®SCx8000 comes with broadband precorrection data for each digital standard.

With output powers from 200 W to 600 W for DVB-T/-H, the R&S®SCx8000 can be used for expanding existing transmitter networks and filling coverage gaps. Rolling out or expanding a transmitter network may require large numbers of transmitters; yet costs must be kept to a minimum. Here, the R&S®SCx8000 proves to be the ideal choice: It comes with the high quality that Rohde&Schwarz stands for and offers an excellent price/performance ratio. Follow-up costs are just as favorable: Due to its ultracompact design, the R&S®SCx8000 reduces infrastructure, rental and installation costs. The transmitter's high efficiency ensures low energy costs throughout the product lifecycle.

Availability is the crucial factor for operators of transmitter systems. The new backup exciter redundancy concept eliminates the need for a separate transmitter control. This lowers costs and increases system availability. Each amplifier comes with two power supplies. This ensures high failsafety, which can be further enhanced by adding a third, optional power supply.

## Innovative, compact design

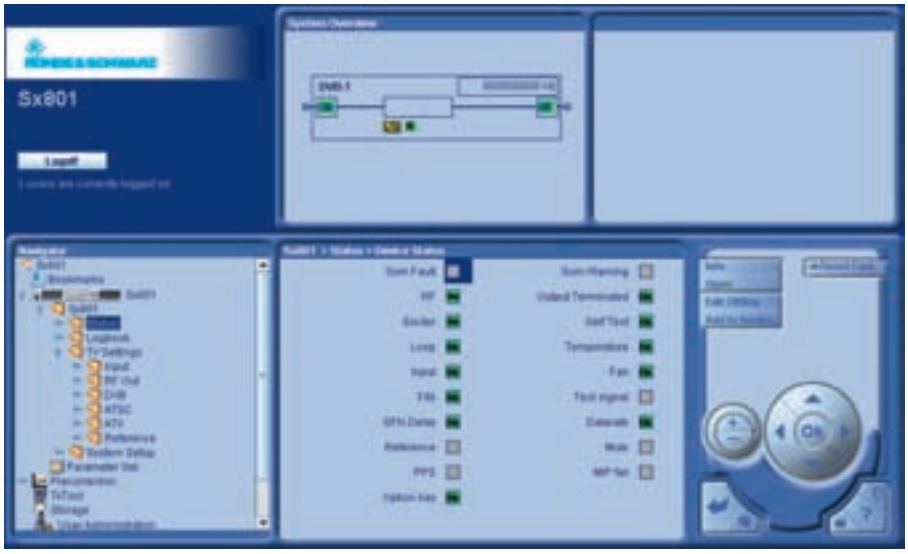
- Transmitters with high power density
- Autonomous cooling concept for flexible use
- New redundancy concepts increase availability and save space

## Special features for operation

- Significant reduction in energy costs
- Precorrection for digital standards with set&go function
- Solutions for migrating from analog to digital TV
- Operation either hands-on or via web browser
- Excellent noise level

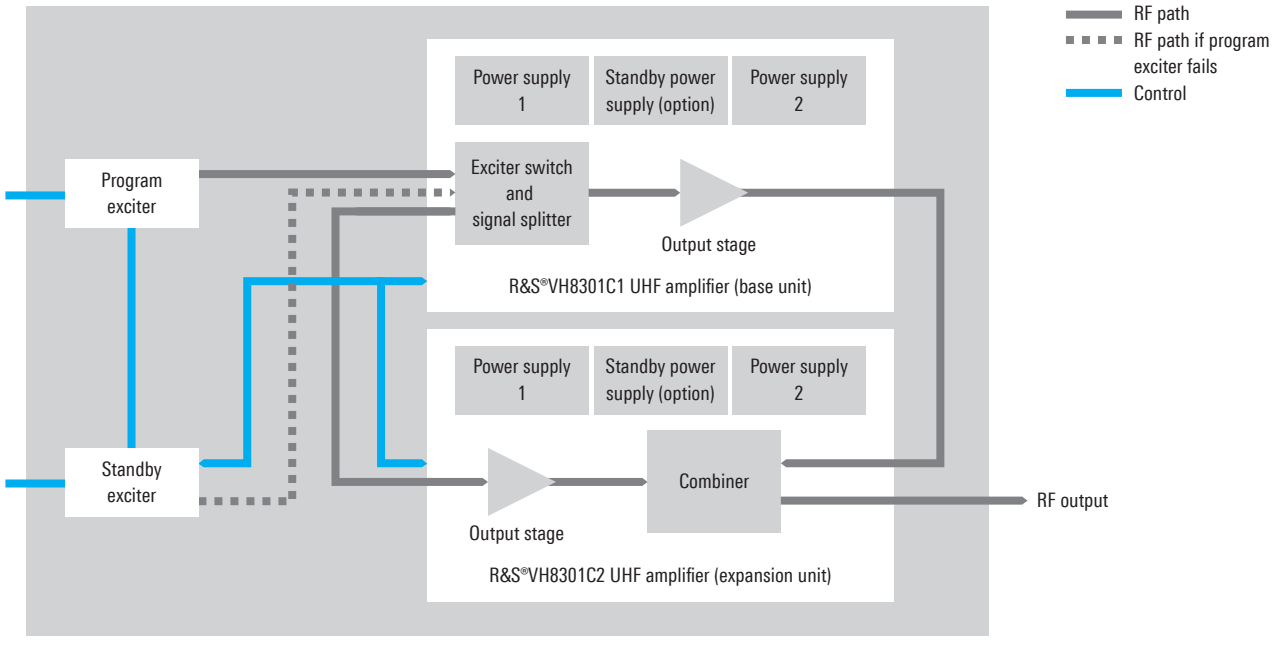
## Continuous coverage

- "Everything from a single source" means utmost quality from Rohde&Schwarz
- Additional transmitter redundancy concepts
- Self-monitoring power output stages
- Optimal power supply design




Typical start menu for operation via the web browser.

## Simplified block diagram of the R&S®SCx8000 with two amplifiers and a backup exciter



## R&S®SCx8000 output powers (rms) [1)]

| Configured as | R&S®SCV8201x | R&S®SCV8301x | R&S®SCV8202x | R&S®SCV8302x |
|---|---|---|---|---|
| DVB-T/DVB-H, MediaFLO™ | 200 W | 300 W | 400 W | 600 W |
| ATSC, ATSC Mobile DTV | 300 W | 450 W | 600 W | 900 W |
| Analog TV (sync peak) | 500 W | 700 W | 1 kW | 1.4 kW |
| RF output | N | N | 7/16 | 7/16 |

1) Without output filter. Important: To comply with the applicable standards and limit values for the suppression of out-of-band emissions (and in the case of digital standards, also for maintaining the required shoulder distance), the transmitter may only be operated with suitable filters at the RF output.

## General data

| | |
|---|---|
| **Frequency range** | |
| UHF (band IV/V) | 470 MHz to 862 MHz |
| Digital standards | DVB-T, DVB-H, ATSC, ATSC Mobile DTV, MediaFLO™ |
| Analog standards | B/G, D/K, M, M1, N, I, I1 |
| **Power supply** | |
| AC | 100 V to 240 V + 10%, 47 Hz to 63 Hz |
| DC (option for exciter) | –48 V (–38 V to –72 V) |
| **Synchronization** | |
| Reference frequency | 10 MHz, –5 dBm to +20 dBm or LVT, BNC |
| Reference pulse | 1 pps (1 Hz, TTL, BNC) |
| **Operation** | |
| Display, keypad and status LEDs | local operation and display, 200 × 48 pixel color display |
| Ethernet interface, RJ-45 | convenient local or remote control via standard web browser |
| Parallel remote control interface | floating contacts for messages and commands |
| **Environmental conditions** | |
| Max. installation height | 2000 m above sea level (>2000 m on request) |
| Operating temperature range | +1°C to +45°C |
| Relative humidity (max.) | 95%, non-condensing |
| **Dimensions (W × H × D)** | |
| R&S®SCV8201x, R&S®SCV8301x | 483 mm (19") × 4 HU × 550 mm 19 in × 4 HU × 22.7 in |
| R&S®SCV8202x, R&S®SCV8302x | 483 mm (19") × 7 HU × 550 mm 19 in × 7 HU × 22.7 in |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| **Typical configuration of UHF transmitter for DVB-T, 600 W rms:** R&S®SCV8302E Low-Power Transmitter, UHF (470 MHz to 862 MHz), without rack, single-phase, AC, 600 W rms DVB-T output power, consisting of: | | |
| Exciter, 1 HU, base unit | R&S®SX801 | 2104.4504K02 |
| UHF Amplifier, DVB-T, 300 W rms, base unit | R&S®VH8301C1 | 2104.8000K02 |
| UHF amplifier, DVB-T, 300 W rms, expansion unit | R&S®VH8301C2 | 2104.8000K02 |

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# R&S®SV8000 UHF Low-Power Transmitter Family

Air-cooled low-power transmitters for digital TV: DVB-T, DVB-H, ATSC, ATSC Mobile DTV, MediaFLO™, ISDB-$T_B$ and DTMB

- Output power 12 W to 400 W (DVB-T/DVB-H) and 18 W to 460 W (ATSC)
- Frequency range from 470 MHz to 862 MHz
- Flexible, scalable and upgradeable
- Highly compact
- Various standby systems available
- Power amplifiers based on LDMOS technology
- Transmitter remote control and monitoring via SNMP and/or HTTP interface

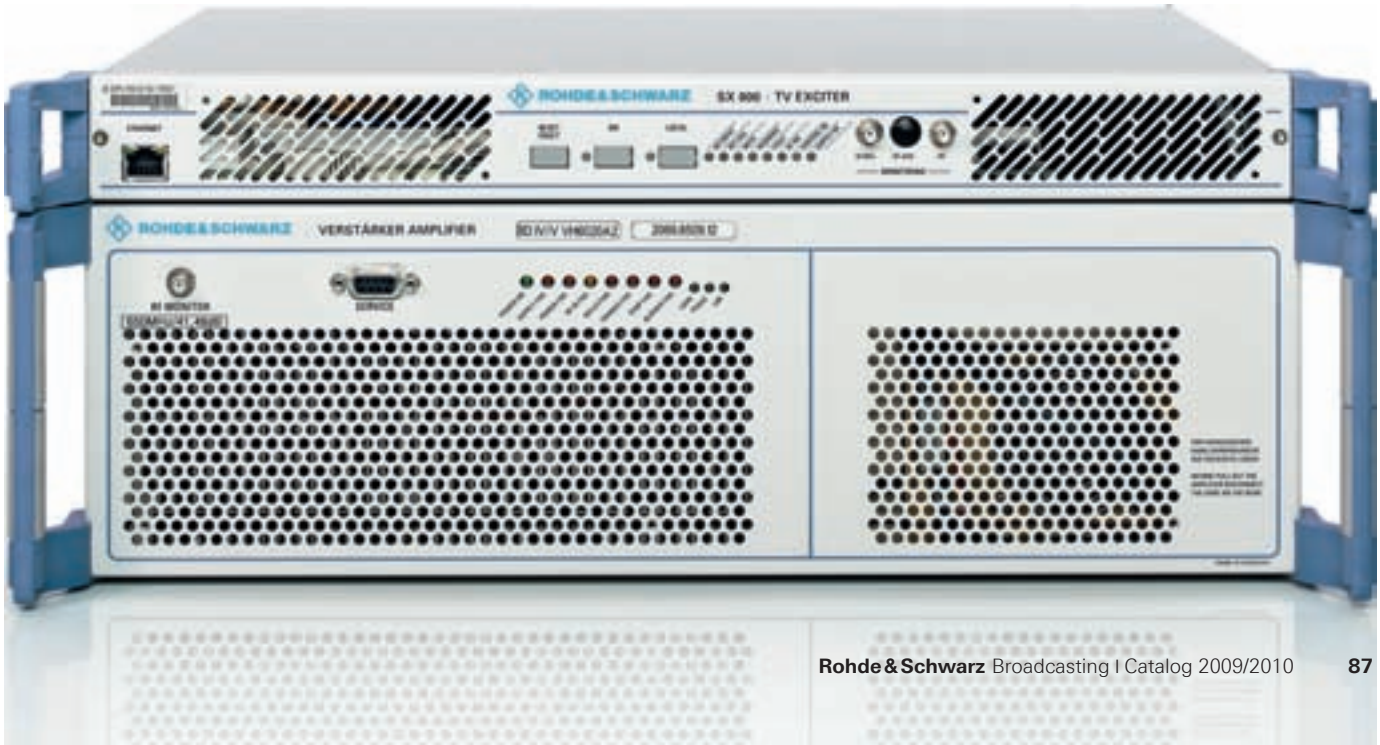
R&S®SV8000 is a complete family of UHF low-power DVB-T, DVB-H and ATSC transmitting equipment to cover the following applications:

- DVB-T/H transmitter with standard ASI signal as input
- ATSC transmitter with SMPTE 310M interface
- DVB-T retransmitter for rebroadcasting an off-air signal

The family is designed as a flexible and compact system consisting of different modules that can be selected and interconnected in accordance with the required application and output power. The main building blocks are the following:

- R&S®Sx800 DVB-T, DVB-H or ATSC exciter
- R&S®VH6xxx amplifiers with integrated power supply (12 W/18 W to 100 W/130 W DVB/ATSC output power)
- R&S®NetCCU®800 as an expanded system controller for standby configurations and/or as a network-oriented remote control unit for SNMP and web

Since the exciter stage is equipped with an amplifier control unit, single transmitters up to 100 W DVB-T/DVB-H (130 W ATSC) are available as standalone systems. Only two modules, exciter and amplifier, are required in this case. All operation-relevant interfaces are fully integrated into the units. Additional components to be built into a rack are required only for standby systems or if several amplifiers are combined to boost output power. 19" racks of 12, 21 and 42 height units are available.



## R&S®SX800 TV exciter

- State-of-the-art technology, only one height unit
- Full signal processing from the transport stream to the standard-conforming RF output signal
- Universal input stage – capable of handling all operating modes of the DVB-T/-H and ATSC standards
  - Four ASI inputs (DVB-T/-H) or two SMPTE 310M and two ASI inputs (ATSC)
  - Input interface monitors packet synchronization and data rate of input signals
  - Input data buffers eliminate line-side jitter and wander effects
  - Seamless, automatic input signal switching ensures redundant signal feed
- MIP decoder in line with TS 101191 for operation in single-frequency networks (SFN)
- Decoder enables automatic delay compensation and automatic operating mode detection
- Digital signal processing ensures maximum stability and allows easy precorrection
- I and Q signals are taken to a linear and nonlinear precorrector for 100% reproducibility of the RF signal

## R&S®VH6xxx power amplifiers

- Single power amplifier modules of 12/25/50/100 W for DVB-T/-H or 18/35/70/130 W for ATSC
- Broadband amplifiers from 470 MHz to 862 MHz
- Power supply and cooling system integrated, thus requiring no peripherals
- Flexible installation in a standard 19" rack or even operation without any rack at all
- Exclusively LDMOS technology for high basic linearity and stability of amplifier characteristic
- Built-in protective circuit safeguards the amplifiers against reflection and overheating

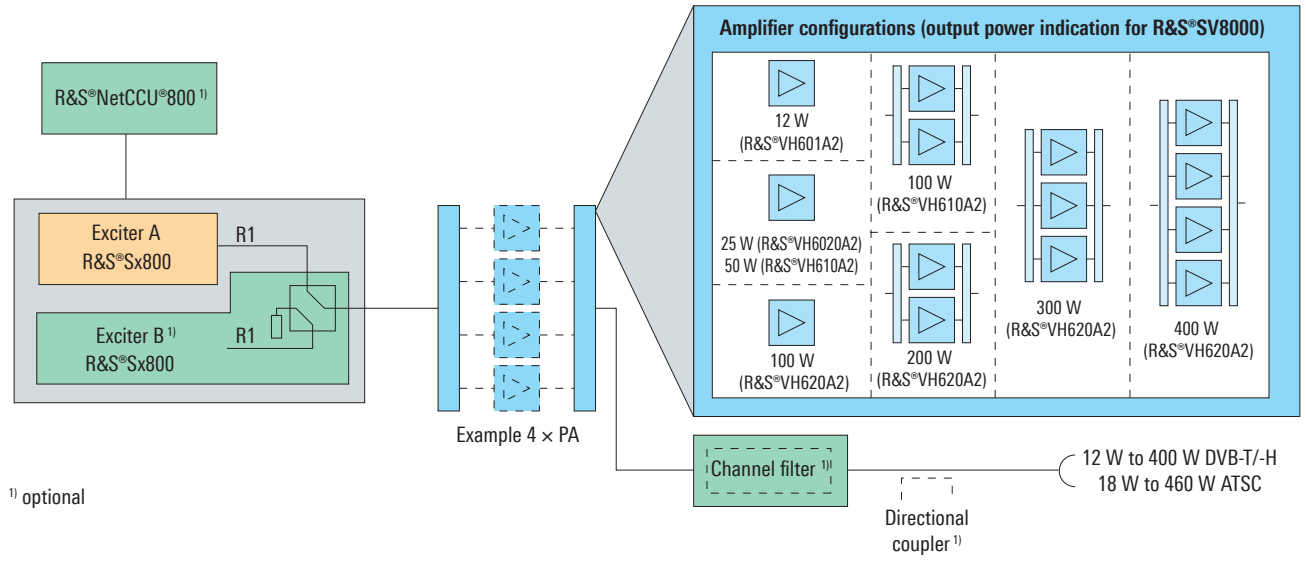
## R&S®NetCCU®800 transmitter control unit

- Contains transmitter control unit and automatic switchover unit for exciter standby, passive transmitter standby and (n+1) transmitter standby configurations
  - ASI distributor can be integrated (option) for exciter standby or passive transmitter standby configurations
  - For passive standby or (n+1) standby configurations, R&S®NetCCU®800 controls exciter switchover and output stage switchover
- Emergency control for interruption-free operation – even if the R&S®NetCCU®800 fails
- Handles internal and external communications and provides all control functions
- Operates as transmitter control unit plus IP interface
- All transmitter and/or amplifier parameters required for diagnostics and data retrievable
  - Locally (local IP interface)
  - Remotely worldwide via IP protocol and standard software (web/SNMP browser)
- Color display clearly shows current status of transmitter system
- Only two height units

## Retransmitter application

- R&S®NetCCU®800 can be enhanced by a professional DVB-T receiver (option)
- Receiver demodulates off-air signal and provides error-corrected ASI signal to the exciter

## Block diagram of an R&S®SV8000 transmitter



## Specifications common to the R&S®SV8000 family

| | |
|---|---|
| Frequency range | 470 MHz to 862 MHz |
| Power supply | 230 V ± 15 %, 47 Hz to 63 Hz |
| Max. installation altitude | 2000 m above sea level (>2000 m on request) |
| Operating temperature range | +1°C to +45°C |
| Permissible relative humidity | 95 %, without condensation |
| RF connector | 7/16 |
| **Synchronization** | |
| Reference frequency | 10 MHz, 0.1 V to 5 V ($V_{pp}$) or TTL, BNC |
| Reference pulse | 1 pps (1 Hz, TTL, BNC) |
| **Local control** | |
| Color display and keys | front-panel operation, optional with the R&S®NetCCU®800 |
| RJ-45 | PC operation via standard web browser |
| **Remote control** | |
| RJ-45 | IEC/IEEE864-2 via Ethernet, standard |
| RJ-45 | network management interface (web server and/or SNMP agent), optional |
| Bitbus | bus interface, in line with IEC/IEEE 864-2, optional |

## Specifications of the R&S®SV8000 for DVB-T/-H

| R&S® | SV8101 | SV8201 | SV8301 | SV8302 | SV8401 | SV8402 | SV8403 | SV8404 |
|---|---|---|---|---|---|---|---|---|
| Number of amplifiers | 1 | 1 | 1 | 2 | 1 | 2 | 3 | 4 |
| RF output power (rms) | 12 W | 25 W | 50 W | 100 W | 100 W | 200 W | 300 W | 400 W |
| Number of height units required in 19" rack | 3 | 4 | 4 | 7 | 4 | 7 | 10 | 13 |
| Inputs (DVB-T/-H) | 4 × ASI (all ASI modes) | | | | | | | |
| Coding and modulation | in line with EN300744, EN302304 (optional) | | | | | | | |
| Modulation | QPSK, 16QAM or 64QAM | | | | | | | |
| Guard interval | 1/4, 1/8, 1/16 or 1/32 of useful symbol duration | | | | | | | |
| IFFT mode | 2 k and 8 k, 4 k (optional) | | | | | | | |
| Inner code rate | 1/2, 2/3, 3/4, 5/6 or 7/8 | | | | | | | |
| Useful symbol duration | 224 µs (2 k) or 896 µs (8 k), 448 µs (4 k, optional) | | | | | | | |

## Specifications of the R&S®SV8000 for ATSC

| R&S® | SV8101 | SV8201 | SV8301 | SV8302 | SV8401 | SV8402 | SV8403 | SV8404 |
|---|---|---|---|---|---|---|---|---|
| Number of amplifiers | 1 | 1 | 1 | 2 | 1 | 2 | 3 | 4 |
| RF output power | 18 W | 35 W | 70 W | 130 W | 130 W | 250 W | 350 W | 460 W |
| Number of height units required in 19" rack | 3 | 4 | 4 | 7 | 4 | 7 | 10 | 13 |
| Inputs (ATSC) | 2 × SMPTE 310M + 2 × ASI | | | | | | | |
| Modulation | 8VSB | | | | | | | |
| Symbol rate | 10.76 MHz | | | | | | | |
| Data rate | 19.39 Mbit/s | | | | | | | |
| Trellis coding | 2/3 | | | | | | | |
| Reed-Solomon encoding | 207/187/10 | | | | | | | |

## Ordering information

| Designation | Type | Order No. [1] |
|---|---|---|
| **DVB-T/H UHF Low-Power Transmitter** | | |
| 12 W | R&S®SV8101 | 2098.9204.01 |
| 25 W | R&S®SV8201 | 2098.9256.01 |
| 50 W | R&S®SV8301 | 2098.9304.01 |
| 100 W | R&S®SV8401 | 2098.9356.01 |
| 100 W | R&S®SV8302 | 2098.9404.01 |
| 200 W | R&S®SV8402 | 2098.9456.01 |
| 300 W | R&S®SV8403 | 2098.9504.01 |
| 400 W | R&S®SV8404 | 2098.9556.01 |

## Ordering information

| Designation | Type | Order No. [1] |
|---|---|---|
| **ATSC UHF Low-Power Transmitter** | | |
| 18 W | R&S®SV8101 | 2098.9204.01 |
| 35 W | R&S®SV8201 | 2098.9256.01 |
| 70 W | R&S®SV8301 | 2098.9304.01 |
| 130 W | R&S®SV8401 | 2098.9356.01 |
| 130 W | R&S®SV8302 | 2098.9404.01 |
| 250 W | R&S®SV8402 | 2098.9456.01 |
| 350 W | R&S®SV8403 | 2098.9504.01 |
| 460 W | R&S®SV8404 | 2098.9556.01 |

[1] The order numbers are for reference only. The actual order numbers of the system depend on the configuration.

