

# R&S® NH/NV8600 UHF Transmitter Family for TV

High power –  
low consumption



# R&S®NH/NV8600 UHF Transmitter Family for TV At a glance



The R&S®NH/NV8600 high-power transmitter family broadcasts TV signals in UHF bands IV/V. High power density, excellent transmission quality and superb reliability are the reasons behind the family's successful use in analog, digital and mobile TV networks all over the world. Owing to its outstanding energy efficiency and small footprint, the transmitter family decisively contributes to the reduction of operating costs in modern transmitter networks. Moreover, the extremely simple upgradeability to future standards such as DVB-T2 ensures maximum safety of investment.

The liquid-cooled transmitters of the R&S®Nx8600 family deliver output powers of up to 35 kW for analog TV. The digital TV standards DVB-T, ISDB-T/ISDB-T<sub>B</sub>, DTMB and the mobile TV standards DVB-H and MediaFLO™ are generated at powers of up to 12.4 kW. The maximum output power for the ATSC standard and its mobile enhancement ATSC Mobile DTV is 17.6 kW. Installed in one or two 19" racks, the transmitters have a depth of just 1100 mm.

The R&S®NH/NV8600 transmitters offer a high degree of flexibility. If requested, simple switchover from analog to digital TV can be included. Configuration for different AC supply voltages and the cooling system's modular design allow the transmitters to be adapted to a wide variety of sites.

The liquid-cooling system of the R&S®NH/NV8600 transmitter family is the most compact of its kind. State-of-the-art components and a well-conceived control system help to ensure that the cooling system also runs with maximum efficiency. As a result, the cooling system contributes to the high efficiency of the transmitter system and reduces operating costs.

## Key facts

- Outstanding efficiency ensuring minimum operating costs
- Multistandard platform for analog, digital and mobile TV
- Prepared for DVB-T2
- Simple switchover from analog to digital TV
- Compact, efficient and flexible liquid-cooling system

# R&S® NH/NV8600

## UHF Transmitter

### Family for TV

## Benefits and key features

#### Future-ready and adaptable

- ▮ Multistandard platform for use worldwide
  - ▮ Modular design
  - ▮ Configurable for different AC supply voltages
- ▷ [page 4](#)

#### Energy-efficient with small footprint

- ▮ UHF broadcast transmitters with excellent efficiency
  - ▮ Constant efficiency even at reduced output powers
  - ▮ Compact design for low infrastructure costs
- ▷ [page 6](#)

#### Always on the air

- ▮ All components from a single source for highest quality standards
  - ▮ Reliable system design
  - ▮ Dependable and low-energy liquid cooling
  - ▮ Standby systems for all requirements
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Digital TV										
Configured as R&S®	NV8602	NV8603	NV8604	NV8605	NV8606	NV8608	NV8610	NV8612	NV8616	NV8620
Number of R&S®VH8600A1 amplifiers	2	3	4	5	6	8	10	12	16	20
Output power (RMS) for COFDM standards <sup>1) 2) 3)</sup>	1.3 kW	1.9 kW	2.6 kW	3.1 kW	3.7 kW	5.0 kW	6.1 kW	7.2 kW	9.7 kW	11.8 kW
RF output for COFDM standards	EIA 1 5/8"						EIA 3 1/8"			
Output power (RMS) for ATSC/ATSC Mobile DTV <sup>1) 2) 4)</sup>	1.8 kW	2.7 kW	3.6 kW	4.4 kW	5.2 kW	7.0 kW	8.5 kW	10.1 kW	13.6 kW	16.5 kW
RF output for ATSC/ATSC Mobile DTV	EIA 1 5/8"				EIA 3 1/8"					EIA 4 1/2"
Dimensions (H x W x D)	2000 mm x 600 mm x 1100 mm (78.7 in x 23.6 in x 43.3 in)							2000 mm x 1200 mm x 1100 mm (78.7 in x 47.2 in x 43.3 in)		