# R&S®SLx8000 VHF/UHF Low-Power TV Transmitters

Extremely compact UHF/VHF low-power transmitter family for digital and analog TV

- Digital and analog standards
  - DVB-T, DVB-H
  - ATSC, ATSC Mobile DTV
  - ATV: B/G, D/K, M/N, I
- Output power up to
  - UHF: 100 W DVB-T/-H, 160 W ATSC, 250 W ATV
  - VHF: 50 W DVB-T/-H, 80 W ATSC, 125 W ATV

To meet modern TV transmission requirements, existing infrastructure needs to be renewed or further expanded. This affects stationary TV based on the DVB-T and ATSC standards as well as mobile TV based on the DVB-H standard. Thus, an enormous number of transmitters or re-transmitters will be required in the very near future, especially for low-power applications. Despite the high quantities that will be needed, budgets should not be overstrained.

Yet high transmitter quality is crucial when it comes to preventing nationwide transmitter replacements or reworking, which would entail enormous follow-up costs.

Space in low-power transmitter sites is often very tight and the voltage supply is often not ideal. Moreover, the transmitters are sometimes difficult to access. Thus, high requirements are placed on transmitter ruggedness, flexibility, compactness and easy transport.

The R&S®SLx8000 transmitters, which are rugged, compact and flexible, complement the company's low-power-range portfolio. Due to the components' extremely large scale of integration, the instruments are favorably priced and can be delivered within a short time. And these advantages come with the high quality Rohde&Schwarz stands for – also when it comes to high quantities.

In addition to the digital networks, the R&S®SLx8000 transmitters can be used in existing analog networks to modernize low-power transmitters. The R&S®SLx8000 transmitters support the DVB-T/-H and ATSC standards as well as the analog B/G, D/K, M/N and I TV standards.

The family of R&S®SLx8000 transmitters supports the (n+1) redundancy concept, which is especially favored by digital TV networks. In this case, a common standby transmitter is available for one to eight main transmitters. The standby transmitter stores all data required for the active transmitter systems and can replace the affected transmitter in the event of a failure.

The entire system, including all associated distribution and switching units in the signal paths, is monitored and controlled by an independent, higher-level switchover unit. The R&S®NetCCU800® is the switchover unit for all transmitter families from Rohde&Schwarz. To set up this type of system, Rohde&Schwarz offers different rack configurations, TS distribution matrices and RF switching sets.

### Digital standards DVB-T/DVB-H, ATSC, AVSB ready

- Two data inputs (ASI/SMPTE 310M) provided
- Input signals can be applied redundantly
- Usable with DVB-T/-H for the hierarchical modes
- Unaware of any interruptions during switchover due to seamless switching function
- Output power in UHF band up to 100/160 W (DVB/ATSC), in the VHF range up to 50/80 W (DVB/ATSC)

### Analog standards B/G, D/K, M/N and I TV

- All color transmission methods
- Sound transmission methods mono, stereo/dual sound (in line with IRT) and BTSC
- NICAM transmission (option)
- Output power in UHF band up to 250 W (sync peak), in the VHF range up to 125 W (sync peak)

### Single frequency networks (SFN)

- Interfaces for reference signals
- Integrated SFN adapter (option) for data synchronization
- Precise transmitter synchronization owing to integrated GPS receiver (option)

### Integrated RF receiver card (option)

- Input signals applicable over the air
- Turns the R&S®SLx8000 transmitters into re-transmitters, suitable for all DVB-T modes
- Usable as integrated monitoring receiver to view different quality parameters via display, web browser, or SNMP

### High-quality power supplies for smooth operation under diverse conditions

- Wide input voltage range from 90 V to 265 V meets every electricity supply worldwide
- Alternatively –48 V DC applicable to DC/DC converter (option) for optimal integration in mobile radio environments

### Powerful and reliable amplifier output stages

- VHF modules in VMOS technology
- UHF modules in LDMOS technology
- Automatic recognizing of current active operating mode
- Usable in broadband applications without additional pre-correction in case of channel changing
- Perfect cooling even at maximum output power
- Protection circuits prevent over-temperature or transistor damage due to excessive reflection, for example
- Output power of modules can be reduced by up to 6 dB

### Multitude convenient ways of operation

- Local operation via backlit graphical display (200 × 48 pixel) and front-panel keypad.
- Straightforward menus allow intuitive navigation
- Shortcuts permit quick access for frequently used entries
- Most important operating parameters displayed via LEDs and on display's overview menu
- Local or remote operation via JAVA-capable web browser
- Remote control and remote monitoring by SNMP agent
- Easy integration in a network management system (NMS) structure
- Floating contacts (option) for control and query tasks in areas without fast network infrastructure
- All operation-relevant data stored on CompactFlash card
- Simple transfer of setting parameters for easy replacement of transmitters
- Data sets of a transmitter up/downloadable via Ethernet to a controller or central server

### Highly compact transmitters

- 19" housing of two or three height units
  - Up to 10 W only two height units
  - 25 W to 100 W, three height units
- Easy transport and minimum space requirements

### Future-proof investment, suitable in digital and analog networks

- Meets high quantity demands at favorable prices
- Switchable from analog to the installed digital standards simply by pressing a button – also via remote control
- Supports (n+1) including (1+1) standby configurations
- Flexible adaptation to changing requirements at hand
- Convenient update of operating software via Ethernet

**Specifications in brief: type specific output power**

| **DTV UHF** | **R&S®SLV8002** | **R&S®SLV8005** | **R&S®SLV8010** | **R&S®SLV8025** | **R&S®SLV8050** | **R&S®SLV8100** |
|---|---|---|---|---|---|---|
| DVB-T/-H (rms) | 2 W | 5 W | 10 W | 25 W | 50 W | 100 W |
| ATSC | 3 W | 8 W | 16 W | 40 W | 80 W | 160 W |
| **DTV VHF** | **R&S®SLW8025** | | | **R&S®SLW8050** | | |
| DVB-T/-H (rms) | 25 W | | | 50 W | | |
| ATSC | 40 W | | | 80 W | | |
| **ATV UHF** | **R&S®SLV8025A** | | **R&S®SLV8050A** | | **R&S®SLV8100A** | |
| Output power (sync peak) | 50 W | | 125 W | | 250 W | |
| **ATV VHF** | **R&S®SLW8025A** | | | **R&S®SLW8050A** | | |
| Output power (sync peak) | 50 W | | | 125 W | | |

## Specifications in brief: common data

| | |
|---|---|
| **RF output connector** | N |
| **Synchronization** | |
| Reference frequency | 10 MHz, 0.1 V to 5 V ($V_{pp}$) or TTL, BNC |
| Reference pulse | 1 pps (1 Hz, TTL, BNC) |
| **DVB-T/-H standards and interfaces** | in line with EN300744, EN302304 (optional) |
| Inputs | 2 × ASI (all ASI modes) |
| **ATSC standards and interfaces** | in line with Doc. 53/1995 |
| Inputs | 2 × SMPTE310M or 2 × ASI |
| **ATV standards and interfaces** | B/G, D/K, M/N, I |
| Color transmission | PAL, NTSC, SECAM |
| Sound transmission | mono, stereo, or IRT dual sound BTSC (M, N standards) optionally NICAM (coder/ modulator) |
| Inputs (video) | 1 × video, BNC |
| Inputs (audio) | 2 × audio, XLR<br>1 × BTSC, BNC |
| NICAM input | NICAM 728 data input, BNC |
| **General data** | |
| Voltage supply | 90 V AC to 265 V AC, 47 Hz to 63 Hz; alternatively: –48 V DC, see options |
| Operating temperature range | +1 °C to +45 °C |
| Permissible temperature range (specifications may not be complied with) | 0 °C to +50 °C |
| Storage temperature range | –30 °C to +70 °C |
| Relative humidity (max.) | 95 %, non-condensing |
| Max. installation height | 2000 m above sea level (>2000 m on request) |
| Dimensions (W × H × D) | |
| Transmitter with 2 HU (2 W to 10 W | 483 mm × 88 mm × 467 mm (19.0 in × 3.5 in × 18.4 in) |
| Transmitter with 3 HU (25 W to 100 W | 483 mm × 132 mm × 474 mm (19.0 in × 5.2 in × 18.7 in) |

## Specifications in brief: common data

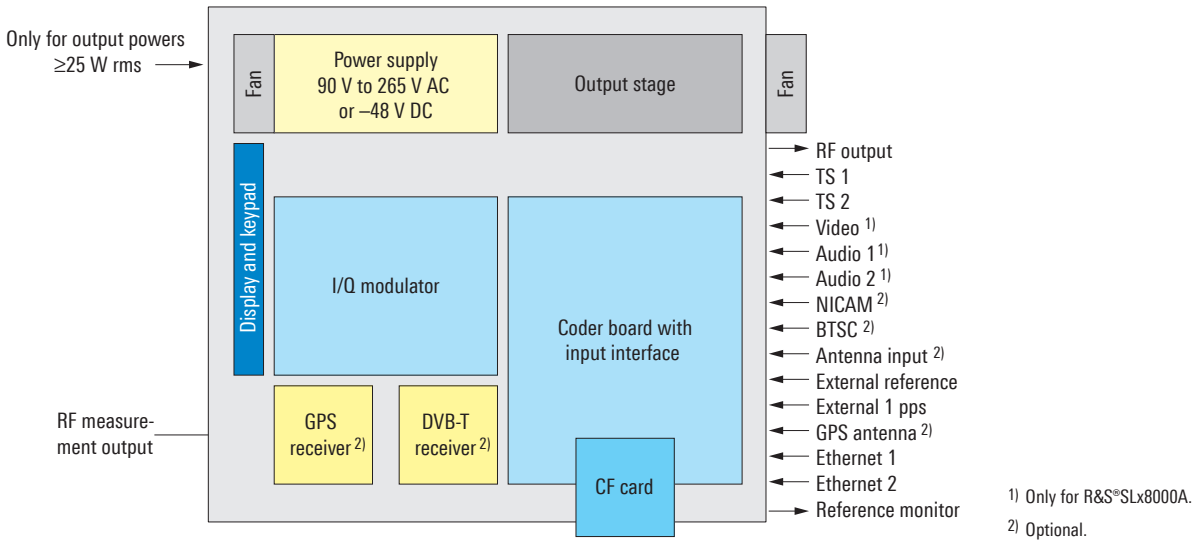
| | |
|---|---|
| **Operation** | |
| Display, keypad and status LEDs | local operation and display |
| Ethernet interface, RJ-45 | convenient local or remote control via standard web browser |
| **Options** | |
| Switchover from ATV to DTV | local or remote by pressing a button (for R&S®SLx8000A only) |
| GPS receiver | integrated receiver for GPS reference signals |
| RF receiver | retransmitter or monitoring applications |
| SNMP agent | remote monitoring and control via standardized network management systems (NMS) |
| NICAM | coder or modulator function |
| Floating contacts | parallel interface or integration of station equipment |
| DC voltage supply, –48 V | DC voltage input for mobile radio environments |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| **DTV UHF** | | |
| DVB-T/ATSC Transmitter from 2 W/3 W to 10 W/16 W | R&S®SLV8000 | depending on configuration |
| DVB-T/ATSC Transmitter from 25 W/40 W to 100 W/160 W | R&S®SLV8000 | |
| **DTV VHF** | | |
| DVB-T/ATSC Transmitter from 25 W/40 W to 50 W/80 W | R&S®SLW8000 | |
| **ATV UHF** | | |
| Transmitter from 50 W to 250 W | R&S®SLV8000A | |
| **ATV VHF** | | |
| Transmitter from 50 W to 125 W | R&S®SLW8000A | |

Detailed information about possible configurations, options and other accessories can be obtained from your local Rohde&Schwarz sales office.

## Simplified block diagram of the R&S®SLx8000




1) Only for R&S®SLx8000A.

2) Optional.

# R&S®XLx8000 UHF/VHF Transposer Family



Efficient transposer solutions for analog and digital broadcasting standards

- UHF/VHF transposers/retransmitters for analog and digital TV as well as digital sound broadcasting
- Rohde&Schwarz quality with excellent price/performance ratio
- Highly efficient echo cancellation for use in single-frequency networks
- Outstanding adjacent-channel selectivity
- Set&go function for precorrecting the output stages
- Ultracompact design
- Flexible integration of options

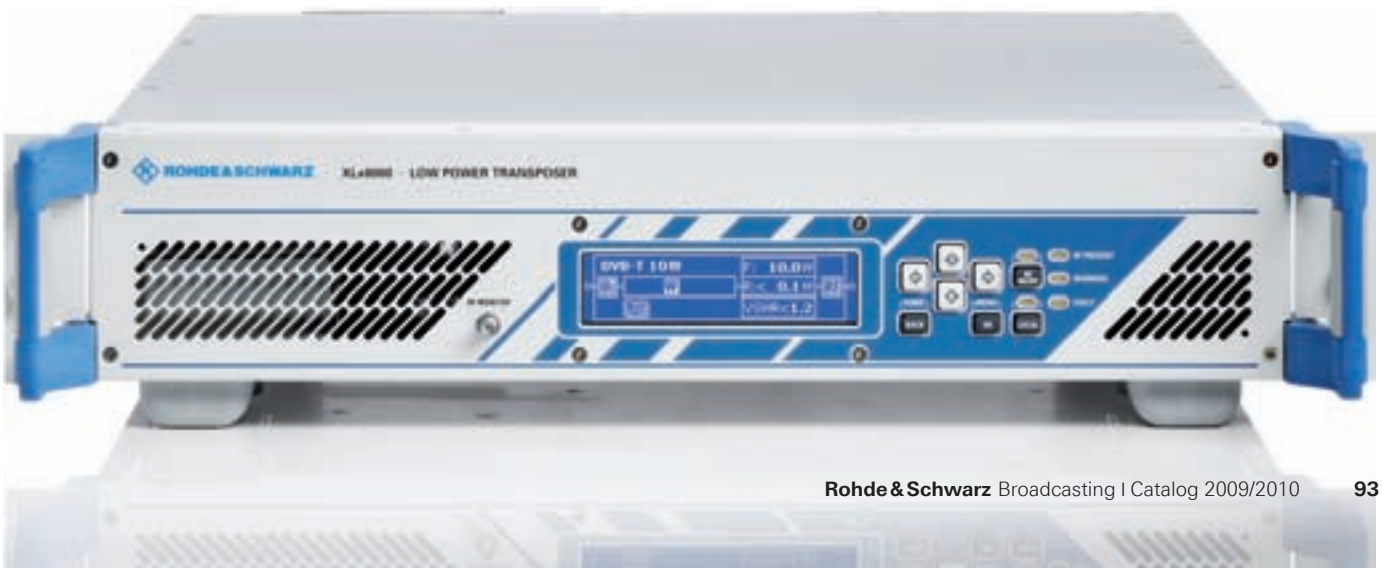
The transposers of the R&S®XLx8000 family fill coverage gaps in transmitter networks. They are reliable, compact and flexible. Plus, they are specially designed to meet the requirements of small, remote transmitter sites that are difficult to access, offer only limited space and whose power supply may be subject to strong variations.

The R&S®XLx8000 family includes UHF and VHF transposers for digital and analog TV as well as for digital sound broadcasting. The ultracompact devices can be used as transposers or retransmitters. Due to the short processing time, R&S®XLx8000 transposers can be integrated into digital single-frequency networks (SFNs). Feedback is eliminated by high-quality, two-level echo cancellation. Intelligent operating functions reduce the transposers' setting times.

For example, the automatic set&go function does away with a time-consuming manual precorrection of the output stages for all digital standards. The compact but flexible all-in-one-box concept allows various options to be integrated, which simplifies logistics and handling when sites are difficult to access.

The transposers cover analog TV standards as well as digital TV standards (DVB-T/-H, ATSC including ATSC M/H, MediaFLO™, DTMB and ISDB-T/$T_B$). For digital sound broadcasting, the transposer family supports broadcasts in line with the DAB, DAB+ and T-DMB specifications. If necessary, a transposer can be easily converted from analog to digital TV without modifying the hardware. The output powers range up to 100 W for DVB-T/-H, up to 150 W for ATSC, up to 250 W for analog TV and up to 250 W for DAB/T-DMB. The broadband output stages are based on state-of-the-art, powerful LDMOS and VMOS transistors and feature high efficiency.

R&S®XLx8000 configured as R&S®XLV8010.



## Flexible concept and wide range of applications

- Ultracompact solution
- Operation either hands-on or via web browser
- Transposer in multi-frequency networks
- Transposer in single-frequency networks
- Retransmitter in multi-frequency networks for DVB-T/-H

## Continuous coverage

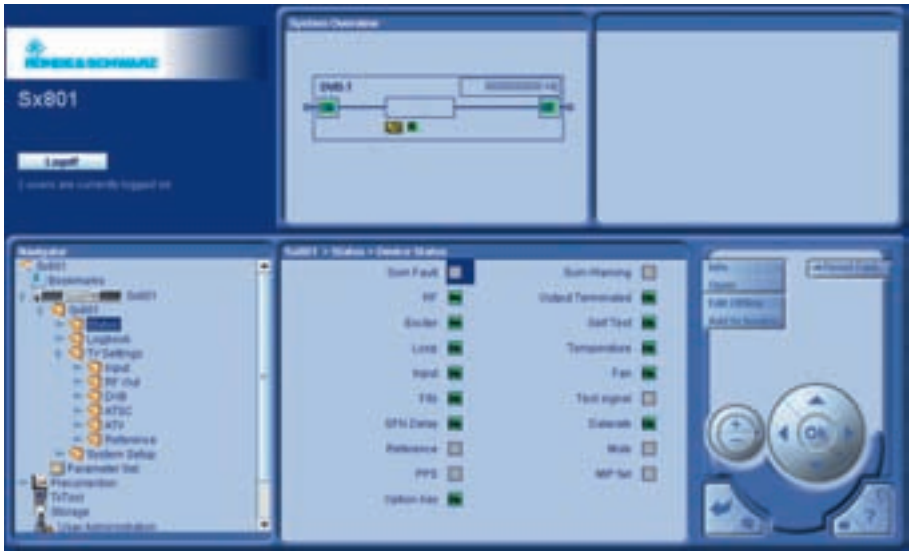
- Convenient supply with different nominal voltages
- Self-monitoring power output stages
- Standby systems for high availability

## Special features for operation

- Precorrection for digital standards with set&go function
- High adjacent-channel selectivity
- DVB-T/-H receiver for signal monitoring
- Synchronized operation in networks

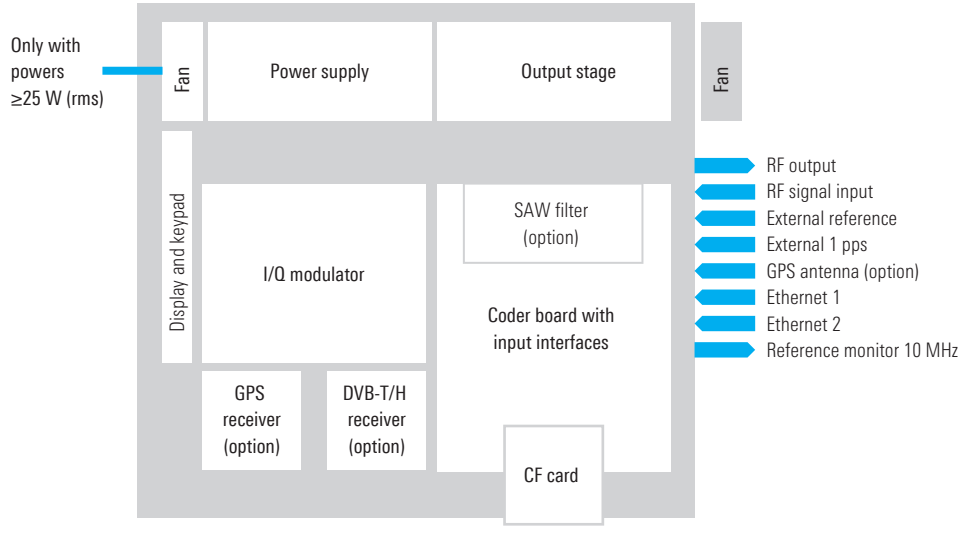
## Custom tailoring

- Desktop unit or rack installation
- Integrable options
- Other accessories




Typical start menu for operation via the web browser.

## Block diagram of the R&S®XLx8000



## Output power of the different models of the R&S®XLx8000 transposer family

| R&S®XLx8000 configured as | ATSC (M/H) (rms) | DVB-T/DVB-H, MediaFLO™, DTMB, ISDB-T/$T_B$ (rms) | ATV (sync peak) | DAB(+), T-DMB (rms) | 2 HU | 3 HU | 4 HU |
|---|---|---|---|---|---|---|---|
| **UHF** | | | | | | | |
| R&S®XLV8002 | 3 W | 2 W | – | – | ○ | | |
| R&S®XLV8005 | 8 W | 5 W | 12 W | – | ○ | | |
| R&S®XLV8010 | 16 W | 10 W | 25 W | – | ○ | | |
| R&S®XLV8025 | 40 W | 25 W | 60 W | – | | ○ | |
| R&S®XLV8050 | 80 W | 50 W | 125 W | – | | ○ | |
| R&S®XLV8100 | 150 W | 100 W | 250 W | – | | ○ | |
| **VHF** | | | | | | | |
| R&S®XLW8025 | 40 W | 25 W | 60 W | 30 W | | ○ | |
| R&S®XLW8050 | 80 W | 50 W | 125 W | 60 W | | ○ | |
| R&S®XLW8100 | 150 W | 100 W | 250 W | 125 W | | ○ | |
| R&S®XLW8200 | – | – | – | 250 W | | | ○ |

## General data

| | |
|---|---|
| Supply voltage | |
| Models with 2 HU and 3 HU | 100 V to 240 V, ±10% |
| Model for ATV, >125 W, with 3 HU | 110 V to 240 V, ±10% |
| Model with 4 HU | 230 V to 240 V ±10%<br>100 V to 120 V ±10% (option) |
| Alternatively (option) | –48 V DC, –20% to +40% |
| Operating temperature range | +1°C to +45°C |
| Permissible temperature range (specifications may not be complied with) | 0°C to +50°C |
| Transport temperature range | –30°C to +70°C |
| Relative humidity (max.) | 95%, non-condensing |
| Max. installation height | 2000 m above sea level (>2000 m on request) |
| RF interface (input and output) | N |
| **Synchronization** | |
| Reference frequency | 10 MHz, 0.1 V to 5 V ($V_{pp}$) or TTL, BNC |
| Reference pulse | 1 pps (1 Hz, TTL, BNC) |
| **Internal processing time** | |
| for DTV, depending on filter | 6 µs to 13 µs |
| for DAB/T-DMB, depending on filter | 20 µs to 28 µs |
| **Echo cancellation** | |
| Permitted echo at input | |
| Without echo cancellation | <–10 dB relative to input signal |
| With echo cancellation | ≤+5 dB relative to input signal |
| With enhanced echo cancellation | ≤+15 dB relative to input signal |
| Between input and output | 35 dB |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| Typical configuration: UHF transposer for DVB-T, 100 W rms | | |
| **Low-Power Transposer** (configured as R&S®XLV8100, UHF (470 MHz to 862 MHz), DVB-T power 100 W rms) | | |
| Low-Power Transposer (3 HU, base unit) | R&S®XLX8000 | 2100.1100.30 |
| DVB-T UHF Amplifier, 100 W rms | R&S®SLX8000B47 | 2100.1217.02 |
| AC Power Supply, 3 HU | R&S®SLX8000B11 | 2100.4045.02 |
| Power cable | country-specific | |
| **Hardware options** | | |
| Enhanced Echo Cancellation | R&S®XLX8000B19 | 2104.2201.02 |
| GPS Receiver Card | R&S®SLX8000B13 | 2100.3232.02 |
| GPS Antenna, suitable for R&S®SLX8000B13 | R&S®SLX8000B17 | 2100.4100.02 |
| SAW Filter, 8 MHz | R&S®XLX8000B80 | 2104.2153.02 |
| Installation Kit for DVB-T/DVB-H monitoring receiver | R&S®SLX8000B15 | 2100.3355.20 |
| Dust Filter, for 3 HU base units | R&S®SLX8000B23 | 2100.3803.03 |
| **Software options** | | |
| Echo Cancellation Option Key | R&S®XLX8000K18 | 2100.4300.18 |
| Enhanced Echo Cancellation Option Key | R&S®XLX8000K19 | 2100.4300.19 |
| Monitoring Receiver Option Key for R&S®XLx8000 | R&S®XLX8000K25 | 2100.4300.25 |

Your local Rohde&Schwarz expert will help you to find the solution that is optimally suited to your requirements and will be glad to prepare a custom offer for you.

To find your nearest Rohde&Schwarz representative visit:
www.sales.rohde-schwarz.com

# R&S®ED170 GPS Receiver

Reference receiver for high-precision offset operation

- High accuracy and worldwide use around the clock
- Separate antenna/converter unit including wall bracket
- Up to four receivers can be operated from one antenna as an option
- Conversion of receive frequency into IF in the antenna unit
- Use of commercial coaxial cables up to 200 m as antenna feeder
- Configuration and remote control via Ethernet interface (RJ-45)
- Time telegram provided every hour, every minute or on request
- Four fixed output frequencies
- 19" module, 1 height unit

The R&S®ED170 GPS receiver is another link in the DAB and DVB-T transmission chain allowing synchronous operation of all units. In analog TV transmitter networks the R&S®ED170 GPS receiver can be used as a reference receiver for high-precision offset operation.

The R&S®ED170 is equipped with a satellite radio clock which has been developed to provide the user with a high-precision time and frequency reference. Both the transmitter and the SFN inserter can be synchronized with various fixed frequencies.

## GPS Introduction

**Frequency and time synchronization**

To satisfy the frequency and time conditions and the requirements regarding dynamic delay compensation for single-frequency operation in a DAB/DVB-T/-H network, all transmitters need a high-precision frequency and time reference. This reference can be made available by a GPS (global positioning system) satellite clock.

**Synchronous operation in DVB-T/-H and DAB**

Digital single-frequency networks (SFN) require synchronous operation of all transmitters involved. This means that all transmitters of a single-frequency network must have identical signal components and simultaneously send a uniform COFDM signal at the same frequency.

At each transmitter site the received ETI signal for DAB and the MPEG-2 transport stream for DVB-T/-H therefore have to be delayed in line with the transmitter's location in order to ensure synchronous radiation of the signal. An SFN adapter receiving its time reference from the GPS signal is required for this purpose.

The capability for single-frequency operation is mainly achieved through the guard interval of the digital signal. Undisturbed reception is only ensured if the time dispersion of the received signals lies without the guard interval. The guard intervals depend on the mode used which is determined by the topography of the area to be covered and lie in the range between 246 µs and 31 µs for DAB and between 224 µs and 7 µs for DVB-T/-H.

The guard intervals determine the frequency accuracy and the subcarrier offsets. They are also an indirect measure of the maximum transmitter distance in a single-frequency network. The relative frequency accuracy of neighboring digital transmitters in a SFN should be $10^{-8}$ to $10^{-9}$ depending on the transmitter frequency. This requirement can be fulfilled by linking the transmitter to a GPS system.

**Frequency stability of analog transmitters**

In addition to the use of frequency standards, the 10 MHz signal of a GPS receiver can be used as an external reference to ensure precision offset operation of analog TV transmitter systems.

**Principle of time determination**

The principle of determining position and time of a GPS receiver is based on a highly accurate measurement of the signal delay from the individual satellites to the receiver. 21 active GPS satellites and three additional standby satellites are orbiting the earth once in approx. 12 hours on six orbits at an altitude of 20 000 km. This ensures that at least four satellites are visible at a time at any point of the earth. Simultaneous reception of signals from four satellites is required for the receiver to determine its spatial position (x, y, z) and the deviation of its clock from the GPS time.

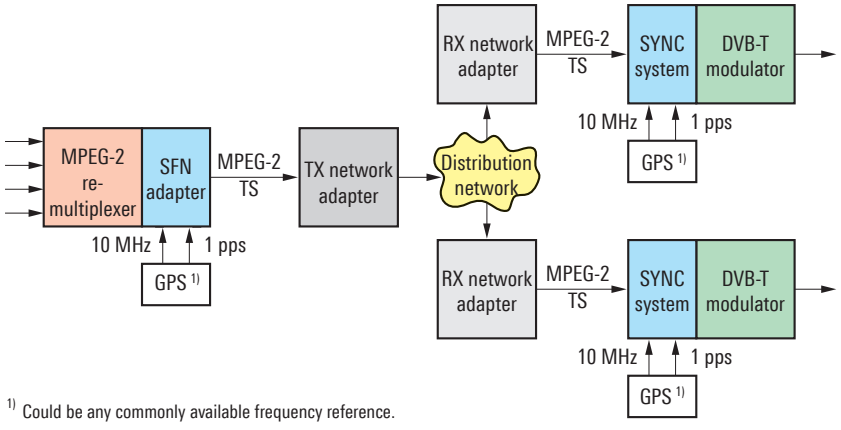
The GPS time is a linear time scale that has been synchronized with the international time scale UTC upon launching of the satellite system in 1980. Since that time however leap seconds have repeatedly been inserted in the UTC time in order to adapt it to the variation in the earth's rotation. For this reason, the GPS time differs today by a few seconds from the UTC time. The number of the difference seconds is however contained in the data stream of the satellites so that the receiver is internally synchronous with UTC with a system time difference of <500 ns.

The GPS satellites are not geostationary but orbit the earth once every 12 hours approximately. The satellite orbits are between the 55th latitude south and the 55th latitude north. Reception from satellites is only possible if there are no obstacles in the line of sight from the antenna to the satellite. For proper operation of the satellite clock the antenna should have a free sight of 5° above the horizon to ensure that a sufficient number of satellites will be received.

**Redundant satellite receiving system**

If several transmitters are to be connected to a GPS receiver systems, it is recommended to use a redundant system. The system consists of two self-contained R&S®ED170 GPS receivers that are linked via an automatic switchover unit. The 1 pps pulse and the 10 MHz reference frequency are taken each via a separate distribution amplifiers to eight BNC outputs.

**DVB-T/H transmission string**

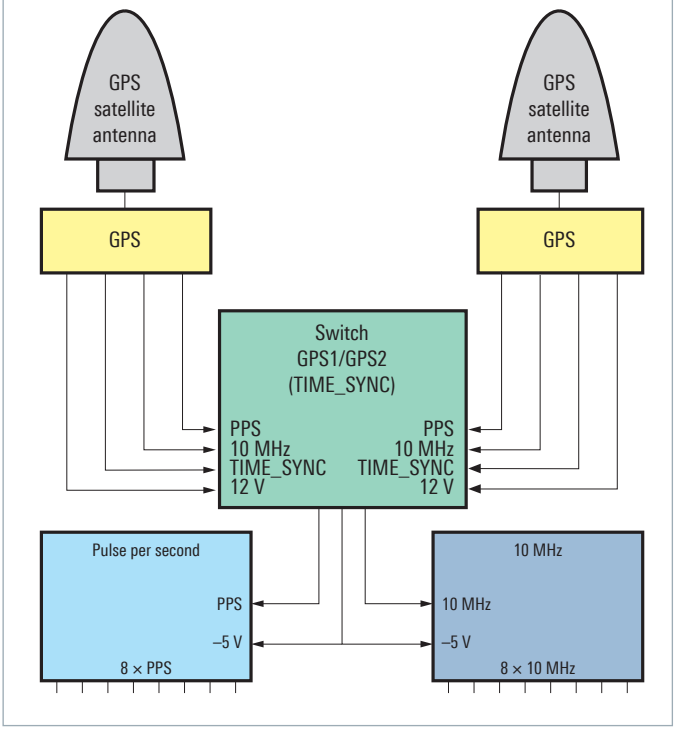



1) Could be any commonly available frequency reference.

## Specifications in brief

| | |
|---|---|
| **Antenna/converter unit** | |
| Antenna:<br>Remotely fed antenna/converter unit, cable length up to 300 m with standard RG-58 cable, antenna array DC-isolated, max. voltage 1000 V | |
| Antenna input | N connector, female, 50 Ω |
| Receive frequency | 157542 MHz (L1) |
| IF from converter | 35.4 MHz |
| Ambient temperature | –40°C to +65°C |
| Protection | IP 56 |
| **Receiver** | six-channel C/A code receiver with detached antenna/converter unit |
| Mixer frequency to converter | 10 MHz |
| Frequency accuracy | |
| After switchoff time >2 h | |
| First 20 min after sync | $\pm 2 \times 10^{-8}$ |
| After sync and 20 min of operation | $\pm 2 \times 10^{-9}$ |
| After sync and 1 h of operation | $\pm 1 \times 10^{-9}$ |
| After sync and 4 h of operation | $\pm 5 \times 10^{-10}$ |
| After switchoff time <1 h | |
| First 20 minutes after sync | $\pm 2 \times 10^{-8}$ |
| After sync and 20 min of operation | $\pm 1 \times 10^{-9}$ |
| After sync and 1 h of operation | $\pm 5 \times 10^{-10}$ |
| Frequency accuracy of crystal | |
| 1 day, free-running crystal | $\pm 1.5 \times 10^{-9}$ |
| 1 year, free-running crystal | $\pm 1 \times 10^{-7}$ |
| Short-term stability | |
| ≤10 s, with GPS link | $\pm 5 \times 10^{-10}$ |
| ≤1 s, free-running | $\pm 2 \times 10^{-10}$ |
| Temperature drift, free-running crystal | $\pm 5 \times 10^{-8}$ |

## Application redundant satellite receiving system




## Specifications in brief

| | |
|---|---|
| SSB noise | |
| 1 kHz from carrier | –140 dBc (1 Hz) |
| 10 Hz from carrier | –110 dBc (1 Hz) |
| Time to synchronization | max. 2 minutes with known receiver position and valid almanac, approx. 12 minutes without valid data in memory |
| Frequency outputs (BNC) | 10 MHz, 2.048 MHz, 1 MHz, 100 kHz (TTL levels) |
| 10 MHz, direct | 3.0 V ($V_{pp}$) into 50 Ω |
| 10 MHz, switched | 3.0 V ($V_{pp}$) into 25 Ω |
| 2.048 MHz, direct | 3.0 V ($V_{pp}$) into 50 Ω |
| 2.048 MHz, switched | 3.0 V ($V_{pp}$) into 25 Ω |
| 2.048 MHz, phase jitter | max. 1 ns |
| Capture inputs | D-Sub, 9-pin, TTL |
| Trigger | on falling TTL edge |
| Pulse sequence | 1.5 ms min |
| Resolution | 100 ns |
| Frequency accuracy | |
| Synchronized | $<\pm 5 \times 10^{-12}$ |
| 1 pps synchronization | ±100 ns |
| Outputs | 2 |
| 10 MHz | 4 ×, >0 dBm, 50 Ω, BNC female |
| 1 pps | 4 ×, TTL, 50 Ω, BNC female |
| Serial interfaces | 2, asynchronous (RS-232-C) |
| Baud rate | 300 Bd to 9200 Bd |
| Data formats | 7N2, 7E1, 7E2, 8N1, 8N2, 8E1 |
| COM1 (default setting) | 9600, 8N1 |
| COM0 (LANXPT) | Ethernet, RJ-45 |
| COM1 (DCE2) | shielded data line |
| Pulse outputs | D-Sub, 9-pin, RS-232-C |
| Every second | P_SEC, TTL levels |
| Every minute | P_MIN, TTL levels |
| Pulse accuracy | |
| After synchronization and 20 min of operation | better than ±250 ns |
| In the first 20 min after synchronization | better than 2 ms |
| Synthesizer accuracy | |
| Basic accuracy | same as system accuracy |
| $^1/_8$ Hz to 10 kHz | phase synchronous to seconds pulse |
| 10 kHz to 10 MHz | frequency drift <0.0047 Hz |
| **General data** | |
| Input voltage | 90 V to 260 V AC, 47 Hz to 63 Hz |
| Power consumption | max. 61 W |
| Ambient temperature | –10°C to +60°C |
| Humidity | max. 90% |
| Protection class | IP 20 |
| Dimensions (W × H × D) | 482.6 mm × 43.7 mm × 285 mm (19 in × 1.7 in × 11.2 in) |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| GPS Receiver | | |
| 1 input/4 outputs, 1 pps/10 MHz, with receiving antenna and cable, with LAN interface, rack mount 19", 1 HU | R&S®ED170 | 2105.5856.02 |
| 8 outputs, 1 pps/10 MHz, passive standby, 19", 3 HU | R&S®ED170 | 2065.4303.02 |

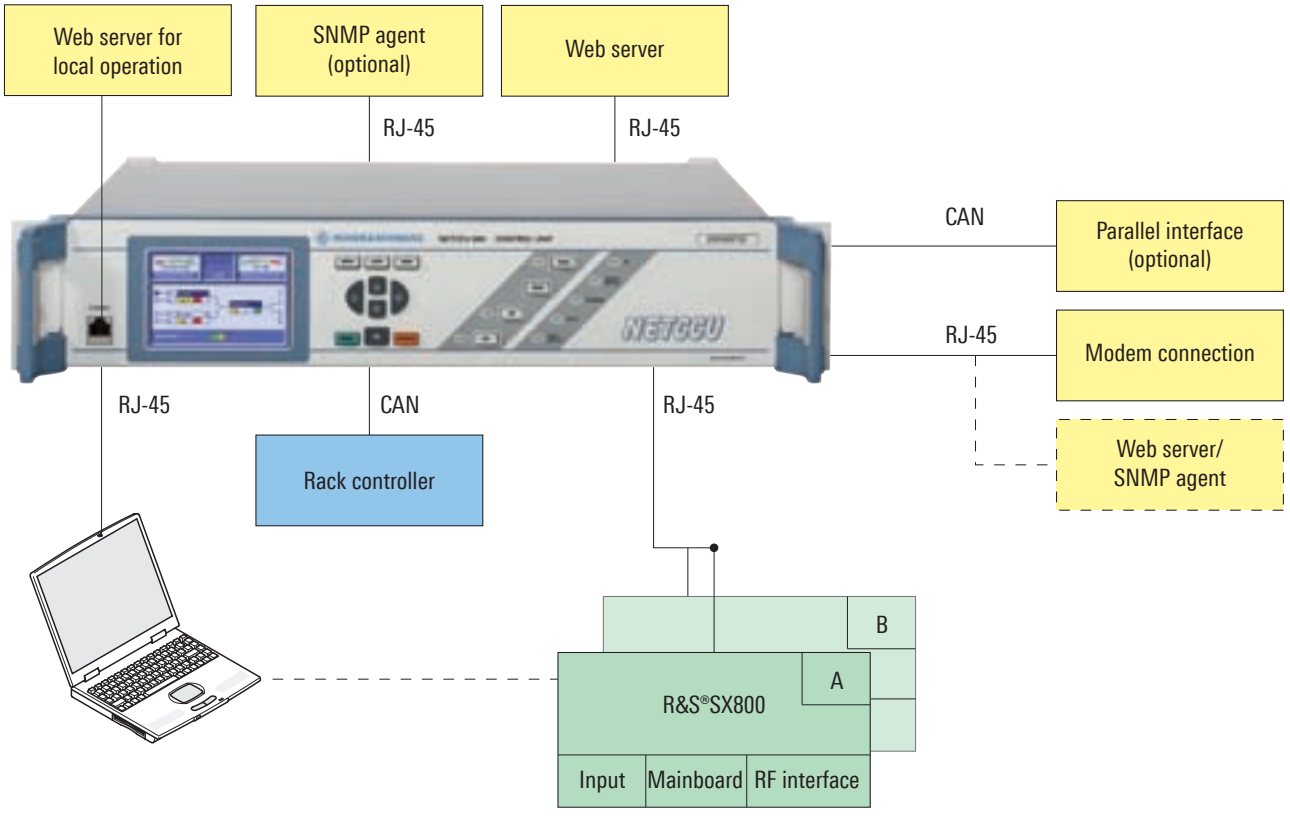
# Remote Control Interfaces for R&S®Nx8000 High-, Medium- and Low-Power Transmitters

The R&S®Nx8000 series provides several remote control interfaces. All transmitters may be operated via display and keypad. Access via a webserver comes as standard feature for local and remote operation. Further optional remote functionalities are:

- Parallel interface
- SNMP agent
- RS-232-C connection
- Bitbus via RS-232-C and via BitbusOverIP



**Control and monitoring interfaces for R&S®Nx8000 series transmitters control unit R&S®NetCCU800**



# Standby Systems for Digital and Analog Broadcasting Transmitters

Maximum availability of transmitter systems has always been the main concern of program providers. Passive standby, i.e. a complete transmitter as standby ready to take over operation from the main transmitter, has been state of the art with tube transmitters for many years.

The passive standby configuration lost in importance with the advance of transistorized transmitters whose output stages consists of many single transistors connected in parallel. Failure of a transistor does not immediately cause a failure of the total system. A passive standby is provided for the exciter only.
With the introduction of digital services where several programs are transmitted by a single transmitter, the well-proven standby systems became interesting again. High availability is a must for every program provider today.

A brief overview of the standby systems available from Rohde&Schwarz is given in the following. The type of standby is indicated by the last character of the type designation. The "V" of R&S®NM7100V for instance means "exciter in passive standby". The DVB-T transmitter is taken as an example. The same configuration applies also to the analog transmitter with combined vision/sound amplification.

### Single transmitter, transmitter with exciter standby

Fig. 1 shows the configuration of a single transmitter ("E"), i.e. an exciter and a single amplifier stage. Fig. 2 shows the principle of a transmitter with passive exciter standby ("V").

### Exciter in passive standby, amplifier stage in active standby, RF U-link patch panel

The disadvantage of these two configurations is that it is practically impossible to perform measurements and/or maintenance on the total system during ongoing operation. This is the reason why many users ask for a amplifier stage in active standby configuration. Fig. 3 shows such a configuration with RF patch panel with manually switchable U links ("A").

**Fig. 1: Single transmitter – "E"**

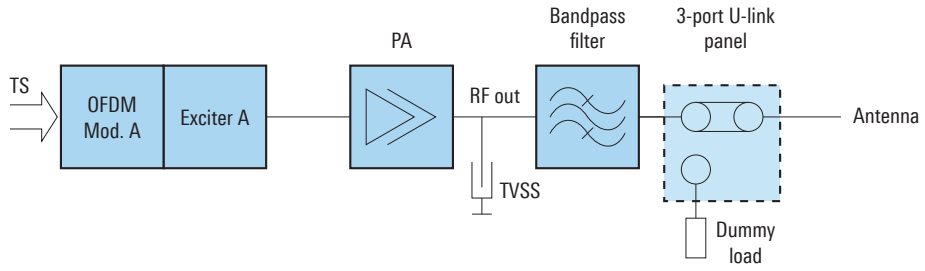



**Fig. 2: Transmitter with exciter standby – "V"**

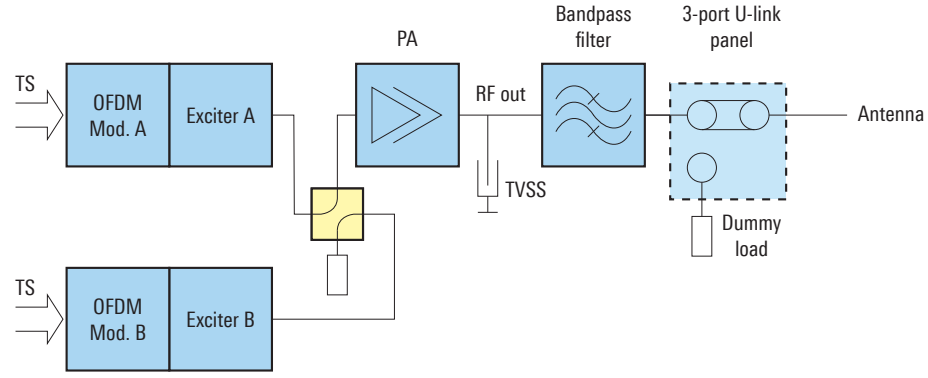
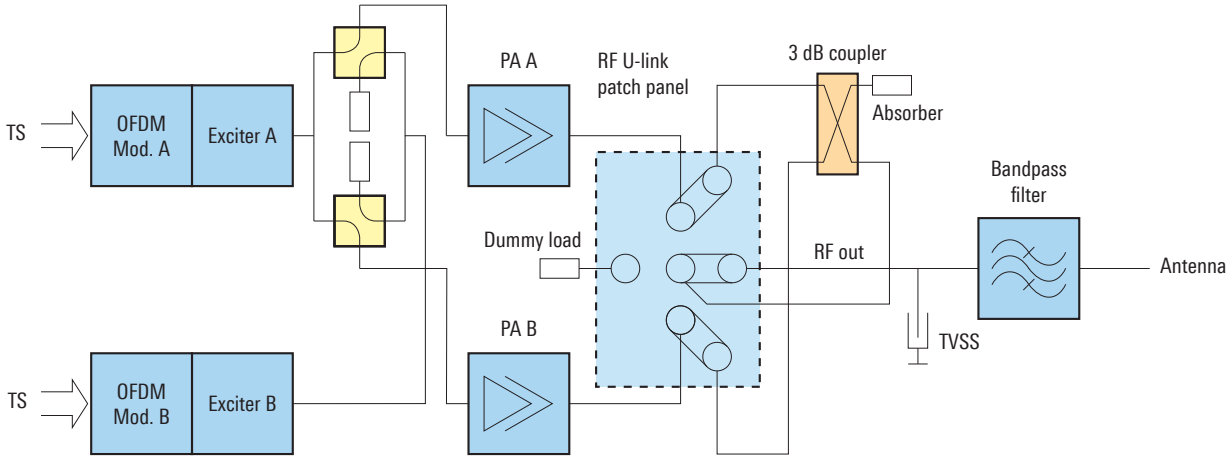



**Fig. 3: Exciter in passive standby, amplifier stage in active standby, RF U-link patch panel – "A"**



### Exciter in passive standby, amplifier stage in active standby, patch panel

The configuration shown in Fig. 4 contains an automatically and/or manually switched RF relay panel ("S"). If an amplifier stage fails, the output power will be reduced by 6 dB. After direct connection of the properly functioning amplifier stage to the antenna, the power reduction is only 3 dB. Usually the RF patch panel is accommodated in a central rack together with other central components, e.g. 3 dB coupler, balance absorber and dummy antenna.