Analog TV										
Configured as R&S®	NH8602C	NH8603C	NH8604C	NH8605C	NH8606C	NH8608C	NH8610C	NH8612C	NH8616C	NH8620C
Number of R&S®VH8600A1 amplifiers	2	3	4	5	6	8	10	12	16	20
Output power (sync peak) <sup>5)</sup>	3.5 kW	5.1 kW	7.0 kW	8.5 kW	10 kW	13.3 kW	16.3 kW	19.5 kW	25.6 kW	31.4 kW
RF output	EIA 1 5/8"				EIA 3 1/8"				EIA 4 1/2"	
Dimensions (H x W x D)	2000 mm x 600 mm x 1100 mm (78.7 in x 23.6 in x 43.3 in)							2000 mm x 1200 mm x 1100 mm (78.7 in x 47.2 in x 43.3 in)		

<sup>1)</sup> Before bandpass filter.

<sup>2)</sup> With AC power supply of 3 x 400 V AC.

<sup>3)</sup> Average output power; at < 510 MHz, power reduced by approx. 10%; at > 662 MHz, power increased by approx. 5%.

<sup>4)</sup> Average output power; at < 510 MHz, power reduced by approx. 5%; at > 662 MHz, power increased by approx. 6%.

<sup>5)</sup> After four-cavity bandpass filter; other output powers on request.

# Future-ready and adaptable

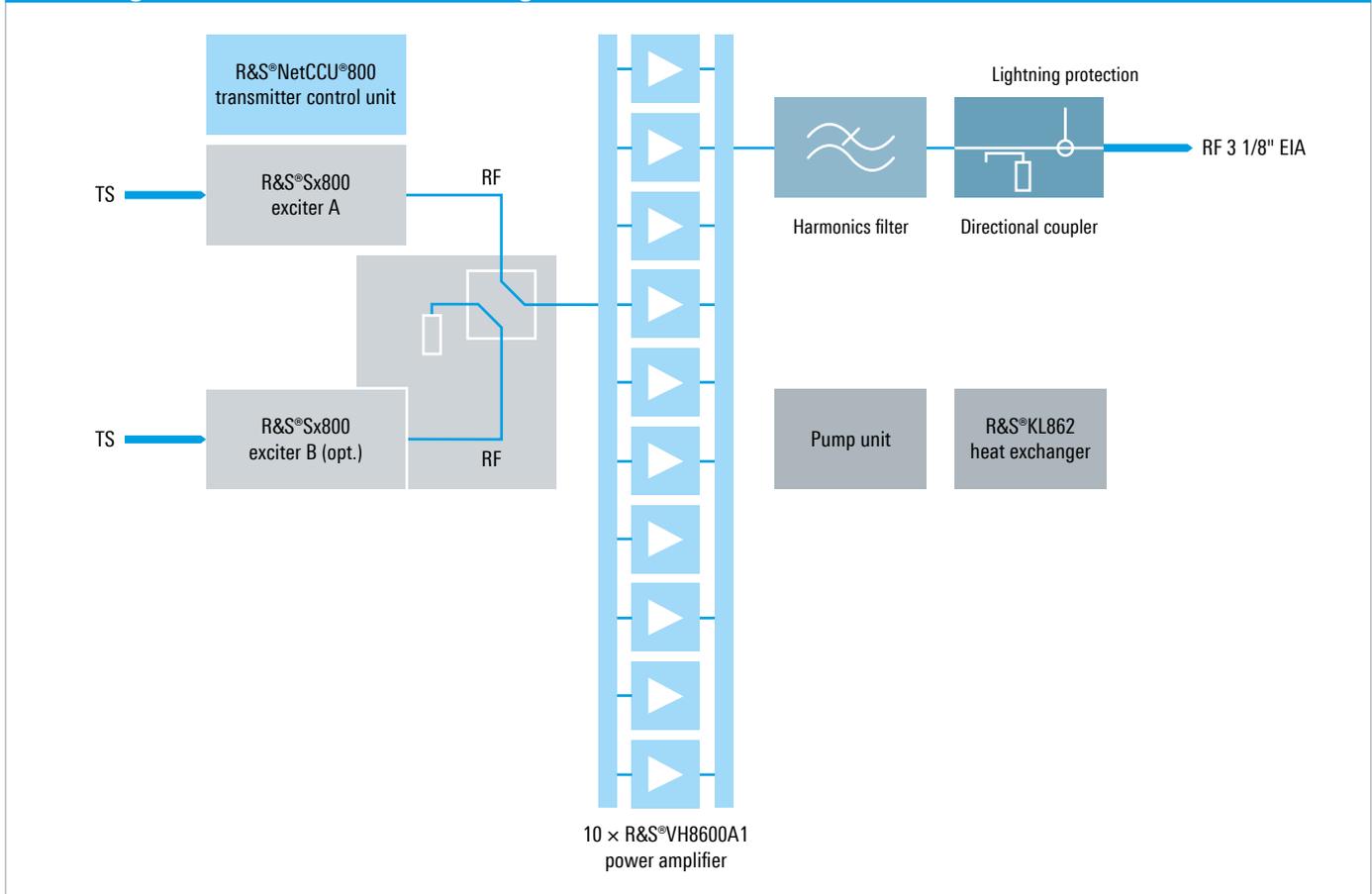
## Multistandard platform for use worldwide