### Passive transmitter standby

In many cases there is (again) a demand for a complete passive standby system. This configuration ensures that in case of a transmitter failure the standby transmitter provides coverage of the same area with the same output power. This may be very important for single-frequency networks (SFN). With the configurations shown in Figs. 4 and 5 coverage may be poorer in boundary regions of the area to be covered so that SFN operation may become impossible at all.

**Fig. 4: Exciter in passive standby, amplifier stage in active standby, switched RF relay panel – "S"**

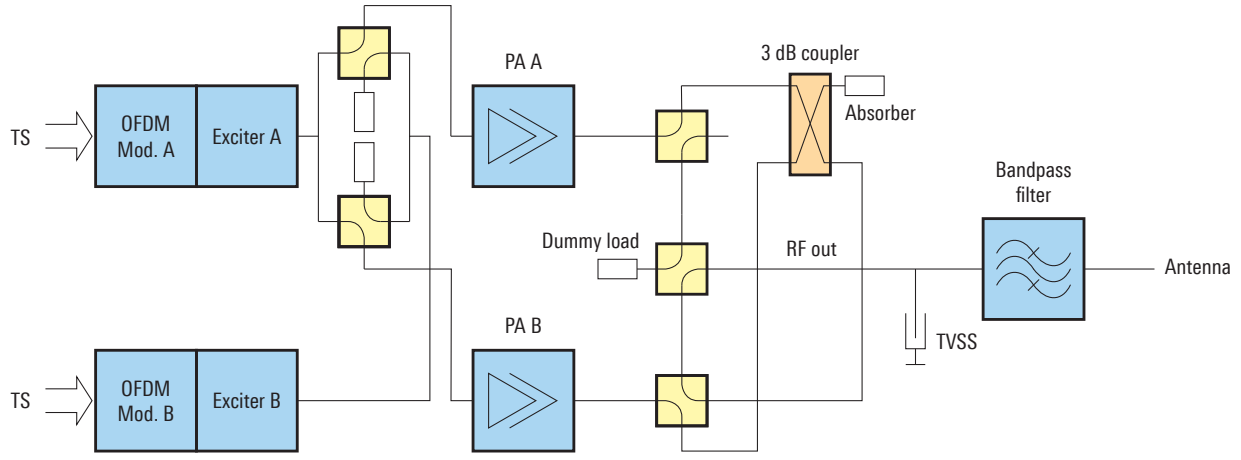
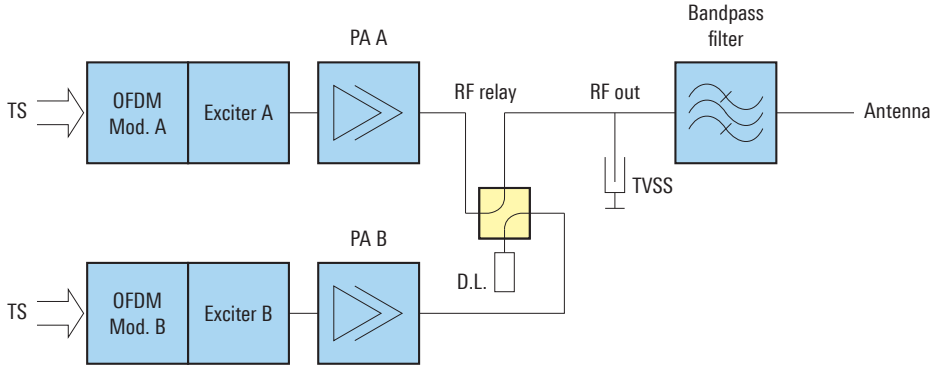



**Fig. 5: Passive transmitter standby – "P"**



### Passive transmitter standby with exciter standby

Fig. 6 shows a special version of a passive transmitter standby configuration. The additional exciter standby allows crosswise operation (i.e. exciter A with power amplifier B and exciter B with power amplifier A) and prevents switchover of the amplifier stages in the case of exciter problems.

### (n+1) DVB-T transmitter standby system

Especially with digital services several transmitters are responsible for transmitting a bouquet. Using one common standby transmitter for n single transmitters is economically the better solution than for instance one standby transmitter for each program transmitter. This (n+1) standby configuration has been used with FM transmitters for a long time. For TV, broadband characteristic of the standby transmitter is a basic requirement. This is exactly where Rohde&Schwarz transmitters excel. Fig. 7 shows an n+1 system that has been implemented several times already.

**Fig. 6: Passive transmitter standby with exciter standby – "PV"**

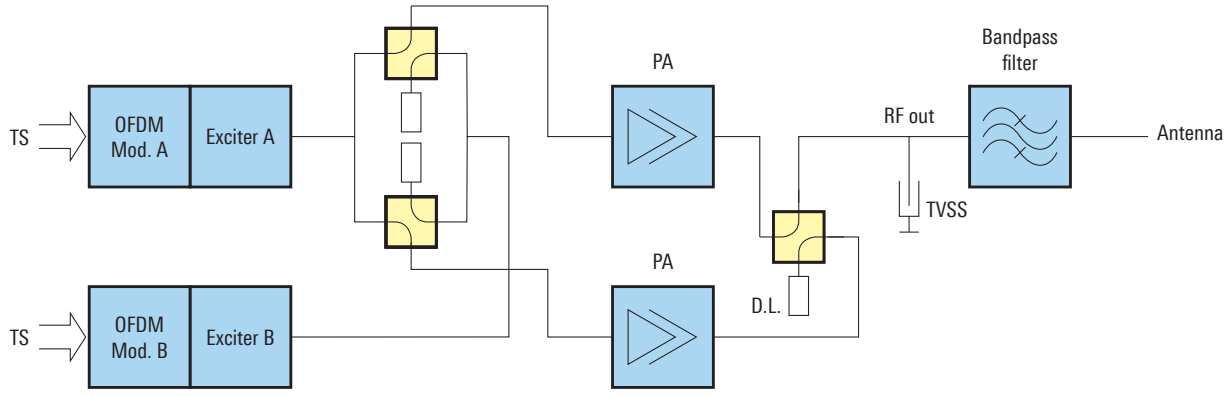
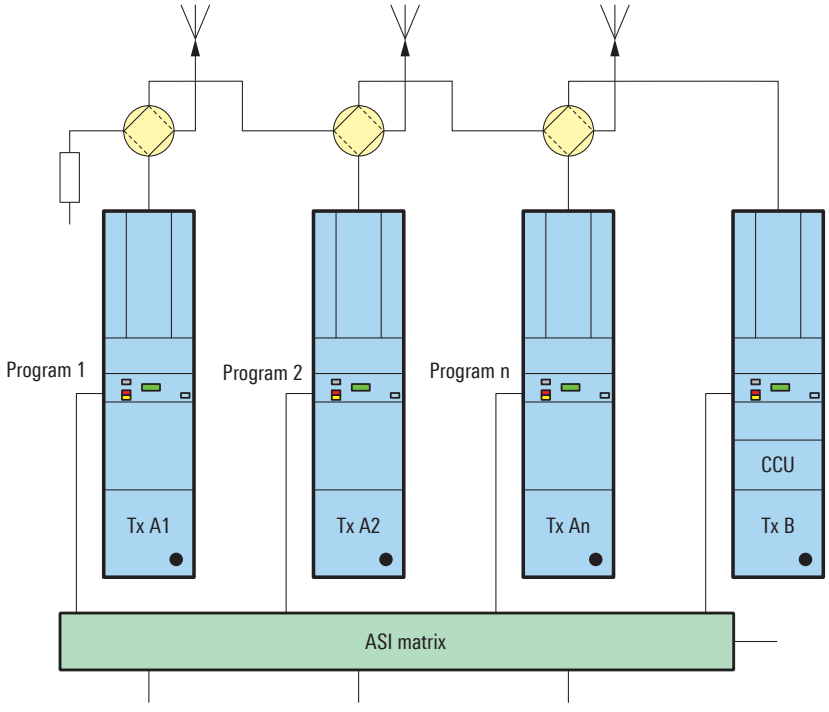



**Fig. 7: (n+1) transmitter standby system**

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# Content Chapter 3
# Sound Transmitters



Rohde&Schwarz offers sound transmitters for FM as well as DAB(+) and T-DMB standards. Choose from state of the art air and liquid cooled VHF band III transmitters for digital audio broadcasting DAB(+)/T-DMB and air cooled band II FM transmitters. The transmitters comply with the R&TTE Directive 1999/5/EC.

- The FM transmitters meet the following standards:
  - EN60215 for protection of personnel
  - EN301489-1 and EN301489-11 for EMC
  - EN302018-1 and EN302018-2 for RF requirements
  - ITU-R B.S450-3 for stereo emissions
- The DAB(+)/T-DMB transmitters meet the following standards:
  - EN300401, EN60215, EN300799 and EN302077-2 for RF equipments with external bandpass filter

# R&S®NR8200 VHF-FM Transmitter Family

Powerful, air-cooled FM transmitters of solid-state design for 2.5 kW to 30 kW with excellent specifications

- Compact modules featuring max. 800 mm rack depth and up to 10 kW output power in a 19" rack
- All conventional air ducting configurations feasible
- Standby concepts: exciter standby, (n+1) standby, passive standby and active amplifier standby

The air-cooled R&S®NR8200 VHF-FM transmitter family covers a power range from 2.5 kW to 30 kW. The transmitters include the following components:

- Digital exciter with AES/EBU interface in one height unit
- Power amplifier with latest MOSFET technology
- Transmitter rack with cooling system
- Frequency-response-compensated directional coupler
- Innovative, nearly wireless power distribution system
- Control unit with color display and multilingual menus

All transmitters feature outstanding technical parameters, an optimum cost/benefit ratio, plus maximum reliability and ease of servicing. They are equipped with the digital state-of-the-art R&S®SU800 exciter with integrated AES/EBU interface. The compact air-cooled models with max. 800 mm rack depth provide an output power of up to 10 kW in a 19" rack.

The R&S®NetCCU®800 transmitter control unit handles both internal and external communication and provides all control functions. The R&S®NetCCU®800 clearly shows the current status of the transmitter system on a color display in different languages. All transmitter and amplifier parameters required for diagnostics can be retrieved locally or remotely via standard (IP) protocol and standard software (web browser, SNMP).

Conventional standby systems such as exciter standby, (n+1) standby, passive standby and active amplifier standby can be implemented. No additional control units are needed for exciter standby and active amplifier standby.

### R&S®SU800 exciter

- Synthesizer-based digital exciter
- FM-modulated RF signal from 87.5 MHz to 108 MHz
- Combines outstanding specifications of first-rate analog exciters with reliability of digital signal processing
- Analog AF signals as well as digital signals can be processed in line with the bit-serial AES/EBU protocol
- Modulation with left/right, MPX, RDS or SCA signals

- Digital performance of all signal processing including frequency modulation
- Meets high requirements for spurious and spectrum masks by using powerful digital technology and state-of-the-art D/A converters
- Integrated stereo coder with its own deviation limiter
- All parameters, e.g. transmit frequency, operating mode, modulation mode, or properties of modulation interfaces settable via transmitter control unit
- Evaluation and display of of exciter parameters, e.g. operating hours, system events, frequency deviation, AF level, etc.
- Comprehensive monitoring functions inclusive error table

## R&S®VU825 power amplifier

- Excellent efficiency, compact and modular design due to state-of-the-art MOSFET technology
- Each RF amplifier has its own power supply
- Approx. 2.7 kW output power
- Integrated harmonics filter ensures harmonics suppression of >85 dB
- Optimized, highly efficient heat sink
- Self-monitoring and evaluating of protective functions (e.g. over temperature switch-off, VSWR reduction)
- Automatic phase correction and output power control prevents from being overdriven, if a transistor fails, etc
- Self-monitoring and self-protecting ensures long life for individual transistors
- All relevant operating parameters and fault messages transferred to transmitter control unit via CAN bus
- Amplifier modules easily replacable during operation; no re-adjustment of the transmitter necessary

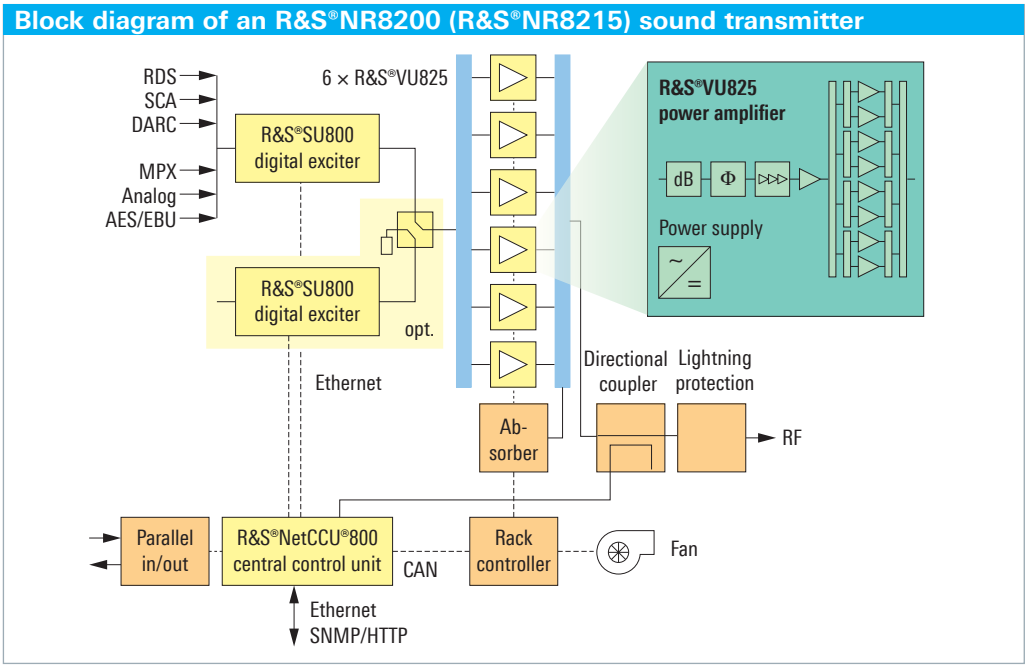
## R&S®NetCCU®800 transmitter control unit

- Handles internal and external communications, including all control functions
- Operation and control as with the other TV transmitters of the R&S®Nx8000 family
- Only two height units suffice to implement functions of transmitter control unit plus IP interface
- Provides straightforward summary of transmitter's current status on a color display
- Communication with internal components (amplifier, rack controller, other transmitter racks) via CAN bus
- Communication with external components via Ethernet
- Transmitter remote control and remote monitoring via SNMP and/or web interface
- Enables accurately evaluation of transmitter status of unattended stations

## Transmitter rack with integrated cooling

- 19" rack for all power classes
- One rack accommodates up to six amplifier modules
- Elaborate air-cooling concept ensures effective cooling with only small amounts of air
  - Air-cooled by two internal fans (up to R&S®NR8210) or by an internal or external fan
  - Internal fan suppliable with ambient air or via air ducts by a central ventilation system
  - Cooling air intake from the top, bottom or rear of the transmitter rack
  - Exhaust air discharge toward the top or bottom
  - Monitoring of fans
- Integrated lightning protection

**Block diagram of an R&S®NR8200 (R&S®NR8215) sound transmitter**



## Specifications

| | |
|---|---|
| **Frequency** | |
| Frequency range | 87.5 MHz to 108 MHz |
| Internal tuning | menu-controlled in 10 kHz steps |
| External tuning | 8 frequencies, selectable |
| Frequency drift | <200 Hz/3 months |
| Center frequency offset at ±75 kHz frequency deviation | typ. 0 Hz |
| Nominal frequency deviation | adjustable from ±40 kHz to ±150 kHz |
| Deviation limitation | adjustable from ±40 kHz to ±150 kHz |
| Max. frequency deviation | ±150 kHz |
| Emission class | F3E, stereo and mono |
| Stereo emissions | in line with ITU-R BS.450-3 |
| **RF output** | |
| Impedance | 50 Ω |
| **Audio input** | |
| Connector | XLR on transmitter top |
| AF input level for nominal deviation | |
| L and R mode | –6 dBu to +12 dBu |
| Multiplex mode | +5 dBu to +7 dBu |
| AES/EBU mode | 200 mV to 10 V ($V_{pp}$) |
| Input impedance | |
| L and R mode, multiplex mode | 600 Ω or >2 kΩ, balanced/ unbalanced |
| AES/EBU mode | 110 Ω, balanced |

## Specifications

| | |
|---|---|
| **Control interfaces** | |
| Bitbus | optional |
| Parallel remote-control interface | optional |
| TCP/IP | HTTP, SNMP |
| **Auxiliary frequency** | |
| Pilot-tone frequency | 19 kHz |
| Amplitude | 1 V ($V_{pp}$) + 0.1 V into 1 kΩ; unbalanced |
| Pilot-tone deviation | 0 Hz to 15 kHz, adjustable in 100 Hz steps |
| Output | BNC |
| **General data** | |
| AC supply voltage | 380 V or 400 V or 415 V, 3 phases + neutral wire [1)] |
| AC supply frequency | 50 Hz or 60 Hz [1] |
| Permissible voltage variation | ±15% |
| Power ratio | >0.9 |
| Cooling | air cooling by internal fan/fans (air ducts or ambient air) or external fan |
| Operating temperature range | +1°C to +45°C, upper limit de-creased by +5°C for each 1000 m of elevation above sea level |
| Storage temperature range | –40°C to +70°C |
| Permissible relative humidity | <95 % at +26°C |
| Permissible external electric field strength | <10 V/m |
| Maximum installation altitude | 3000 m above mean sea level |

[1)] To be specified when placing the order.

## Model-specific data and ordering information

| R&S® | NR8202 | NR8205 | NR8207 | NR8210 | NR8212 | NR8215 | NR8220 | NR8230 |
|---|---|---|---|---|---|---|---|---|
| Nominal output power | 2.5 kW | 5 kW | 7.5 kW | 10 kW | 12.5 kW | 15 kW | 20 kW | 30 kW |
| Number of amplifiers | 1 | 2 | 3 | 4 | 5 | 6 | 8 | 12 |
| RF output connector | 1 5/8" EIA | 1 5/8" EIA | 1 5/8" EIA | 1 5/8" EIA | 1 5/8" EIA | 3 1/8" EIA | 3 1/8" EIA | 3 1/8" EIA |
| Dimensions (W × H × D) | | | | | | | | |
| With internal fan, air ducts | 600 mm × 2000 mm × 800 mm | | | | 600 mm × 2000 mm × 1200 mm | | 1200 mm × 2000 mm × 800 mm | 1200 mm × 2000 mm × 1200 mm |
| With internal fan, ambient air | 600 mm × 2000 mm × 900 mm | | | | 600 mm × 2000 mm × 1200 mm | | 1200 mm × 2000 mm × 900 mm | 1200 mm × 2000 mm × 1200 mm |
| With external fan | 600 mm × 2000 mm × 800 mm | | | | 600 mm × 2000 mm × 1200 mm | | 1200 mm × 2000 mm × 800 mm | 1200 mm × 2000 mm × 1200 mm |
| Volume flow rate of internal fan at 1000 hPa barometric pressure | | | | | | | | |
| With air ducts/ ambient air | 5 m³/min | 15 m³/min | 19.2 m³/min | 24.2 m³/min | 29.2 m³/min | | 48.4 m³/min | 58.4 m³/min |

Your local Rohde&Schwarz expert will help you to find the solution that is optimally suited to your requirements and will be glad to prepare a custom offer for you.

To find your nearest Rohde&Schwarz representative visit:
www.sales.rohde-schwarz.com

# R&S®SR8000 VHF-FM Transmitter Family

Air-cooled FM transmitters of solid-state design for 100 W to 2.5 kW with excellent specifications

- RF parameters meeting or exceeding ETSI and ITU-R requirements
- Transmitter for 2.5 kW in only eight height units
- Transmitter remote control and monitoring via SNMP option and web interface
- Integrated parallel remote-control interfaces
- Solid-state broadband amplifiers with guard circuits and integrated harmonics filter
- State-of-the-art MOSFET technology in power amplifiers
- Very robust operation even with high VSWR
- Passive standby and (n+1) standby possible
- Easy operation via graphical display
- Easy installation, startup and maintenance due to all-in-one box concept

The air-cooled R&S®SR8000 generation of FM transmitters covers a power range from 100 W to 2.5 kW. The transmitters include the following components:

- Digital exciter, based on the R&S®SU800, with excellent spectral purity and integrated stereo coder
- Power amplifier
- Housing with integrated cooling
- Power supply
- Integrated transmitter control unit

All transmitters feature outstanding technical parameters, an optimum cost/benefit ratio, extremely high reliability plus ease of servicing. They contain the engineering of the digital state-of-the-art R&S®SU800 exciter and include an integrated AES/EBU interface.

The air-cooled 19" units are extremely compact. The 100 W transmitter occupies two height units, the 1 kW transmitter four height units and the 2.5 kW transmitter only eight height units. The 2.5 kW transmitter consists of two modules. The first module contains the exciter functions, an amplifier with an integrated splitter and a power supply. The second module contains the second amplifier, the combiner, the absorber and a second power supply.

The transmitter control unit handles internal and external communications, including all control functions and displays the transmitter's current status in various languages on a display. All transmitter and amplifier parameters required for diagnostics can be retrieved locally as well as remotely via standard (IP) protocol and standard software (web browser, SNMP option). In addition, an integrated parallel remote-control interface for message signaling and commands is available. Both (n+1) standby and passive standby systems can be implemented.

The transmitters comply with the R&TTE Directive 1999/5/EC and meet the following standards: EN 60215 for protection of personnel, EN 301489-1 and EN 301489-11 for EMC, EN 302018-1 and EN 302018-2 for RF requirements and ITU-R B.S450-3 for stereo emissions.