The R&S®NH/NV8600 transmitter family can be used worldwide. In addition to analog TV, the family supports the digital TV standards DVB-T, ATSC, ISDB-T/ISDB-T<sub>B</sub> and DTMB. Moreover, the transmitters cover the mobile TV standards DVB-H, MediaFLO™ and ATSC Mobile DTV. As the market leader, Rohde & Schwarz offers its customers maximum safety of investment for the products they acquire. Since the signal processing of the transmitters is software-based, network operators can respond to expansions of existing standards and subsequently integrate them into their networks.

The transmitters are already prepared for DVB-T2, the next-generation DVB-T standard. If requested, simple switch-over of the transmitters from analog to digital TV without the need for hardware modifications can be included.

The R&S®NH/NV8600 UHF high-power transmitters are suitable for all local requirements. They are a future-safe investment for network operators worldwide.

Block diagram of the R&S®Nx8600, configured as an R&S®NV8610 with max. 6.4 kW for DVB-T



## Modular design

The R&S®NH/NV8600 broadcast transmitters essentially consist of the following components:

- R&S®Sx800 exciter
- R&S®NetCCU®800 transmitter control unit
- R&S®VH8600A1 UHF amplifier
- Rack with control unit and power distribution
- R&S®ZK800Sx pump rack and control unit
- R&S®KL862 heat exchanger

The core components of the R&S®xx8000 generation have been tried and tested in the field for many years. Apart from their successful use in analog networks, they have demonstrated their reliability on a daily basis in digital and mobile transmitter networks throughout the world.

The R&S®Sx800 exciter includes the complete digital signal processing functionality for analog video/audio input signals and digital transport streams and ensures precise modulation to the desired output channel. The circuits and algorithms used are 100% produced by Rohde & Schwarz to ensure maximum quality and flexibility on a long-term basis. The exciter, which is 19" in width and only one unit in height, is extremely compact. The R&S®Sx800-K5 automatic adaptive precorrection option compensates for linear and nonlinear distortions in the amplifier and the output filter, which allows simple and fast installation and commissioning in digital transmitter networks.

The R&S®NetCCU®800 transmitter control unit with its Linux-based operating system ensures reliable control and state-of-the-art operation. The transmitters can be accessed locally and remotely via the graphical color display, web interface, SNMP or a parallel interface.

The modular design and the fact that most of the components are used throughout the R&S®xx8000 transmitter family provide a high degree of synergy, which simplifies installation, maintenance and spare parts supply. The uniform operating and maintenance philosophy minimizes the training required for the operating personnel.

## Configurable for different AC supply voltages

The AC supply for the R&S®NH/NV8600 transmitters can be configured for the different AC supply types used worldwide:

- Three-phase 400 V (3w + N + PE, standard)
- Three-phase 208 V (3w + N + PE)
- Two-phase 120/240 V (2w + N + PE)

As a result, additional investments (e.g. for transformers) are unnecessary, and the required installation space is reduced.

Overvoltage protection connected before the power distribution effectively protects all connection variants against damage caused by fast transients. If the overvoltage protection is triggered, a warning is issued by the transmitter control unit and, if necessary, also sent to remote units.

# Energy-efficient with small footprint

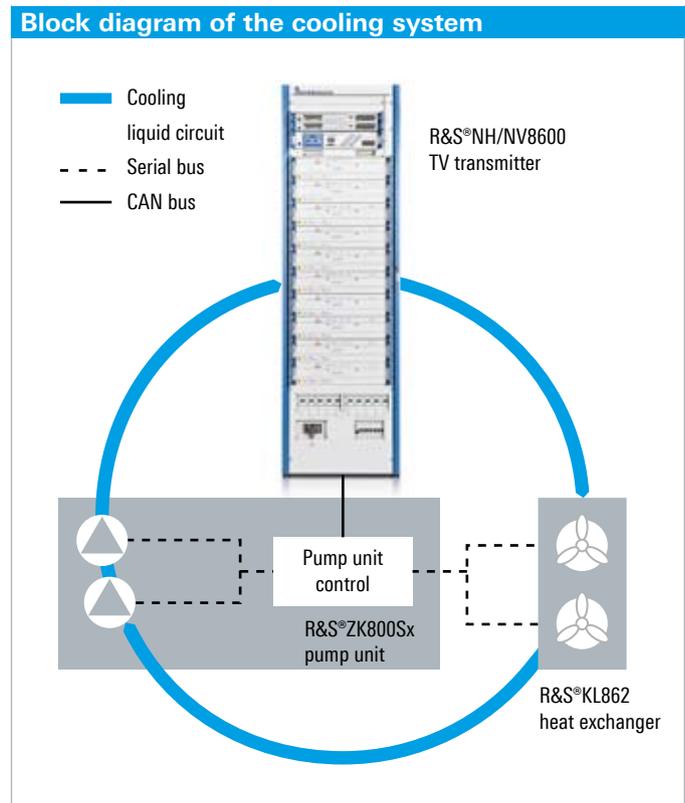
## UHF broadcast transmitters with excellent efficiency

A series of innovative solutions implemented across the entire transmitter system gives the R&S®NH/NV8600 transmitter family an excellent level of energy efficiency of up to 23% for OFDM signals and > 25% for ATSC signals.

This is primarily due to the optimized design of the R&S®VH8600A1 UHF power amplifier with optimum adaptation and cooling of the developed amplifier circuits and of the integrated power supply unit.

The extremely small number of heat transfer points in the amplifier modules ensures low thermal resistance and allows optimum heat dissipation. This is achieved by mounting all boards and components directly on the liquid-cooled aluminum heat sink of the amplifier.

Rohde&Schwarz is the only manufacturer of high-power broadcast amplifiers that does not use straight, drilled coolant routing in the UHF amplifiers, but instead implements complex methods for flexibly distributing the coolant in the heat sink. As a result, all hot spots of the RF circuit and of the power supply unit can be reached directly and precisely.



Despite the high gain required to achieve maximum efficiency, all power components (especially the power transistors) can be operated at a low temperature level. This is the most important criterion for stable and long-term operation of the transistors.

Moreover, the special cooling technology does not require air circulation inside the amplifier. The use of the R&S®VH8600A1 amplifiers therefore eliminates the need for expensive maintenance trips to replace the integrated fans.

In order to retain the amplifiers' high level of efficiency across the entire system, Rohde & Schwarz uses minimum attenuation in the transmitter's output network. Short signal paths due to direct plug-in connectors and adequately dimensioned cross sections are essential in this context. Owing to the in-house development and production of all components used (e.g. power couplers, absorbers and harmonics filters), each module is optimally designed to maximize the transmitter's overall efficiency.

Liquid cooling is also used for the R&S®NH/NV8600 transmitters' RF output network. No additional rack fan is required, which has a positive effect on the efficiency of the cooling system.

### **Constant efficiency even at reduced output powers**

New, digital broadcast networks are often planned with reduced transmitter power in order to compensate for any unexpected coverage gaps with additional power, or if operation at maximum transmit power is not yet possible when the transmitter is switched on.