## Exciter

- Synthesizer-based digital exciter
- FM-modulated RF signal from 87.5 MHz to 108 MHz
- Combines outstanding specifications of first-rate analog exciters with reliability of digital signal processing
- Analog AF signals as well as digital signals can be processed in line with the bit-serial AES/EBU protocol
- Modulation with left/right, MPX, RDS or SCA signals
- Digital performance of all signal processing including frequency modulation
- Meets high requirements for spurious and spectrum masks by using powerful digital technology and state-of-the-art D/A converters
- Integrated stereo coder with its own deviation limiter
- All parameters, e.g. transmit frequency, operating mode, modulation mode, or properties of modulation interfaces settable via transmitter control unit
- Evaluation and display of of exciter parameters, e.g. operating hours, system events, frequency deviation, AF level, etc.
- Comprehensive monitoring functions inclusive error table

## Power amplifier

- Excellent efficiency and compact design due to state-of-the-art MOSFET technology
- 100 W, 250 W, 500 W, 1 kW or 1.3 kW output power
- Integrated harmonics filter ensures compliance with ETSI standards
- Optimized, highly efficient heat sink
- Self-monitoring and evaluating of protective functions (e.g. over temperature switch-off, VSWR reduction)
- Automatic phase correction and output power control prevents from being overdriven, if a transistor fails, etc
- Self-monitoring and self-protecting ensures long life for individual transistors
- All relevant operating parameters and fault messages transferred to transmitter control unit via CAN bus

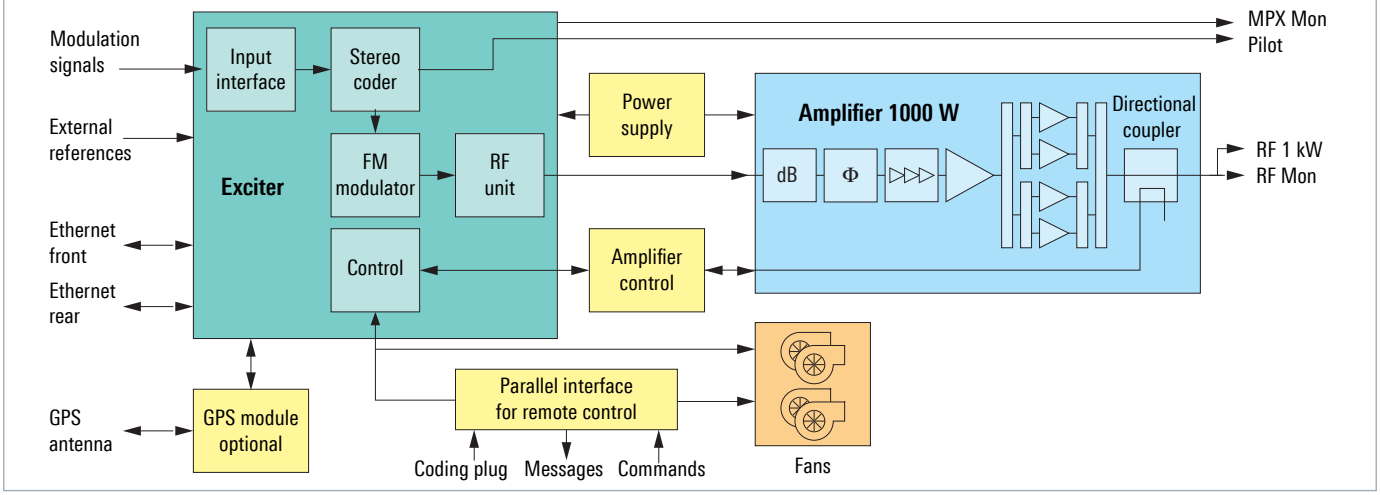
## Transmitter control unit

- Handles internal and external communications, including all control functions
- Integrated on the exciter board
- Provides straightforward summary of transmitter's current status on a display
- Communication with internal components (e.g. amplifier) via CAN bus
- Communication with external components via Ethernet
- All transmitter and/or amplifier parameters required for diagnostics locally and remotely available via (IP) protocol and standard software (web browser/SNMP option)
- Enables accurately evaluation of transmitter status of unattended stations

## Housing with integrated cooling

- 19" housing for all power classes
- Elaborate air-cooling concept ensures effective cooling with only small amounts of air
  - Compact internal fans
  - The surrounding air is drawn in from the front. It cools the modules via conducted channels and is expelled at the back
  - Extremely powerful and highly efficient fans
  - Monitoring of fans
  - Fans replacable during operation for easy transmitter servicing
- Integrated frequency-response-compensated directional coupler
- Built-in lightning protection

**Block diagram of an R&S®SR8100 sound transmitter**



## Specifications

| | |
|---|---|
| **Frequency** | |
| Frequency range | 87.5 MHz to 108 MHz |
| Internal tuning | menu-controlled in 10 kHz steps |
| Frequency drift | <200 Hz/3 months |
| Center frequency offset at ±75 kHz frequency deviation | typ. 0 Hz |
| Nominal frequency deviation | adjustable from ±40 kHz to ±150 kHz |
| Deviation limitation | adjustable from ±40 kHz to ±150 kHz |
| Max. frequency deviation | ±150 kHz |
| Emission class | F3E, stereo and mono |
| Stereo emissions | in line with ITU-R BS.450-3 |
| **RF output** | |
| Nominal impedance | 50 Ω |
| Nominal power | VSWR up to 1:1.5 |
| **Audio input** | |
| Connector | XLR |
| AF input level for nominal deviation | |
| L and R mode | –6 dBu to +12 dBu |
| Multiplex mode | +5 dBu to +7 dBu |
| AES/EBU mode | –12 dBFS to 0 dBFS |
| Input impedance | |
| L and R mode, multiplex mode | 600 Ω or >2 kΩ, balanced/unbalanced |
| AES/EBU mode | 110 Ω, balanced |
| **Control interfaces** | |
| Parallel remote-control interface | integrated |
| TCP/IP | HTTP, SNMP (option) |
| **Auxiliary frequency** | |
| Pilot-tone frequency | 19 kHz |
| Amplitude | 1 V ($V_{pp}$) + 0.1 V into 1 kΩ; unbalanced |
| Pilot-tone deviation | 0 Hz to 15 kHz, adjustable in 100 Hz steps |
| Output | BNC |
| **General data** | |
| AC supply voltage | 100 V to 240 V, single-phase; R&S®SR8100: 220 V to 240 V |
| AC supply frequency | 50 Hz or 60 Hz |
| Permissible voltage variation | ±10% |
| Power ratio | >0.9 |
| Cooling | air cooling by internal fans (surrounding air) |
| Operating temperature range | +1°C to +45°C, upper limit decreased by +5°C per 1000 m above mean sea level |
| Storage temperature range | –40°C to +70°C |
| Permissible relative humidity | <95% at +26°C |
| Permissible external electric field strength | <10 V/m |
| Maximum installation altitude | 3000 m above mean sea level |

## Type specific data and ordering information

| **VHF-FM Sound Transmitter** | **R&S®SR8010** | **R&S®SR8025** | **R&S®SR8050** | **R&S®SR8100** | **R&S®SR8130** | **R&S®SR82050A** |
|---|---|---|---|---|---|---|
| Nominal output power | 100 W | 250 W | 500 W | 1 kW | 1.3 kW | 2.5 kW |
| Power range (load with VSWR = 1) | 10 W to 100 W | 125 W to 250 W | 125 W to 500 W | 250 W to 1 kW | 325 W to 1.3 kW | 625 W to 2.5 kW |
| Connector | N, female | junction $^{7}/_{16}$ | junction $^{7}/_{16}$ | junction $^{7}/_{16}$ | junction $^{7}/_{16}$ | junction $^{7}/_{16}$ |
| Dimensions (W × H × D) without power cable | 420 mm × 2 HU × 510 mm (16.54 in × 2 HU × 20.01 in) | 420 mm × 4 HU × 590 mm (16.54 in × 3 HU × 23.23 in) | 420 mm × 4 HU × 590 mm (16.54 in × 4 HU × 23.23 in) | 420 mm × 4 HU × 590 mm (16.54 in × 4 HU × 23.23 in) | 420 mm × 4 HU × 590 mm (16.54 in × 4 HU × 23.23 in) | 420 mm × 8 HU × 590 mm (16.54 in × 8 HU × 23.23 in) |
| Amplifier | 100 W | 250 W | 500 W | 1 kW | 1.3 kW | 2 × 1.3 kW |
| **Order No.** | **5300.9002.02** | **5300.9102.02** | **5300.9202.02** | **5300.9302.02** | **5300.9302.03** | **5300.9502.02** |

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# R&S®NA7000 VHF DAB/T-DMB Transmitter Family

## Liquid-cooled DAB/DMB transmitters VHF band III for 900 W to 7.2 kW

- Frequency range 174 MHz to 240 MHz
- MOSFET technology for power amplifiers
- Digital pre-correction
- Liquid cooling
- Redundancy of essential components
- Very compact design
- Cost-effective installation
- Exciter standby (option)

The R&S®NA7000 VHF DAB/T-DMB transmitter family is a generation of liquid-cooled transmitters for digital audio broadcasting. The transmitters consist of the following main components:

- Exciter
- Power amplifiers including power supply
- Transmitter rack
- Harmonics filter

The DAB/DMB VHF transmitters provide an output power range from 900 W to 7.2 kW (higher and lower power ratings on request). Each amplifier has its own power supply which is integrated into the amplifier module and therefore also liquid-cooled.

The amplifier modules are self-engaging and can be replaced during operation without losing any liquid from the closed cooling system and without impairing the functioning of the other modules. When an amplifier module is inserted into the rack, it is hooked up to the RF, control and cooling system lines by appropriate connecting elements. As the AC supply voltage is directly fed to the amplifier modules, additional auxiliary power supplies are not required. This enhances the availability of the transmitters.

All transmitters can be equipped with a second exciter (exciter standby) and the associated automatic switch-over unit.

## Exciter

The very compact design of the modules makes it possible to accommodate two complete exciters, including the automatic switchover units, in a 19" frame of 7 height units. Each exciter has its own power supply, ensuring full redundancy. The fully digital precorrection can be reproduced 100 % and adjustments are not required if this module has to be replaced. For replacing the exciter or its individual modules, the digital precorrection values can be output and saved externally. After replacement, the saved values are loaded to the exciter, which completely restores the precorrection facility without any adjustments being necessary.

## Power amplifiers

Owing to MOSFET technology, the power amplifiers feature high linearity, excellent efficiency and compact design. The power supply is integrated into the amplifier module, which is an enclosed unit. There is practically no heat dissipation in the rack, since a radial fan makes the air circulate inside the module. Residual heat is conveyed to the cooling system via a heat exchanger.

The amplifiers also contain circuits for protection against reflection, excessive temperature and the like; under normal operating conditions the junction temperature of the transistors is only around +120 °C at an ambient temperature of +25 °C.

## Transmitter rack

The transmitters are accommodated in a rack 630 mm wide, which means minimum space requirements. The connectors for modulation and reference signals (ETI, GPS) and the remote control interface are located on the top of the transmitter rack. The connectors for the cooling system can be located either on the top or at the bottom of the rack. The cooling system components inside the transmitter rack are exclusively made of stainless steel, aluminium or plastic. The uniform cross-section throughout the cooling system prevents different flow rates and consequently blocking.

An additional external output filter (on request, see specifications) is required to go on the air. This output filter is not integrated into the transmitter, but is located outside the transmitter rack.

## Central control unit

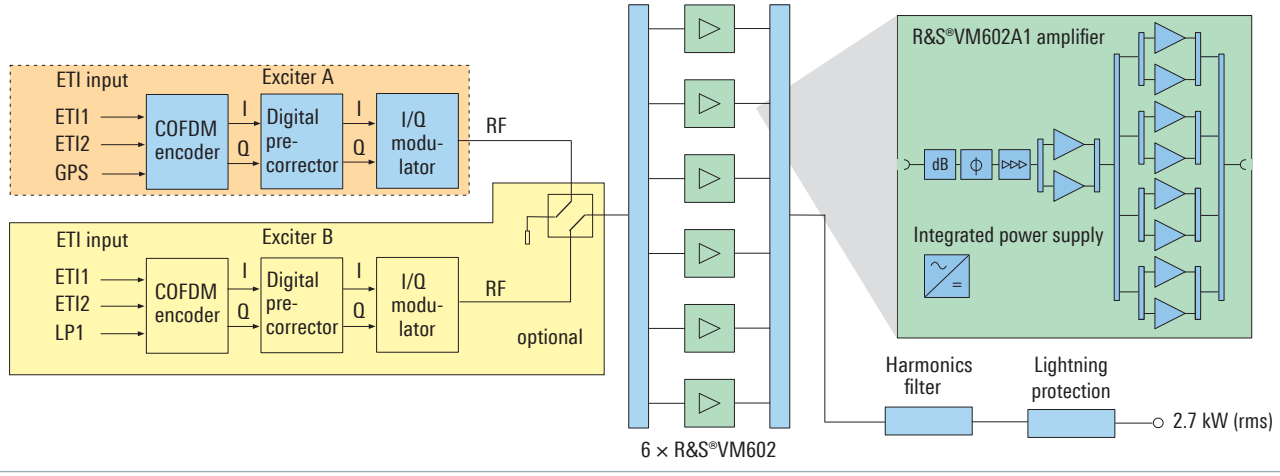
The entire transmitter is controlled via an external PC software running under Windows or via a display integrated into the central control unit. The central control unit, which is accommodated in the exciter rack, controls and monitors the entire transmitter. It enables the user to access the parameters of the entire system and especially those of the built-in encoders, by means of the control panel. This also means that only one interface is required to remote-monitor all functional units of the transmitter.

## Cooling system

The liquid cooling system makes the transmitters immune to air pollution and significantly reduces the noise level. In comparison with air cooling, liquid cooling increases the transmitter output power per amplifier.

The standard cooling system (which comes as an external unit outside the transmitter rack) consists of one pump unit per transmitter rack. It comprises two series-connected pumps for full redundancy, a control unit and a mixer. A cooler for each pump unit is installed outside the transmitter room. For reasons of redundancy, the cooler is also equipped with two fans that operate in active standby. The cooling agent used is AntifrogenN.

### Block diagram of an R&S®NA7000 DAB/T-DMB VHF transmitter



| Common specifications in brief | |
|---|---|
| Frequency range | 174 MHz to 240 MHz |
| Permissible VSWR | <1.5 |
| Power supply | 3 × 230/400 V AC ±15%, 50/60 Hz ±2% |
| Ambient temperature range (transmitter rack) | +1 °C to +40 °C |
| Ambient temperature (cooler) | –30 °C to +50 °C |
| Permissible relative humidity | 95% (at +26 °C, no-condensing) |
| Max. installation altitude | 2000 m above sea level (>2000 m on request) |
| **Interfaces** | |
| 2 × RS-232-C | configuration and operation via external computer with graphical user interface (GUI) on front-panel interface, remote control (on transmitter top) |
| RS-485/Bit-bus | remote control (on transmitter top) |
| Parallel | parallel interface (option, on transmitter top) |
| SNMP/HTTP | with R&S®Netlink (option) |
| External frequency and clock reference | 1/2.048/5/10 MHz, 0.1 V to 5 V ($V_{pp}$) or TTL (BNC), 1 pps input, antenna connector for built-in GPS receiver (option) |
| Test points | ETI signal, RF test point exciter, RF test point at each amplifier, RF test point at transmitter output before filter |
| **Transmission characteristics** | |
| DAB/DMB modes | I, II, III, IV |
| Modulation inputs | XLR, BNC, 75 Ω or 120 Ω, with impedance transformer >2 kΩ (BNC, option) for ETI(NI, G.703) and ETI(NA, G.704), automatic switchover |
| Correction | digital after IFFT and FIR filter |
| IF | without direct modulation |
| Frequency stability | better than $1 \times 10^{-9}$ with GPS, after GPS failure better than $1 \times 10^{-7}$ in 24 h |
| Frequency response in DAB/DMB block | <1 dB |
| Output spectrum | masks to EN302077-2 or EN300401 with additional output filter (on request) |
| Shoulder distance ±970 kHz before filter | corrected >35 dB, typ. –37 dB |
| Static delay compensation | max. 1 s, in steps of 488 ns |
| Dynamic delay compensation | max. 1 s, in steps of 488 ns |
| **Output filter** | additionally required, external |

**Type specific data in brief**

| R&S® | NA7090 | NA7140 | NA7180 | NA7230 | NA7270 | NA7360 | NA7460 | NA7540 | NA7720 |
|---|---|---|---|---|---|---|---|---|---|
| Output power without filter [1] | 900 W | 1.4 kW | 1.8 kW | 2.3 kW | 2.7 kW | 3.6 kW | 4.6 kW | 5.4 kW | 7.2 kW |
| Number of amplifiers | 2 | 3 | 4 | 5 | 6 | 8 | 10 | 12 | 16 |
| RF connector | 1 5/8 EIA | 1 5/8 EIA | 1 5/8 EIA | 1 5/8 EIA | 1 5/8 EIA | 1 5/8 EIA | 3 1/8 EIA | 3 1/8 EIA | 3 1/8 EIA |
| Approx. power consumption with pump rack and cooler | 6 kW | 8 kW | 10 kW | 12 kW | 14 kW | 18 kW | 22.5 kW | 26.5 kW | 36 kW |
| Efficiency without output filter | 15% | 17.5% | 18% | 19% | 19% | 20% | 19% | 19% | 20% |
| Fuse | 63 A | 80 A | 80 A | 80 A | 80 A | 80 A | 80 A | 80 A | 80 A |
| Dimensions (H × D × W) | 2167 mm × 1200 mm × 630 mm (single versions) | | | | | | 2167 mm × 1200 mm × 1260 mm | | |

**Ordering information (R&S®NA7xx0, Order No. 3500.7x09.x4)**

| R&S® | | NA7090 | NA7140 | NA7180 | NA7230 | NA7270 | NA7360 | NA7460 | NA7540 | NA7720 |
|---|---|---|---|---|---|---|---|---|---|---|
| Single transmitter | 3500 | .7009.04 | .7109.04 | .7209.04 | .7309.04 | .7409.04 | .7509.04 | .7609.04 | .7709.04 | .7809.04 |
| Transmitter, exciter standby | 3500 | .7009.24 | .7109.24 | .7209.24 | .7309.24 | .7409.24 | .7509.24 | .7609.24 | .7709.24 | .7809.24 |

[1] Other power classes on request.

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# R&S®NA8200 VHF DAB(+)/T-DMB Transmitter Family

Air-cooled medium-power transmitters with highest energy efficiency and signal quality

- Energy efficiency – up to 25 % efficiency at typ. 37 dB shoulder distance
- Excellent signal quality – high MER of typ. 33 dB
- Compact transmitters – 400 W to 2.4 kW transmit power (rms) in a standard 19" rack
- High safety of investment – prepared for the implementation of new standards



The transmitters of the R&S®NA8200 family transmit very high-quality digital audio broadcasting (DAB) signals in VHF band III. The transmitters' high efficiency combined with a small footprint significantly reduces investment and operating costs. High availability means reliable broadcasting operation for the customer. The transmitters can be flexibly adapted to special requirements in the transmitter stations and they feature a convenient operating concept.

By providing excellent signal quality with a modulation error rate (MER) of typ. 33 dB, the transmitters of the R&S®NA8200 family are market leaders. This is due to the high signal processing quality of the R&S®SX801 exciter and the low-loss and low-distortion RF design of the R&S®VM8350A1 amplifier. Large shoulder distance and low out-of-band emissions are the crowning touches to the impressive characteristics of the RF output spectrum.

An air-cooled 19" rack offers output power ranging from 400 W to 2.4 kW. The space-saving design increases the lifetime of the transmitters by making efficient use of materials and providing short signal paths. The components deliver high reliability, and standy systems such as dual drive as well as (1+1) and (N+1) standby increase availability. Each transmitter station has its own requirements for cooling, RF connectors, or remote control. The flexible mechanical concept of the R&S®NA8200 family enables users to smoothly adapt the transmitter to their individual requirements on site.

Starting already in the early days, Rohde&Schwarz has continuously presented itself as a supplier of DAB solutions. The R&S®NA8200 family of transmitters reflects the company's extensive experience in DAB technology. Transmissions in line with the existing DAB, DAB+ and T-DMB specifications are supported. As a beacon to the future, the transmitter family is prepared to handle the implementations of expansions to existing or new standards.

## Maximum signal quality combined with low space and energy requirements

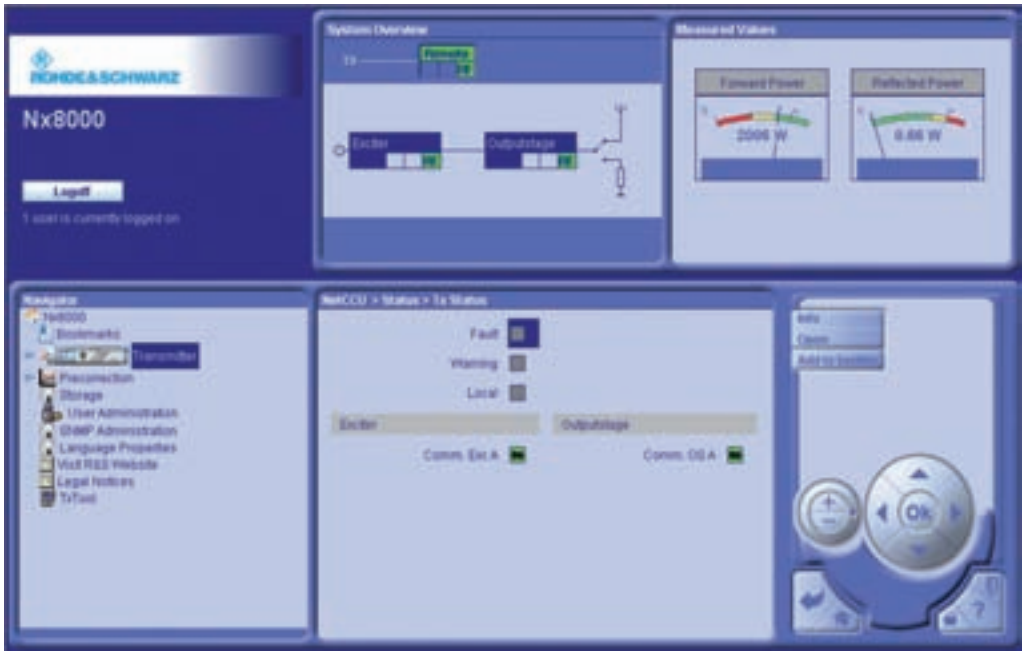
- Energy efficiency lowers operating costs
- Top value in signal quality (MER) for high reception security
- Excellent RF output spectrum
- Space-saving transmitter concept

## Continuous coverage

- All components deliver high reliability
- Standby systems enhance availability
- Seamless switchover of the ETI inputs
- Self-monitoring power amplifiers
- Highly sensitive GPS receiver with fast synchronization (option)

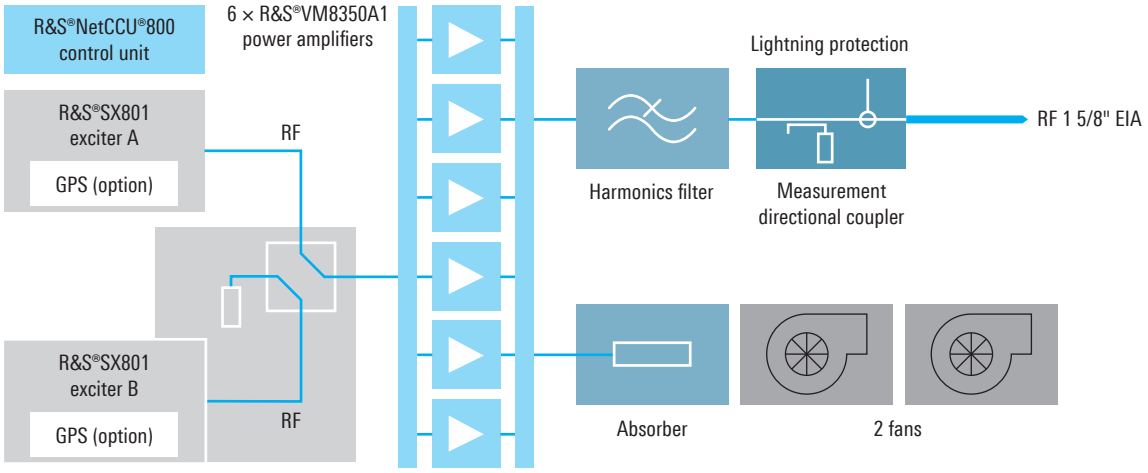
## Custom tailoring

- Cooling suitable for any location
- Convenient operation and diagnostics either directly on the transmitter or via remote control




Convenient operation of the R&S®NA8200 transmitter family via web browser.

## Block diagram of the R&S®NA8200, configured as R&S®NA8206V with dual drive



## Specifications in brief

| R&S®NA8200 configured as | R&S®NA8201 | R&S®NA8202 | R&S®NA8203 | R&S®NA8204 | R&S®NA8205 | R&S®NA8206 |
|---|---|---|---|---|---|---|
| Output power (rms) | 400 W | 800 W | 1200 W | 1600 W | 2000 W | 2400 W |
| Number of R&S®VM8350A1 amplifiers | 1 | 2 | 3 | 4 | 5 | 6 |
| Frequency range | 174 MHz to 240 MHz (VHF band III) | | | | | |
| Shoulder attenuation at nominal power | 35 dB, typ. 37 dB | | | | | |
| RF output | EIA 1 5/8" | | | | | |
| Maximum permissible reflection (VSWR) | 1.3 | | | | | |
| Operating voltage | 3-phase 3P + N + PE, 400 V AC, 47 Hz to 63 Hz | | | | | |
| Cooling system | air cooling with two internal fans | | | | | |
| Total air volume | 8.5 m³/min | 12.0 m³/min | 15.0 m³/min | 17.0 m³/min | 17.0 m³/min | 17.0 m³/min |
| DAB-specific parameters | in line with EN300401, EN302077-2, EN300799 | | | | | |
| Supported standards | DAB, DAB+, T-DMB | | | | | |
| DAB modes | I, II, III, IV | | | | | |
| MER | ≥30 dB (typ. 33 dB) | | | | | |
| Delay compensation (static and dynamic) | max. 1 s, step size 61 ns (time stamp level 5) | | | | | |
| Signal input | 2 × ETI (NI, G.703/NA, G.704), automatic detection; seamless switchover,<br>75 Ω BNC female or >10 kΩ BNC female (high-impedance), switchable | | | | | |
| GPS antenna input | N female (optional) | | | | | |
| External reference clock | 1 Hz (1 pps) TTL, BNC; 10 MHz, 0.1 V to 5 V, BNC | | | | | |
| Operating temperature range | +1 °C to +45 °C | | | | | |
| Storage temperature range | –20 °C to +60 °C | | | | | |
| Installation altitude at nominal power | 2000 m | | | | | |
| Relative humidity | 95 %, non-condensing | | | | | |
| Dimensions (H × W × D) | 2000 mm × 600 mm × 800 mm; when surrounding-air cooling is used: 2000 mm × 600 mm × 900 mm | | | | | |

## Ordering information

**Typical configuration of a DAB/T-DMB transmitter with 2.4 kW and dual drive**

| Designation | Type | Order No. |
|---|---|---|
| DAB(+)/T-DMB Transmitter, configured as R&S®NA8206V,<br>VHF band III, 174 MHz to 240 MHz, 2.4 kW output power with dual drive | | |
| DAB(+)/T-DMB Basic Transmitter | R&S®NA8206X | 5302.9551.50 |
| RF Power Assembly Kit 400 V, 3-phase | R&S®ZR800C1 | 2098.5009.36 |
| 6 × VHF Power Amplifier | R&S®VM8350A1 | 2097.9000.02 |
| 2 × R&S®SX801 Exciter, configured as DAB/T-DMB exciter | R&S®SX801 | 2104.4504K02 |
| Assembly Kit for R&S®SX801 Exciter | R&S®ZR800T1 | 2099.1007.04 |
| Assembly Kit for R&S®SX801 Dual Drive | R&S®ZR800V1 | 2099.1507.06 |
| Control Unit | R&S®NetCCU800 | 2095.8007.02 |
| Rack with Internal Fans | R&S®KG830M1 | 2096.2002.02 |
| Fan Set with 2 Fans, 210 l/s, 230 V, 50/60 Hz | R&S®KL830M1 | 2096.2377.10 |
| Air Filter Kit for 4 to 6 Power Amplifiers | R&S®KL830F1 | 2096.5901.06 |
| Air Ducting Kit, exhaust air on top | R&S®KL830M1 | 2096.2377.04 |

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# R&S®SLA8000 VHF DAB/T-DMB Transmitter Family

The ongoing setup of new DAB/T-DMB transmitter networks as well as network optimization require a large number of low-power transmitters.

The R&S®SLA8000 VHF DAB/T-DMB transmitter family is an extremely compact and efficient solution with a wide power range from 40 W to 300 W. It can be used for DAB, DAB+ and T-DMB transmission in VHF Band III (174 MHz to 240 MHz).

- Shortest processing time on the market
- High output power in a compact design (all-in-one)
- High efficiency
- Convenient user interface (standard web browser)
- Easy parameter settings for SFN operation
- No manual precorrection necessary
- Internal GPS receiver with short synchronization time (option)
- Remote control by SNMP, relay contacts (option)


R&S®SLA8000 status display with web GUI.

R&S®SLA8050 front view.

## Specifications

| | R&S®SLA8025 | R&S®SLA8050 | R&S®SLA8100 | R&S®SLA8200 |
|---|---|---|---|---|
| Output power | 40 W | 75 W | 150 W | 300 W |
| Frequency | VHF band III, 174 MHz to 240MHz | | | |
| RF connector | N female | N female | junction $^{7}/_{16}$ | junction $^{7}/_{16}$ |
| Dimensions (W × H × D) | 483 mm (18.7 in) × 133 mm × 474 mm (5.2 in × 18.7 in) | 483 mm (18.7 in) × 133 mm × 474 mm (5.2 in × 18.7 in) | 483 mm (18.7 in) × 133 mm × 474 mm (5.2 in × 18.7 in) | 483 mm (18.7 in) × 177 mm × 632 mm (7 in × 24.9 in) |
| Weight | 11 kg (24.25 lb) | 11 kg (24.25 lb) | 12 kg (26.46 lb) | 26 kg (57.32 lb) |
| DAB parameters | in line with EN300799, EN300401, EN302077-2 | | | |
| Inputs | | | | |
| ETI | 2 × G.703 (NI)/G.704 (NA), autodetection; BNC female with 75 Ω, high impedance,120 Ω (with adapter); seamless switch | | | |
| GPS antenna | N female | | | |
| External reference | 1 pps, 1 Hz TTL, BNC female; 10 MHz, 0.1 V to 5 V ($V_{pp}$) or TTL, BNC female | | | |
| **Monitoring and remote control** | SNMP, web browser; parallel contacts; modem | | | |
| **General data** | | | | |
| AC supply voltage | 95 V to 265 V, 47 Hz to 63 Hz | | | 230 V –10%/+15%, 47 Hz to 63 Hz |
| Power ratio | <0.9 | | | |
| Cooling | air cooling by internal fan | | | |
| **Environmental data** | | | | |
| Operating temperature range | +1°C to +45°C | | | |
| Storage temperature range | –30°C to +70°C | | | |
| Relative humidity | 95%, non-condensing | | | |
| Max. operating altitude | 2000 m above sea level | | | |
| **Operation** | graphical display, front-panel keys, LEDs for local operation and status display | | | |
| | Ethernet RJ-45 for local and remote operation via PC with web browser | | | |
| **Options** | | | | |
| GPS receiver | internal GPS receiver board, antenna and accessories | | | |
| SNMP agent | software key | | | |
| Parallel interface | 25-pin, floating contacts | | | |
| UPS | UPS external | | | |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| DAB/T-DMB Transmitter 40 W | R&S®SLx8000 configured as R&S®SLA8025 | 2100.1000.K32 |
| DAB/T-DMB Transmitter 75 W | R&S®SLx8000 configured as R&S®SLA8050 | 2100.1000.K32 |
| DAB/T-DMB Transmitter 150 W | R&S®SLx8000 configured as R&S®SLA8100 | 2100.1000.K32 |
| DAB/T-DMB Transmitter 300 W | R&S®SLx8000 configured as R&S®SLA8200 | 2100.1000.K40 |

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R&S®SLA8200 front view.

# Standby Systems for Sound Transmitters

High demands are placed on the operational reliability of broadcast transmitters. Various standby configurations have been developed to further enhance the already high availability. They are all based on the principle of automatic switchover to a standby system if a transmitter, its exciter or an output stage fails. This ensures uninterrupted program transmission – even with unattended stations.

### Passive standby

The passive (1+1) standby configuration includes two complete transmitters. If the active transmitter signals a fault or if data exchange with the exciter is not possible, switchover to the standby transmitter takes place. The standby transmitter uses the operating parameters of the active transmitter stored in its preset channel.

### Passive exciter standby

Passive exciter standby is implemented by means of an additional exciter. The decoupled AF signal is fed to the exciter and the standby exciter without interaction. Exciter and standby exciter may exchange their functions; in the event of fault, the exciter controls switchover.

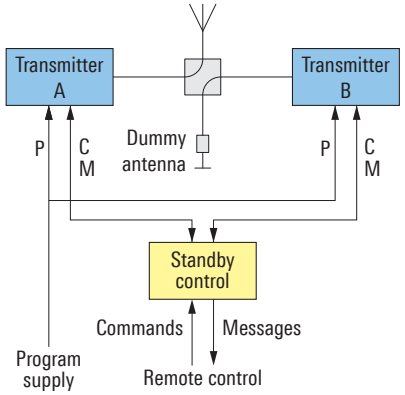
### (n+1) standby

The passive (n+1) standby configuration (n ≤ 8) includes only one standby transmitter for all active transmitters. If one of the active transmitters fails, the standby transmitter is switched on. The program signal is switched over by means of the AF switch. The RF switch connects the standby transmitter to the antenna and the faulty transmitter to the dummy antenna.

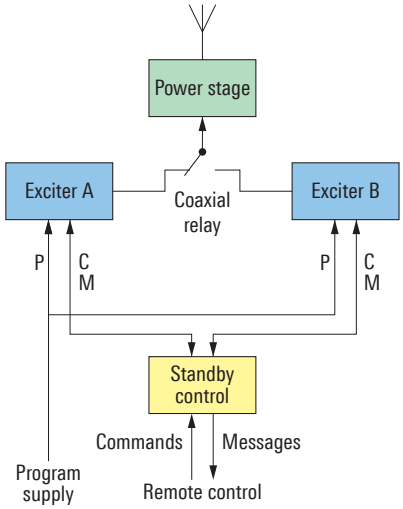
### Passive exciter standby with active output stage standby

In addition to passive exciter standby, active output stage standby further enhances the availability of the transmitter. If one power stage fails, the other power stage is directly switched to the antenna. The transmitter continues to transmit with half the output power (–3 dB).

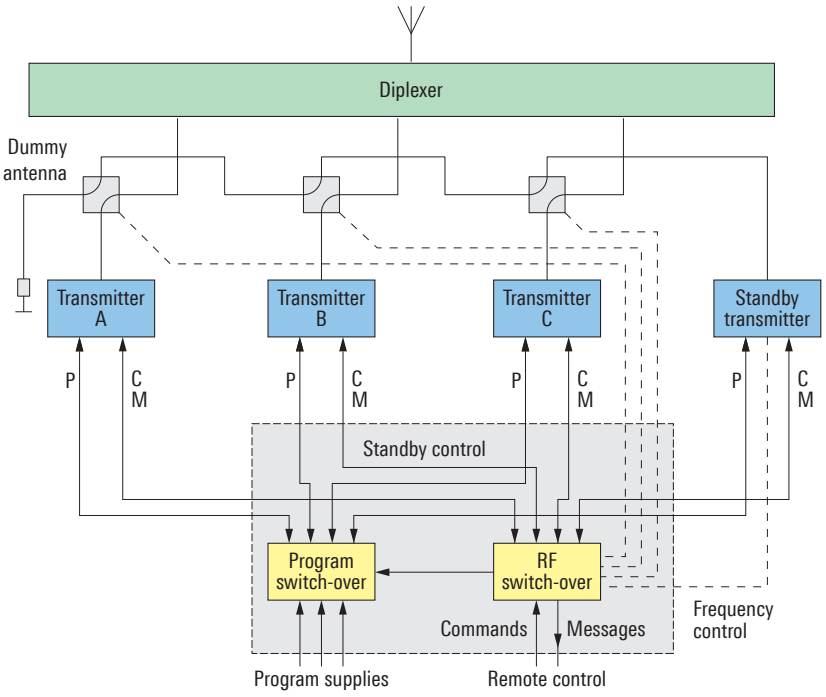
**Principle of passive standby**




**Principle of passive exciter standby**

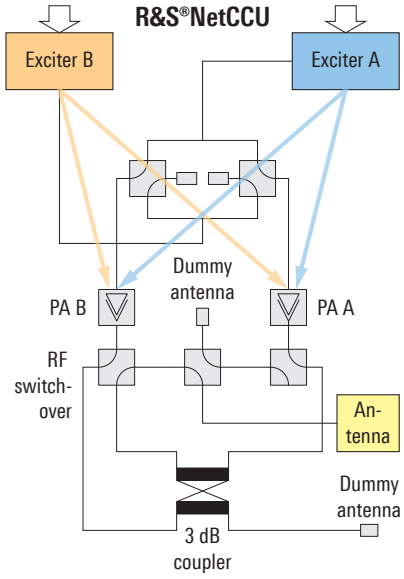


## Principle of (n+1) standby (n = 3 transmitters)




## Principle of passive exciter standby

**with active output stage standby**



# Filter Units and Systems

Combining filters are required when several sound programs are to be transmitted via one antenna. Their primary function is to provide isolation between the individual transmitters.

2-transmitter starpoint combining filter (photo Kathrein)


In sound broadcasting stations, several transmitters with different frequencies and programs are often connected to one and the same antenna. The usually very elaborate and expensive antenna can thus be better utilized, provided that it has sufficient bandwidth and is able to handle the higher power.

In the narrow sound broadcasting range 87.5 MHz to 108 MHz, up to four transmitters are connected to a common antenna via combining filters, which provide isolation between the individual transmitters. Filter circuits tuned to the transmitter frequencies allow the signals to pass from the respective transmitter to the antenna while signals from the other transmitters are prevented to be reflected back to the amplifiers. There are various ways of interconnecting the filter circuits with the transmitters.

### Starpoint combining filters

- All transmitters are connected via filter circuits to a starpoint which is connected to the antenna
- High-power starpoint combining filters are normally not used for more than four transmitters

### Directional-coupler combining filters

- These combining filters, also called bridge diplexers, use 3-dB directional couplers for connecting the filter circuits

The two types differ in their characteristics and design but can be combined with one another. Due to their constant matching, directional-coupler combining filters are used in sound broadcasting where the narrowband starpoint combining filters cannot always be used. Directional-coupler combining filters are frequently used because of high isolation and expandability.

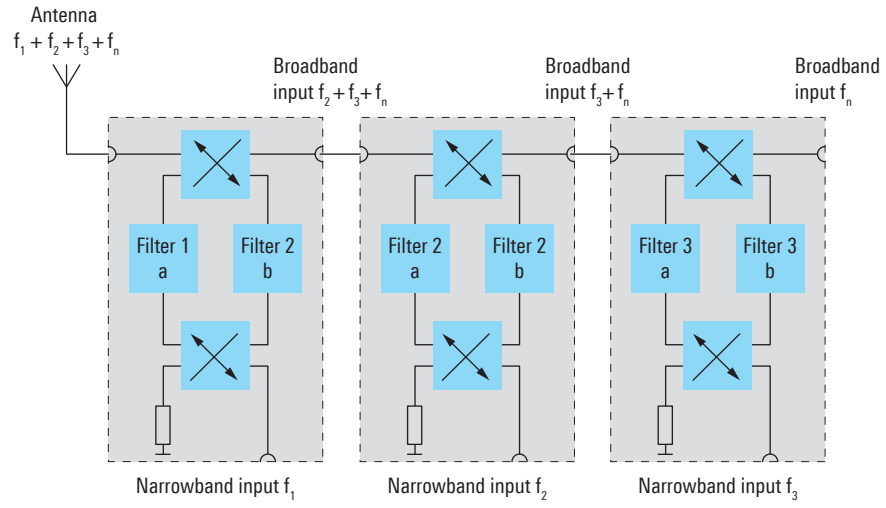
By cascading several combining filter modules, several transmitters can be connected to a common antenna. The illustrated combining filter is an example from a wide range of available types. Combining filters can be supplied for 100 W, 1/3/5/10 kW and 20 kW transmitters.

### Advantages of cascaded combining filters

- Frequency-independent input impedance
- Change of frequency at the broadband input without retuning the filter
- If only the narrowband inputs are used, particularly high isolation is obtained through the use of directional couplers and filters even in the case of very small frequency spacing. In this case the broadband input may be used as an additional input without any modifications to the combining filter being required.

Each module consists of two temperature-stabilized, double-tuned bandpass filters, two 3-dB couplers and an absorber.

## Cascading of 3(4) FM transmitters




2-transmitter directional coupler combining filter (photo Kathrein).

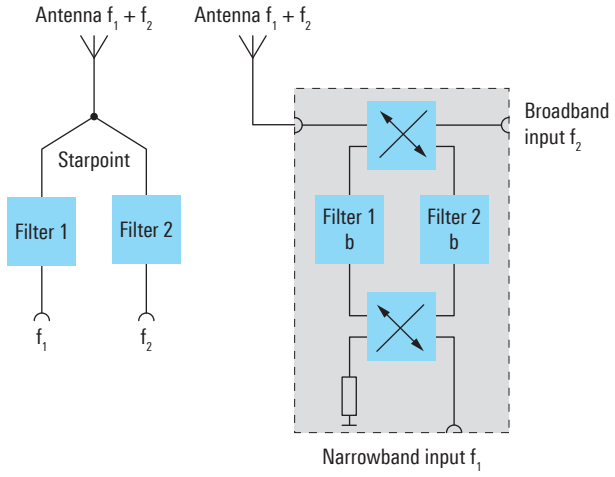
The heat produced is dissipated via heat sinks so that no fans are required. Consequently, the combining filter is maintenance-free and particularly reliable. The impedance of all inputs is 50 Ω, independent of the frequency.

### Tuning

The bandpass filters of a module have to be tuned to the channel frequency applied to the narrowband input. On request tuning is carried out in the factory (please state channels when ordering) or at site. Tuning instructions as well as special tools are part of the equipment supplied.

Principle of starpoint combining filter (left) and directional-coupler combining filter (right).

## Principle of combining filters



# Contents of Chapter 4
# Headends

Instruments from Rohde&Schwarz for the transmission of radio or TV channels from the broadcaster to various networks include statistical multiplex managers for DVB-H and DAB playout, playout base units, encoders, etc.

# Playout with Statistical Multiplex

Significant data rate reduction in each TV channel

- System with
  - R&S®AVE264 video and audio encoder
  - R&S®AVP264 video and audio playout base unit
- Efficient video/audio encoding with variable bit rate
- Encoder redundancy
- Optimized time slicing for variable data rate
- Powerful standards for H.264/AVC video and AAC audio
- CA synchronizer for typical encoding systems
- File broadcasting with ALC/FLUTE carousel
- Web operation
- SNMP for monitoring the statistical multiplex

Standards for transmitting mobile TV services to small mobile terminals are gaining ground. Rohde&Schwarz offers service and network providers a playout system with statistical multiplex function. This system allows up to 40% of the data rate to be saved – without compromising on video quality. As a result, more than 20 (instead of 15) mobile TV programs can be broadcast on a TV channel, for example, ensuring highly efficient use of the limited DVB-H frequency spectrum. For the encoder and the playout base unit, Rohde&Schwarz uses software licensed by the Fraunhofer Institute for Telecommunications, Heinrich-Hertz-Institut (HHI).

Each R&S®AVE264 encodes a program with video and audio information in line with the H.264 and AAC standards. The statistical multiplex manager coordinates the variable program-dependent data rates of the encoders for the statistical multiplex.

### R&S®AVE264 video and audio encoder

- H.264 video encoder (MPEG-4 AVC, ISO/IEC 14496-10)
- AAC audio encoder (HE AAC, ISO/IEC 14496-3)
- Fully configurable encoding parameters:
  - Aspect ratio, frame rate, frame size, GOP size, bit rate
  - Constant bit rate (CBR) and variable bit rate (VBR) for statistical multiplex
- Video inputs:
  - Analog: composite, S-video
  - Digital: SDI
- Audio inputs:
  - Analog: unbalanced (RCA), balanced (XLR)
  - Digital: AES/EBU, embedded SDI
- RAID capability
- 2 × Ethernet (10/100/1000BaseT)
- Graphical user interface for setup (CBR)

The R&S®AVE264 video and audio encoder encodes video data in line with H.264 and audio data in line with HE AAC and LC AAC, in realtime. Each instrument encodes one program with video and audio information and uses this information to generate an IP data stream. With a statistical multiplex of several programs, the R&S®AVP264

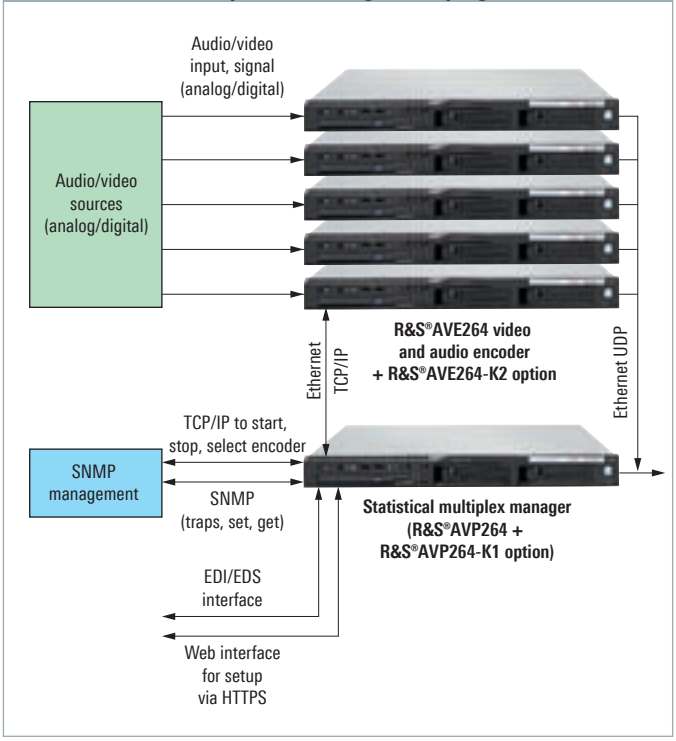
statistical multiplex manager configures and controls the encoders. The R&S®AVE264 was specially designed for the requirements of mobile TV services (QVGA resolution, slow picture repetition rate and low data rates).

The video encoder can be operated in two different modes – in the constant bit rate (CBR) mode and in the variable bit rate (VBR) mode. In the CBR mode, the encoded IP data stream is constant and independent of the current picture content. In the VBR mode, however, the variable output data rate outputs the programs depending on the amount of picture content, which varies as a function of time.

With constant bit rate, the encoders can be operated via a web browser; if the bit rate is variable, they are operated via the web interface of the upstream statistical multiplex manager. The following encoding parameters are fully configurable:

- Maximum video data rate in VBR mode
- Constant bit rate in CBR mode
- Aspect ratio
- Frame rate
- Frame size
- GOP size
- Cropping
- Scaling
- Qualitative weighting of individual services

**DVB-H playout**
**with a statistical multiplex consisting of five programs**




The encoder has two Ethernet interfaces (10/100/1000BaseT) and an audio/video grabber card. The RAID hard disk system increases the memory capacity and enhances the instrument's fail-safety.

The various encoder functions are fully software-implemented. As a result, the instrument can be flexibly adapted when future modifications need to be made. In networks, the instrument's IP output signal can be forwarded via Ethernet in accordance with user-specific requirements.

## R&S®AVP264 video and audio playout base unit

- Functions:
  - Statistical multiplex manager
  - SimulCrypt synchronizer
  - ALC/FLUTE carousel
- Graphical user interface for setting up a statistical multiplex
- RAID capability
- 2 × Ethernet (10/100/1000BaseT)

Operating as a statistical multiplex manager, the R&S®AVP264 controls and configures the individual encoders in such a way that their individual program data rates allow the respective picture information to be encoded and that the sum of all data rates is constant all the time.

To play out electronic service guides (ESG) or other file-based content (e.g. a video preview channel), additional services can be configured. Operating as an ALC/FLUTE carousel, the R&S®AVP264 handles the playout of these services; the information is then transmitted in line with the ALC (RFC3450) and FLUTE (RFC3926) standards. The R&S®AVP264 is operated via a web browser.

## Statistical multiplex

To efficiently transmit multiple TV programs within one channel, the programs are combined in a statistical multiplex. Communications among the encoders as well as between the encoders and the playout base unit ensure common compression, as well as data rate control.

The encoder generates a signal with a variable data rate depending on the amount of picture information, which varies as a function of time. To ensure the same quality, video sequences with strongly moving pictures require a higher data rate than picture content that moves less.

The statistical multiplex relies on the fact that still and moving picture content occurs at statistic intervals throughout all programs in a channel. The statistical multiplex manager distributes the available data rate of the transmission channel at any given time to the individual programs. Different data rates are assigned to these pro-

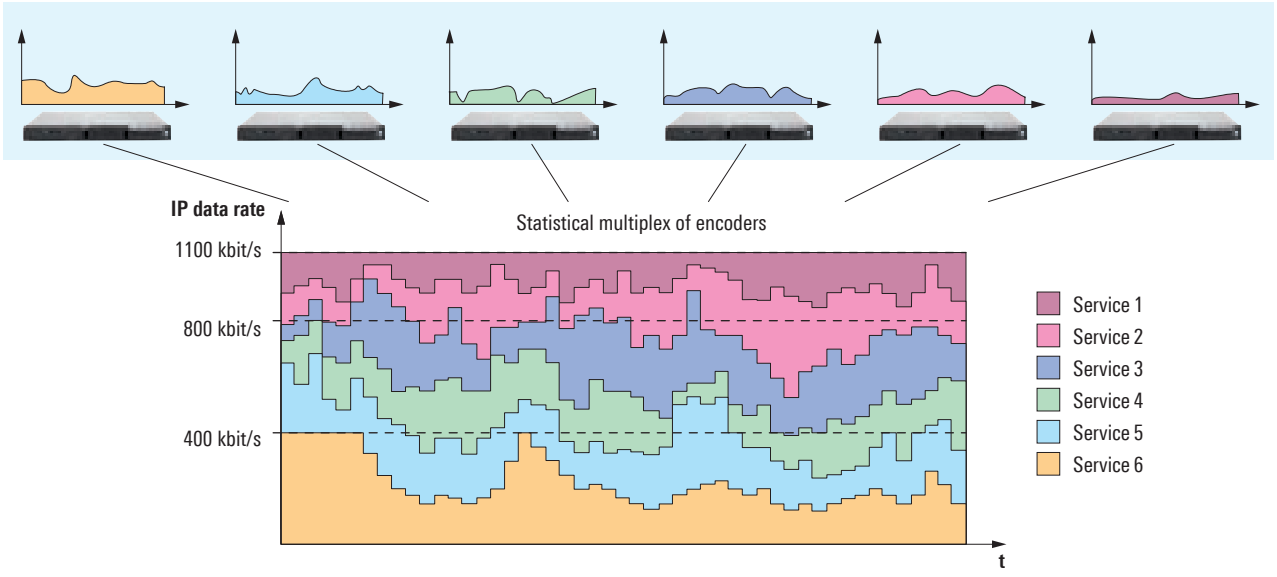
grams, depending on the current content and its complexity. In turn, the sum of the data rates of all programs is minimized to allow optimum use of the transmission channel capacity without compromising on video quality.

In contrast, limiting a permanently assigned data rate in a system often adversely affects the picture quality of strongly moving pictures. Program providers must therefore find a compromise between transmission capacity and video quality.

## Powerful standards

The H.264 standard, also referred to as MPEG-4 part 10 AVC (advanced video coding), complies with ISO/IEC 14496-10 and is a powerful standard for video compression. Audio data is encoded in compliance with the ISO/IEC 14496-3 audio compression standard, providing advanced audio coding (AAC) with HE AAC (high efficiency) and LC AAC (low complexity).

## Principle of statistical multiplex with adaptive time slicing




## Specifications in brief

| R&S®AVE264 video and audio encoder, R&S®AVP264 video and audio playout base unit | |
|---|---|
| **Coding video** | |
| Format | H.264 in line with ISO/IEC 14496-10 |
| Bit rate | variable bit rate (VBR) 40 kbit/s to 384 kbit/s |
| Range | user-selectable in steps of 1 kbit/s |
| **Frequency** | |
| NTSC | 30 Hz |
| PAL | 25 Hz |
| **Capability classes** | |
| Features | context-based adaptive variable length code (CAVLC), noise reduction, deinterlace, cropping, scaling, valid input detection, prioritization of services |
| **Output interfaces** | |
| Network connector | Ethernet (8-pin RJ-45 connector, bandwidth 1000/100/10 Mbit/s, level 2 V ($V_{pp}$), in line with IEEE 802.3 |
| **Platform hardware** | |
| Server | IBM X306M |
| Processor | Intel Pentium 4 HT, 3.2 GHz or later |

## Specifications in brief

| | |
|---|---|
| RAM | 1024 Mbyte |
| Drives | CD/DVD |
| Hard disk | >32 Gbyte SATA (RAID1 for redundancy) |
| Network | standard: 2 × Broadcom NetXTreme Gigabit Ethernet |
| Power supply | 100 V to 127 V/200 V to 240 V AC autosensing |
| Frequency | 50/60 Hz |
| Power consumption | max. 550 VA |
| Cooling | air-cooled with six fans |
| Operating temperature range | +10 °C to +35 °C |
| Permissable temperature range | –40 °C to +60 °C |
| Relative humidity | 8 % to 80 % |
| Dimensions (W × H × D) | 440 mm × 43 mm × 559 mm (max. 711.4 mm) (17.32 in × 1.70 in × 22.01 in (max. 28.00 in)) (19" cabinet, 1 height unit) |
| Weight | max. 12.7 kg (28.00 lb) |
| MTBF | >3 years |
| Noise emissions | max. 65 dB(A) |

## Specifications in brief

**R&S®AVE264 video and audio encoder only**

| | |
|---|---|
| **Platform software** | |
| Operating system | Windows XP Embedded |
| SNMP | SNMP subagent |
| Content encryption (CAS) | |
| System | ISMACryp 1.1 in line with RFC 3640 for audio, RFC 3984 for video<br>SimulCrypt in line with ETSI TS 103 197 digital video broadcasting (DVB); headend implementation of DVB SimulCrypt |
| **Audio input interfaces** | |
| Analog | RCA (chinch) – unbalanced (600 Ω, 5 V ($V_{pp}$))<br>XLR – balanced (600 Ω, 5 V ($V_{pp}$)) |
| Digital | AES/EBU (110 Ω, 1 V to –3.5 V ($V_{pp}$), resolution 16 bit to 24 bit)<br>in line with AES/EBU 3-1992/2003 and AES/EBU 11-1997/2003<br>embedded SDI in line with SMPTE 272M-A |

## Specifications in brief

| | |
|---|---|
| **Coding** | |
| Format | advanced audio coding (AAC) in line with ISO/IEC 14496-3 (HE AAC v1/v2) |
| Bit rate | 32 kbit/s to 128 kbit/s for capability class B, max. 320 kbit/s for multichannel |
| Range | user-selectable in steps of 1 kbit |
| Resolution | 12500, 24000, 32000, 44100, 48000 |
| Modes | mono, stereo, joint stereo |
| **Platform hardware** | |
| Grabber card | Viewcast Osprey-530 |
| **Video input interfaces** | |
| Analog | composite (BNC, 75 Ω, unbalanced, bandwidth 3.5 MHz at 3 dB, 1 V ($V_{pp}$) ±0.3 dB) in line with PAL: ITU-R BT.407; NTSC: ITU-R BT.470-6<br>Y/C (S-video 4-pin mini DIN (Hosiden), 75 Ω, unbalanced, bandwidth 5 MHz at 3 dB, 1 V ($V_{pp}$)) in line with PAL: ITU-R BT.407;<br>in line with NTSC: ITU-R BT.470-6 |
| Digital | serial digital interface (SDI, BNC connector, 75 Ω, unbalanced, bandwidth 270 Mbit/s), in line with SMPTE 259M-C, ITU-R BT.601 |

4

## Selection of instruments and options in line with the requirements placed on the playout system

| | Video and audio encoder | | | Statistical multiplex manager | | SimulCrypt synchronizer | | ALC/FLUTE carousel | |
|---|---|---|---|---|---|---|---|---|---|
| | for each program | | | for each multiplex | | | | | |
| **Playout requirements** R&S® | AVE264 base unit | AVE264-K1 option | AVE264-K2 option | AVP264 base unit | AVP264-K1 option | AVP264 base unit | AVP264-K2 option | AVP264 base unit | AVP264-K3 option |
| Constant bit rate | 1 | 1 | | | | | | | |
| Constant bit rate + ALC/FLUTE | 1 | 1 | | | | | | 1 | 1 |
| **Statistical multiplex** | | | | | | | | | |
| Statistical multiplex | 1 | | 1 | 1 | 1 | | | | |
| Statistical multiplex + ALC/FLUTE | 1 | | 1 | 1 | 1 | | | 1 | 1 |

## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| **Video and Audio Encoder**<br>Base unit for one program with video and audio [1]; input video: SDI digital input, composite PAL/NTSC analog input; input audio: embedded SDI, digital AES/EBU, analog L/R; video encoding: H.264/AVC baseline profile; audio encoding: HE AAC (LC AAC); output: IP/RTP [1] | R&S®AVE264 | 5301.8000.12 |
| **Options** | | |
| CBR Video Encoder H.264: allows constant bit rate (CBR) for video in one encoder | R&S®AVE264-K1 | 5301.8039.13 |
| VBR Video Encoder H.264: allows variable bit rate (VBR) for video in one encoder for statistical multiplex | R&S®AVE264-K2 | 5301.8039.14 |
| **Statistical multiplex manager**<br>For one statistical multiplex per subchannel (in combination with the R&S®AVE264 encoder and R&S®AVE264-K2 option), consisting of: | | |
| Video and Audio Playout Base Unit,<br>based on industrial 19" PC, licensed by Fraunhofer Institute for Telecommunications, Heinrich-Hertz-Institut (HHI) | R&S®AVP264 | 5301.8000.02 |
| Statistical Multiplex Manager Software | R&S®AVP264-K1 | 5301.8039.03 |
| **SimulCrypt synchronizer**<br>Allows encryption for one multiplex (in combination with the R&S®AVE264 encoder and R&S®AVE264-K1 or R&S®AVE264-K2 option), consisting of: | | |
| Video and Audio Playout Base Unit,<br>based on industrial 19" PC, licensed by Fraunhofer Institute for Telecommunications, Heinrich-Hertz-Institut (HHI) | R&S®AVP264 | 5301.8000.02 |
| SimulCrypt Synchronizer Software | R&S®AVP264-K2 | 5301.8039.04 |
| **ALC/FLUTE carousel**<br>Allows playout of ESG files, for one multiplex consisting of: | | |
| Video and Audio Playout Base Unit,<br>based on an industrial 19" PC, licensed by Fraunhofer Institute for Telecommunications, Heinrich-Hertz-Institut (HHI) | R&S®AVP264 | 5301.8000.02 |
| ALC/FLUTE Carousel Software | R&S®AVP264-K3 | 5301.8039.05 |

[1] Only in combination with one of the options.

# R&S®AEM100 Emission Multiplexer

Rohde&Schwarz offers network operators a single-source solution including encoders, multiplexers and transmitters for the entry into the ATSC Mobile DTV market.

Alternatively, network operators can efficiently upgrade existing ATSC infrastructures for the new ATSC Mobile DTV services by using the R&S®AEM100 emission multiplexer. They can continue to use the existing infrastructure as the multiplexer can be easily integrated into the current system. ATSC Mobile DTV also makes it possible to set up frequency-efficient single-frequency networks (SFN). Such networks can easily be implemented by deploying Rohde&Schwarz transmitters.

## Upgrade to ATSC Mobile DTV

ATSC broadcasters can easily upgrade to ATSC Mobile DTV with products from Rohde&Schwarz. Existing infrastructure and configurations can continue to be used unaltered as the R&S®AEM100 is docked on the system and inserted between headend and transmitter. For upgrading, the following components are available:

- Audio and video signals for mobile services must be inserted into a low-definition MPEG-4 encoder whereas one service can be handled by one encoder
- The ATSC-M/H emission multiplexer generates ATSC Mobile DTV specific signaling, adds IP streams for mobile services and restructures the main ATSC transport stream (TS)
- The ATSC transmitter must be upgraded by an ATSC-M/H capable exciter that modulates the ATSC-M/H RF signal and can be synchronized with other transmitters to build a single-frequency network (SFN)

## Single-frequency networks (SFN)

In an SFN, two or more transmitters with an overlapping coverage send the same program content simultaneously on the same frequency. The R&S®AEM100 makes it possible to use ATSC Mobile DTV in SFNs. The advantages are obvious: Broadcasters can enlarge coverage without changing their transmission licenses and reach a greater number of viewers. Seamless handover between transmitters is ensured.

In an SFN, all parts of the transmission chain need a highly precise time signal for synchronization. The multiplexer receives the time reference from an NTP server. An already available NTP server or a newly added NTP server can also be used as a time source in the broadcaster's IT network. This is a cost-effective and easy approach. The TV transmitter uses a GPS signal with 10 MHz and 1 pps (pulse per second).

## Operation interface

The convenient web interface of the R&S®AEM100 enables the operation of the complete ATSC Mobile DTV functionality, i.e. multiplexer and encoders. It configures, controls and monitors the ATSC Mobile DTV system from any location and with any operating system. Due to the intuitive web interface, the user administers data in a single location and not on several devices and thus saves time.

The multiplexer offers an approved local/remote control concept that enables fast local operation and ensures safe remote operation. Furthermore, all commands for automatic monitoring and for settings are available via an SNMP interface. In addition to ASI, the R&S®AEM100 also offers IP interfaces. This allows broadcasters to change to this future-oriented Internet infrastructure at any time.

## Specifications in brief

| | |
|---|---|
| **R&S®AEM100 ATSC-M/H emission multiplexer** | |
| Channel coding and signaling, encapsulation of IP packets from internal and external IP sources | |
| Input interfaces | |
| ASI | 1 × BNC, A/53 |
| Network | 1 × Ethernet, RJ-45, 1000/100/10 Mbit/s, IP, UDP, RTP |
| Output interfaces | |
| ASI | 1 × BNC, A/53, A/153 |
| Network | 2 × Ethernet, RJ-45, 1000/100/10 Mbit/s, MPEG-2, Pro-MPEG, SMPTE 2022 |
| Control interface, network | 1 × Ethernet, RJ-45, 1000/100/10 Mbit/s, IP, UDP, TCP, HTTP, SNMPv2c |
| **R&S®AEM100S ATSC-M/H SFN adapter** | |
| For single-frequency networks in combination with the R&S®AEM100 | |
| Control interface, network | NTP client |
| **LANTIME M600/GPS-HQ NTP time server** | |
| With integrated satellite receiver/radio controlled clock | |
| LAN connectors | 4 × RJ-45 |
| LED status indication | link, activity, speed (10/100 Mbit) |
| OXCO | HQ oscillator |



## Ordering information

| Designation | Type | Order No. |
|---|---|---|
| **ATSC-M/H Emission Multiplexer**<br>Channel coding and signaling, encapsulation of IP packets, consisting of: | R&S®AEM100 | 5302.8582.02 |
| **ATSC-M/H Emission Multiplexer Base Unit**<br>Channel coding and signaling | R&S®AEM100BU | 5302.8403.02 |
| **ATSC-M/H IP Encapsulator**<br>Encapsulation of IP packets from internal and external IP source in combination with the R&S®AEM100BU | R&S®AEM100I | 5302.8390.02 |
| **ATSC-M/H SFN Adapter**<br>For single-frequency networks in combination with the R&S®AEM100BU and R&S®AEM100I | R&S®AEM100S | 5302.8426.02 |
| **Recommended extra** | | |
| NTP Time Server | LANTIME M600/GPS-HQ | 3540.3004.03 |

# Content Chapter 5
# Appendix

# Technologies Come and Go – Good Service is of Lasting Value

## From products to solutions

**Productivity = advanced technology + excellent service**

Customers that choose Rohde&Schwarz show a special esteem for high productivity and profitability of an investment. And they rightly expect these qualities to be maintained throughout the product's entire lifetime. From the time it leaves the factory, a Rohde&Schwarz instrument or system has everything that serves this purpose: cutting-edge, future-proof technology, easy operation and maintenance, ruggedness and perfect quality. But experience has shown that good support is what makes a good product a good solution. For this reason, Rohde&Schwarz has built up a worldwide service and support network that assists you quickly and competently with all your needs so that you can exploit the full potential of your Rohde&Schwarz products.

## Your desire – our commitment

**Full-range service at your command**

There is one goal common to all service operations, no matter how different they may be in detail:
to protect your investment and maximize the added value. The right mix from our service and support package ensures that your Rohde&Schwarz products will perform to their full capacity, thus ensuring that your investments will pay dividends to the end of their lifetime:

- Precision through calibration
- Availability through quick maintenance and repair
- State-of-the-art operation through hardware and software updates
- Deployment possibilities through application support
- Productivity from day one through turnkey installation and commissioning of systems
- Build-up of know-how by training your staff



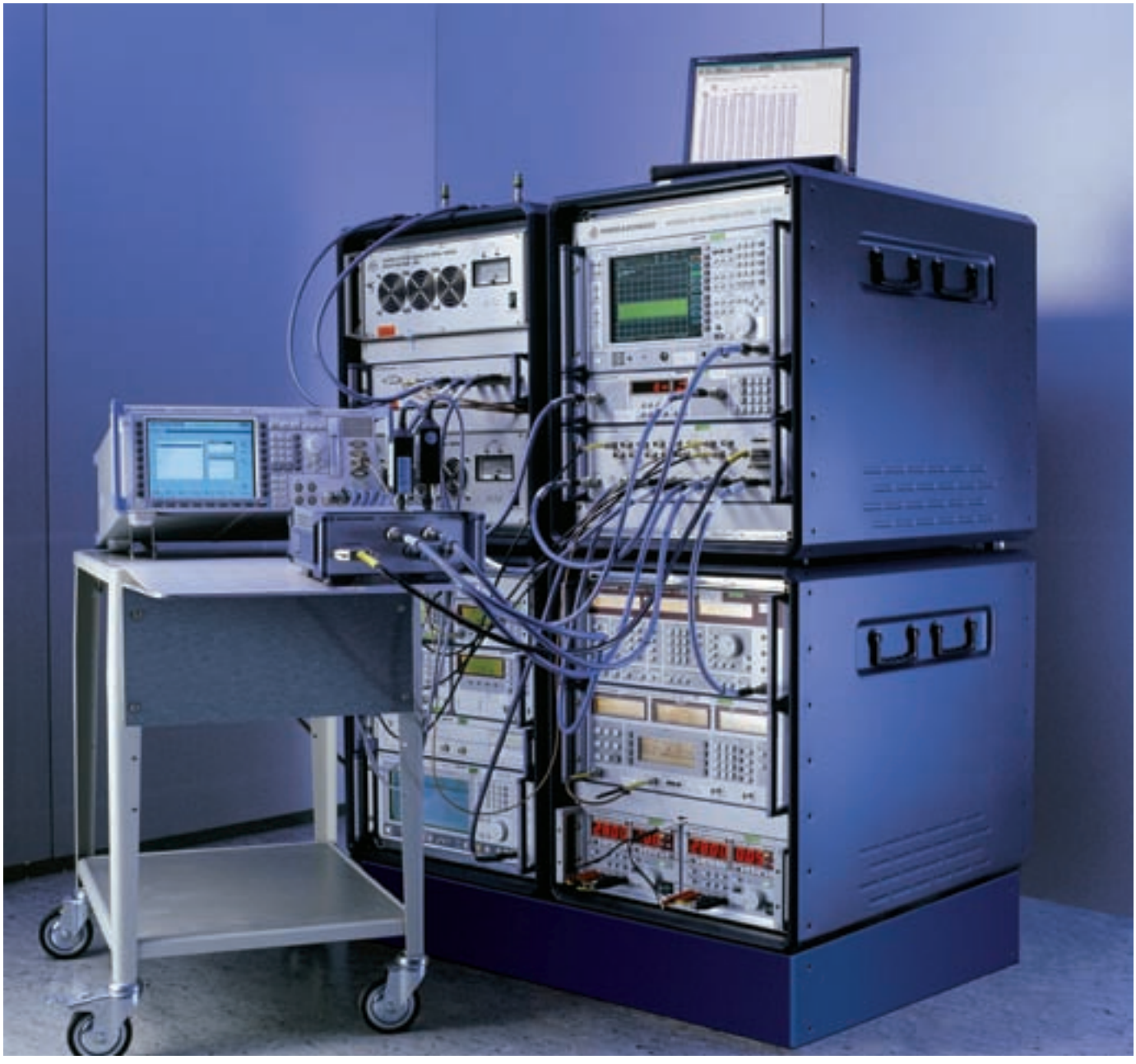
# Calibration Pit Stops

## Calibration by the manufacturer ensures highest expertise and quality

Rohde&Schwarz products are high-precision, high-performance electronic goods that extend the limits of today's technological possibilities. As with all precision technology, these products require expert maintenance so that their specified performance, for which you as the customer have paid, is available to you in the long term and can be used in your application.

Obviously the know-how for the necessary calibration „pit stops" cannot be found just anywhere. Utmost care and skilled handling in the maintenance of your valuable electronic resources are only possible when the calibration is performed by the product's manufacturer, who is familiar with all the details of its design. Detailed knowledge of the equipment's structure is indispensable especially when a readjustment is required as a result of a deviation in specifications.

Most Rohde&Schwarz service centers throughout the world are capable of performing calibrations themselves. In any case, you'll only have to do without your product for a short time until it is as good as new again and you can send it back „into the race".



## Extra value included

**Use the calibration pit stop for product optimization**

Once your product is in the „pit“ for calibration, the service staff can do it some more good, if you wish. For example, they can install the latest firmware version or hardware options. If a useful hardware modification has been made to the product in the meantime as part of a model update, this innovation will also be incorporated, usually at no extra cost to you. After submitting your unit for calibration, it will first be given a thorough check so that inconsistencies of any kind can be detected and the necessary steps taken. This ensures that your equipment will be returned to you in top shape and that you will be able to profit from its peak performance for years to come.

## Maximum automation

**Our smart calibration systems ensure maximum reliability and efficiency**

A quality calibration must be precisely defined and repeatable and it must be possible to document it down to the last detail. In addition, it must be efficient and standardized in order to keep turnaround times short and handling costs low. What‘s more obvious than to use an automatic device that can fulfill these requirements in exemplary fashion?

This is the reason why Rohde&Schwarz decided to develop the unique calibration systems of the R&S®ACS100 series. These systems make our comprehensive calibration know-how standardized and available worldwide. Equipped with calibration routines for all the important equipment series, they form the backbone of our calibration network. The advantages for you are obvious: short handling times, low costs, high testing depth and reliability and international comparability of results.

## See you at your premises

**The alternative: on-site calibration**

Measuring instruments and systems in production facilities are very often in operation round the clock and are thus highly indispensable, even for short periods. But, at the same time, inaccurate measuring equipment frequently has a negative effect on production yield, so the recommended calibration intervals should be adhered to as much as possible. The solution to the dilemma: on-site calibration. We‘ll be happy to sit down with you and devise a calibration concept that will minimize your downtimes as a result of maintenance. R&S®ACS100 systems are usually used for on-site service as well, offering the advantages described above. Just speak with your service advisor if this type of calibration service is of interest to you.

## Traceability guaranteed

**ISO9001 certified? We back your obligations**

Your product will be returned to you with a calibration label, a calibration certificate and a detailed test report in line with ISO17025. You thus fulfill all the requirements of ISO9001 with respect to the complete traceability of your measuring equipment to internationally recognized standards. Yet even in the rare cases – usually due to formal reasons – in which the „ISO calibration“ does not suffice and you need a calibration by an accredited service provider, your Rohde&Schwarz service partner is the right place to go. For several of our service centers are also nationally accredited calibration centers. And even if not, they will still be able to help you. International agreements between accreditation authorities allow in many cases recognition of calibration in line with German Calibration Service (DKD) standards and we can offer you this anywhere.

# Docking with your Process Chain

## Time is money

**Flexibly integrate our service into your operational flow**

Each hour of downtime in the value chain is reflected in costs, which can be quite substantial – particularly in a production environment. For this reason, servicing must not become an emergency measure. Rather, it must be defined as a regular part of the process chain so that it can be organized efficiently and disrupts the operational flow as little as possible. In this respect, we'll be happy to meet your needs with a flexible service portfolio.

## Committed to customized service – choose from a wide range of options

**Service per incident**

You make use of our service without any red tape, when calibration is due or in the case of trouble. We ensure short handling times and fair prices.

**Service per contract**

A service contract allows you to ideally adapt the scope of our services to your requirements. Standard contracts usually meet this objective. We offer standardized service contracts (service options), signed on purchasing your equipment. Or you can take out an annual service contract at a later date. We also arrange for customized service packages to cover special requirements, such as on-site calibration.

Service options can only be ordered when you purchase a product from us. You can choose between calibration and repair options. If you decide in favor of a calibration option, you will not incur any additional calibration costs during the period of coverage. The calibration option includes all recalibrations that are performed in line with the calibration interval recommended by Rohde&Schwarz, plus all calibrations that may become necessary if the product is to be repaired or upgraded. When you purchase a repair option, repairs are made free of charge during the term of the contract.

**Annual service contracts**

Annual service contracts can be concluded at any time. You can specify the term of these prepaid calibration or repair contracts.

**Custom service contracts**

Custom service contracts cover specific requirements. These contracts define the scope and cost of service and where and when it is to be performed, allowing a wide range of variation:

# Rohde&Schwarz Service Options

## Service scope

You can arrange to have individual services rendered, such as calibration, preventive maintenance, repair, upgrading, loan equipment, or full service.

## Place of performance

The work is usually performed at the local service center. Some types of servicing, such as calibration, can also be done on your premises.

## Turnaround times

Assured turnaround times allow you to reliably plan the use of your resources to ensure process optimization – an objective to which we feel committed in the interest of our customers.

## Calibration service at your company

In addition, you can arrange for a Rohde&Schwarz calibration service at your company if you have a large number of instruments to be calibrated. Service options are powerful service contracts that are offered exclusively when you purchase a new product. Taking advantage of a service option ensures you optimum performance and availability of your Rohde&Schwarz product at low, calculable operating costs. The investment in a repair or calibration option will pay off for you as a result of the extended life of the product. Ask your Rohde&Schwarz sales partner for more information.

## You can choose from the following service options:

### Calibration option with a term of two, three, or five years (CO2, CO3, CO5) [1)]

The CO2, CO3 and CO5 calibration options ensure that your Rohde&Schwarz product will be regularly checked and serviced for two, three, or five years, respectively. Simply commission the forwarding agent we name at no extra charge and your product will be returned to you in top condition after a couple of days. The table on the right indicates the number of calibrations included in each option. If your product needs to be calibrated during a repair, these calibrations are also included in the options.

[1)] The terms start with the delivery of the product.

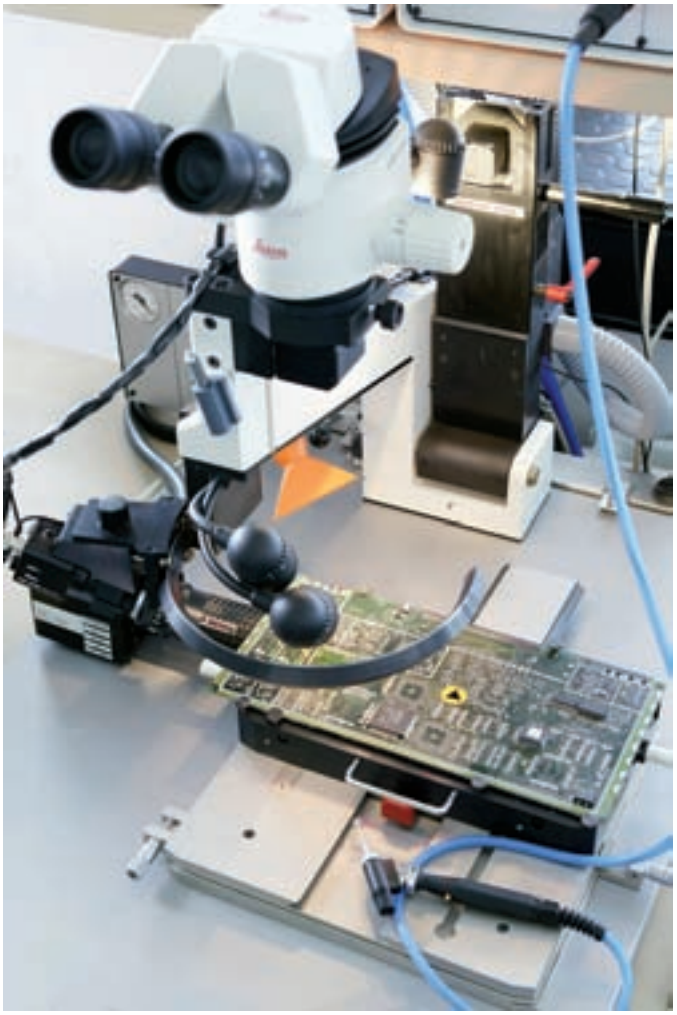
### Repair option with a term of two, three, or five years (RO2, RO3, RO5) [2)]

Repairs are made free of charge during the term of the contract. The repair of defects caused by improper operation or handling and the replacement of consumable parts (such as batteries) are not included. To provide calibration coverage, we recommend in addition a calibration option (CO2, CO3, or CO5), which also includes recalibration during nonroutine service work in the course of corrective maintenance.

## Why you should order service options when you purchase equipment

- A five-year repair option (RO5) usually costs less than a single repair
- Regular and preventive maintenance and calibration (CO2/CO3/CO5) ensure full product performance
- You can reliably plan and calculate the service costs for the term of the option
- No additional transport costs are incurred by you if the product is shipped in country by the forwarding agent commissioned by Rohde&Schwarz

[2)] The net terms are one (RO2), two (RO3) or four (RO5) years following the valid warranty period.



**No "service surprises" anymore – instead, transparent and calculable operating costs**
Maybe you've already experienced this dilemma yourself. Equipment that unexpectedly requires servicing causes unplanned costs and also ties up valuable resources for administration and order approval while being handled.

Unfortunately, failures in highly complex systems and equipment can never be fully excluded – but the trouble associated with such failures can! Purchasing a Rohde&Schwarz service option makes maintenance costs calculable for you and you can concentrate completely on your core tasks.

**Ensuring full product performance through regular maintenance and calibration**
Preventive care and maintenance improve a product's reliability and performance. During regular calibration, we take utmost care to maximize the operating safety of the equipment and prevent possible future failures.
This includes performing useful modifications such as hardware updates, insofar as they fulfill this purpose – a service that only the manufacturer can offer.

Using our modern test and diagnostic systems, we perform a detailed analysis of your equipment and can detect even the first signs of irregularities of any type. Calibration at Rohde&Schwarz is thus considerably more than checking compliance with specifications – we keep your equipment in top shape.

**Fixed price for the term of the contract**
Everything's getting more expensive!? But not service – provided you purchase a Rohde&Schwarz service option. In doing so, you freeze today's service prices and are safeguarded against inflation and price increases. Rohde&Schwarz service options are available for a term of three or five years.

**Maximum protection at a low price**
For only a fraction of their purchase value, you can protect high-end products from Rohde&Schwarz with high-end service. With a Rohde&Schwarz service option, you can benefit from direct manufacturer support for years. For more information, please contact your Rohde&Schwarz sales or service partner.

| Calibration Option | CO2 | CO3 | CO5 |
|---|---|---|---|
| **Term** | 2 years | 3 years | 5 years |
| **Calibration interval 12 months** [1] | 1 calibration [2] | 2 calibrations [2] | 4 calibrations [2] |
| **Calibration interval 24 months** [1] | calibration in the case of repair [2] | 1 calibration [2] | 2 calibrations [2] |
| **Calibration interval 36 months** [1] | calibration in the case of repair [2] | calibration in the case of repair [2] | 1 calibration [2] |

[1] Manufacturer-recommended calibration interval.
[2] The number of regular calibrations included in the options depends on the product and is based on the calibration interval recommended by the manufacturer. Unscheduled calibrations that become necessary for technical reasons during a repair are also included in all calibration options.

# Worldwide Service

## High-quality service safeguards your investment

Test and Measurement equipment and systems from Rohde&Schwarz offer the utmost in precision and accuracy. To make sure that customers can rely on this accuracy at all times, we have built a service network that ensures global access to expert calibration and maintenance, as well as any repair needs.

## Globally local

The Rohde&Schwarz service network is designed to be multilevel and decentralized. This means that all of our equipment and systems can be fully serviced by area support and local service centers and do not have to be sent elsewhere except in only the most exceptional circumstances. For customers, this means minimum downtime and maximum availability.

### The local service center – your partner close by

Each local service center provides a wide range of services tailored to local requirements. The great majority use standardized R&S®ACS100 series test and calibration systems, providing automatic diagnostics, fast repair and calibration. All local service centers are equipped to provide the services typically required by the customers in their area.

### The area support center – expert technical knowledge and logistical backup

Located in the key industrial regions of the globe, these facilities have the resources to assist customers at virtually any level. Engineers are on call and generous stocks of parts are on hand, as is all the equipment needed for advanced diagnostics, repair and calibration.

### The Cologne and Munich service centers

Our service centers in Cologne and Munich, Germany, are at the core of our worldwide service system. They back up our area support and local service centers with wide-ranging support, training, documentation and other services. They also function as area support centers for Europe, providing logistical support, high-level troubleshooting, maintenance, repair and calibration.

## Maximum availability

Working together, this network assures our customers of minimum downtimes and maximum availability. Whether for safety-critical applications or in cost-intensive production, Rohde&Schwarz customers know they can rely on our service network to keep their equipment at the highest level of precision.

### Consistently high standards

All of our service centers are internally audited to stringent quality standards. Our staff undergoes continuous and extensive training on the latest product developments, technologies and procedures. This ensures that Rohde&Schwarz customers the world over have local access to the same consistently high level of expertise.

### Fast spare parts supply

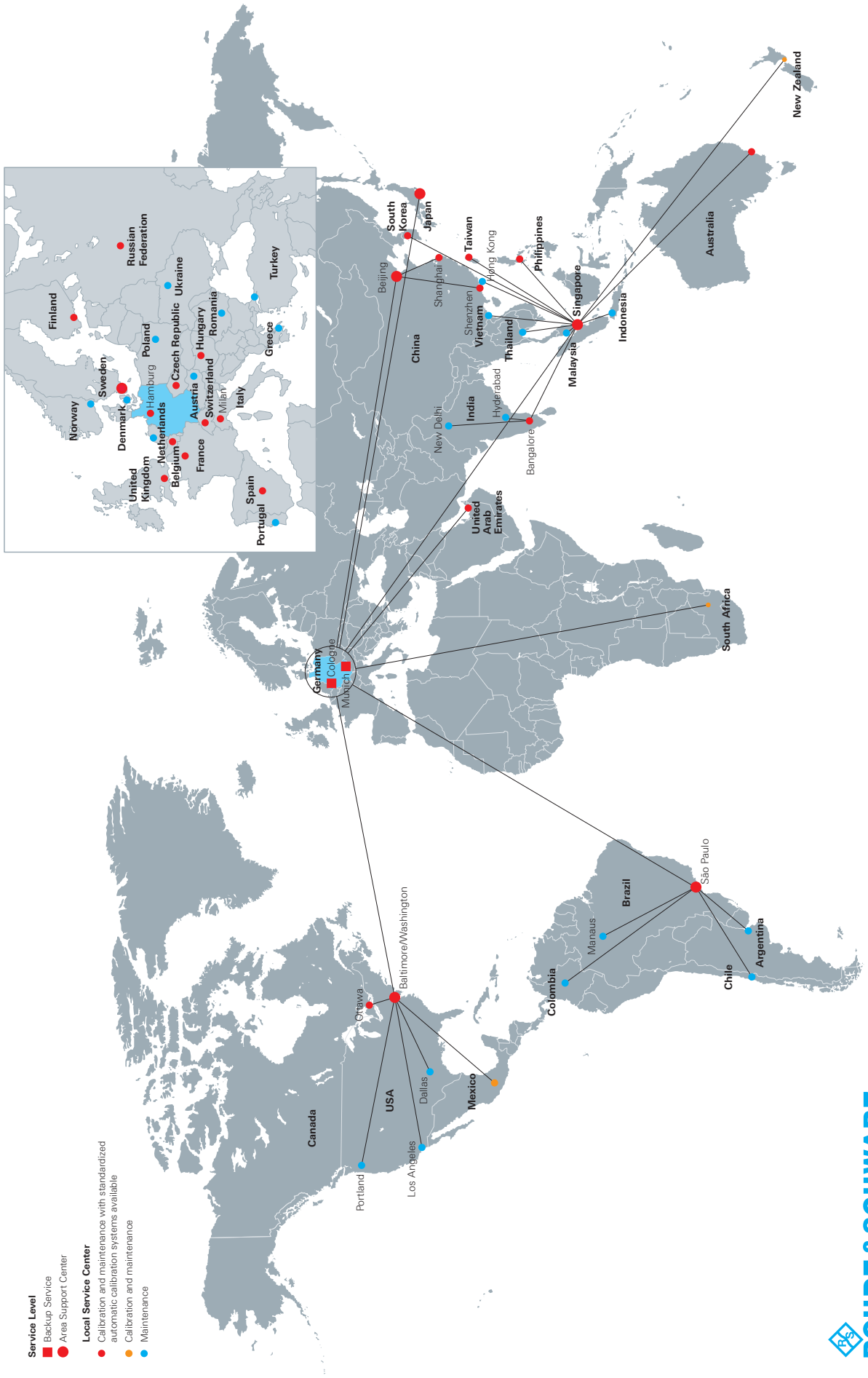
Even the best equipment can fail sometime. And then you are thankful if faulty parts can be replaced fast. More than 30000 different spare parts are stored by Rohde&Schwarz.

For the customer, this modern warehousing and logistics hub means extremely fast spare parts availability virtually anywhere in the world. Rohde&Schwarz equipment is highly modular, which saves time and cuts costs if repair is needed. Rohde&Schwarz ensures longterm spare parts availability also for older modules and systems.

## Service addresses

You will find current addresses on our homepage www.rohde-schwarz.com

# Global Service Network




ROHDE&SCHWARZ

# Training

By building your staff's expertise, you build your company's competitiveness. We can be a valuable part of that effort.

Electronics is a complex field, requiring highly qualified staff. Rohde&Schwarz offers knowledge transfer at every level, from seminars on basic principles to advanced training on instruments and systems, in line with customer requirements.

Our training is designed to help customers help themselves, with the focus on actionable knowledge and hands-on practice. Our seminars are constantly updated to meet the latest requirements.

### Small groups for big results

The number of participants is limited for all seminars. This ensures that every attendee gets maximum benefit and allows an intensive dialog between trainer and trainee. Knowledge can be passed on in greater depth and individual problems dealt with in greater detail. Most seminars include hands-on exercises on the latest test equipment, for most efficient learning.

### Effective training staff

Our communications, electrical and software engineers and physicists provide you with the knowledge you need. They have the latest know-how and years of experience and just as importantly, they have the skills to pass on this knowledge in an interesting and engaging way. We attach the utmost importance to training them in effective teaching skills.

Where appropriate, we call in university lecturers, representatives of standards bodies and government authorities and users. In each instance, we make sure that our customers have the best trainers available.

### Up-to-date material

All seminars are continually reviewed and improved and new knowledge and relevant changes are incorporated immediately. This ensures that the technical knowledge, regulations and standards specifications in the course material are always up to date.

### Standard seminars

Our standard seminars deal with the most commonly encountered measurement issues. Their focus is on the customer perspective, instead of on Rohde&Schwarz test assemblies. Our course offerings are structured so that newcomers and specialists alike will find seminars to suit their needs.

### Customer-specific seminars

We offer tailor-made seminars for training the tasks performed at your company. We start with an analysis of the learning objectives and target group and provide instruction using a tried-and-tested methodological approach. This ensures an optimum cost/benefit ratio and avoids burdening courses with unnecessary information. Within the framework of these seminars we also offer special user and application courses for Rohde&Schwarz instruments, so that your staff can make the most time-saving and efficient use of our equipment.

### Training locations

We hold seminars at our Munich headquarters and Cologne factory in Germany, at our branch offices around the world and on-site at the customer's facility.

### Seminars at Rohde&Schwarz – knowledge at the source

Highly qualified personnel and a complete range of measuring instruments and teaching aids make each seminar a success. Here you can get acquainted with state-of-the-art measurement and communications technology right at the source.

### Seminars at the customer site – focused on you

Do you want to train several staff members at the same time? Do you prefer to put learning to use immediately? Do you need to solve specific problems within the organization? Or do you simply prefer to leave the traveling to us? We're glad to hold seminars at your facility, whether standard Rohde&Schwarz seminars or tailor-made courses.

To find out more about our training, get a schedule of courses and specifics on contents, dates, pricing and more, contact your nearest Rohde&Schwarz sales office or look on the Internet:

**www.rohde-schwarz.com**
SERVICE & SUPPORT/Customer Training

# Information Resources

We back up our technology solutions with exhaustive information in many forms, so that you always have access to what you need

## Support line help

We offer expert support line help. That means when you call us with a question, you talk to a qualified engineer who can give you real answers:

- Are you looking for a special type of instrument?
- Do you need help implementing remote control processes for production test equipment?
- Do you have a question about operating an instrument?
- Or anything else...

## 24 h reachability

**Customer Support**

Our regional support centers will be glad to answer any questions regarding our products and service:

Europe, Africa, Middle East
Phone +49 1805 12 42 42 or +49 89 4129 137 74
customersupport@rohde-schwarz.com

North America
Phone 1 888 837 87 72 (1 888 TEST RSA)
customer.support@rsa.rohde-schwarz.com

Latin America
Phone +1 410 910 79 88
customersupport.la@rohde-schwarz.com

Asia/Pacific
Phone +65 65 13 04 88
customersupport.asia@rohde-schwarz.com

**Our promise**

Whatever questions customers have about Rohde&Schwarz products or services, we will try to provide the answers! If an immediate answer is not possible, we won't waste your time with unnecessary calls or holding patterns. Instead, we'll record your problem, work on it and get back to you.

If you are already a customer, your local service center will often be the fastest source of information – they already know your requirements and applications in more detail.

## Catalogs

In addition to this catalog, we offer:

- Test and Measurement Products
- Secure Communications
- Radiomonitoring and Radiolocation
- HF–VHF/UHF–SHF Antennas

## Product brochures/data sheets

The product brochures/data sheets provide a detailed description of each instrument, with features, applications and specifications. You can find the data sheet reference numbers for each instrument in the Type/Data Sheet Index on page 144. All product brochures/data sheets are also available as pdf files on our website.

## News from Rohde&Schwarz

This journal is published four times a year in English, French, German, Chinese and Russian and informs subscribers on new product developments, articles from the development lab and test hints for specific instruments. The Type/Data Sheet Index on page 144 shows you the issues containing information on specific instruments. Back issues are available on the Web. If you'd like to subscribe, contact your local Rohde&Schwarz sales engineer.

## Application notes

They give you valuable information on specific applications. All our application notes are free of charge and can be downloaded from our website.

## Special publications

Additional technical literature from Rohde&Schwarz is available in the form of special publications on current items, refresher topics, books, compendia, etc.

## Website

Our website **www.rohde-schwarz.com** contains a vast amount of material, including detailed product information, much of which is downloadable as pdf files. You can also get a personal newsletter sent to you automatically, with information on your topics of interest.

# Ownership Options, Demo Units, Trademarks

Rohde&Schwarz offers a variety of ways to acquire our equipment when you need it, without placing undue strain on your liquidity

## Rental with purchase option

Do you need an instrument only temporarily? Are you unsure as to your future plans? Or do you have to bridge a momentary financial bottleneck? Business is not always predictable, so we offer a rental with purchase option. For details and terms, please contact your local Rohde&Schwarz representative.

## Demo units

We offer demo units at very favorable prices. These instruments have seen little use and are in excellent condition. As a matter of course, demo units are thoroughly checked before leaving our premises and we grant full warranty on them.

However, if a fault occurs during the first year after purchase, we will repair the instruments free of charge. For a detailed overview of the instruments available for immediate purchase, visit our online shop at

**www.shop.rohde-schwarz.com**

## Trademarks

**Trade names are trademarks of the owners**

- R&S® is a registered trademark of Rohde&Schwarz GmbH & Co.KG
  Example: R&S®EFA Test Receiver
- The Bluetooth® word mark and logos are owned by the Bluetooth® SIG, Inc. and any use of such marks by Rohde&Schwarz is under license
- Windows is a registered trademark of Microsoft Corp., USA
- CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA - USA)

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