Normally, reducing the nominal output power of a broadcast transmitter adversely affects efficiency. This is because, at reduced power, the transistors leave their optimum operating point. To provide network operators with optimum efficiency even in such cases, the operating point of the transistors in the R&S®NH/NV8600 transmitters can be adapted using a new type of supply control. As a result, the excellent energy efficiency of the transmitter can be achieved even at reduced output powers.

### **Compact design for low infrastructure costs**

With max. 6.4 kW COFDM TV power per rack and a space requirement of 19" in width and just 1100 mm in rack depth, the transmitters of the R&S®NH/NV8600 family are extremely compact and consequently reduce infrastructure costs.

In-house development and production also play a crucial role in transmitter compactness. They allow an optimum form factor and the ideal positioning of each system component to be taken into account during the design process.

The R&S®NH/NV8600 transmitter family therefore has the most compact liquid-cooling system on the market. The ability to install two pump racks directly on top of each other and select the heat exchangers to meet on-site requirements makes it possible to install the transmitters even when space is at a premium.

# Always on the air

## All components from a single source for highest quality standards

Apart from obvious criteria such as the use of advanced algorithms for signal processing, multistandard capability or energy efficiency, a broadcast transmitter is characterized by one other essential feature: interruption-free transmission.

That is why engineers at Rohde&Schwarz attach great importance to reliability during development and design and to the dependability of the components and materials used. True to the motto "reliability through quality", the Broadcasting Division works hand in hand with the in-house departments responsible for component selection, certification and quality assurance.

The wide spectrum of test and measurement solutions provided by Rohde&Schwarz ensures the availability of the latest standards to meet highest quality requirements. Rohde&Schwarz manufactures its products in-house and subjects them to acceptance tests at its own plants. This ensures rapid and reliable production that is largely independent of external suppliers. As a company with an international presence, Rohde&Schwarz provides local support and the necessary know-how to customers all over the world.

Convenient operation of the R&S®NH/NV8600 transmitter family via web browser.



## Reliable system design

The R&S®NH/NV8600 transmitter family includes a variety of features to safeguard transmitter operation. Apart from interruption-free input signal switchover of the four ASI inputs and overvoltage protection at the AC supply input, the system design itself as well as the independence of the individual components significantly contribute to stable operation.

The main transmitter control settings are stored in the Linux-based R&S®NetCCU®800 transmitter control unit and in the rack control system, providing redundancy for this essential function. This allows the transmitter control unit to be replaced without taking the transmitter off air.

The R&S®VH8600A1 power amplifiers have their own internal predriver stage to supply the amplifiers with the direct signal from the exciter. As a result, dedicated pre-amplifiers that represent "single points of failure" along the signal path can be avoided.

The amplifiers are additionally equipped with protective circuits that prevent damage to the transistors caused by overtemperature or excess reflection, for example. The robust design of the amplifiers permits operation even in the case of unfavorable matching of the transmitter output up to a VSWR value of 1.3.

## Dependable and low-energy liquid cooling

The liquid-cooling system ensures dependable cooling of all high-power components in the transmitters. Due to its reliable and innovative design, the cooling system complements the transmitters perfectly in terms of stability and efficiency.

A closed cooling circuit, the use of an application-optimized coolant and the careful selection of the cooling materials provide the system with long-term protection against corrosion. The cooling system has also been largely developed and designed in-house by Rohde&Schwarz.

In the R&S®ZK800Sx pump rack, two high-quality pumps operating in series permanently run in active standby mode. Communications with the central R&S®NetCCU®800 transmitter control unit takes place via the integrated pump controller. The quantity of coolant to be supplied is adapted individually, depending on the transmitter configuration. This ensures optimum operation and minimum consumption. For maintenance purposes, the pumps can be disconnected and replaced individually without impairing transmitter operation.

During regular operation, the electronically commutated heat exchanger fans are operated at up to 60% of their nominal speed, depending on the cooling power currently required. In addition to minimizing power consumption and noise generation, this primarily reduces wear of the fans and increases their lifetime.

There is yet another important reason for deliberately overdimensioning the heat exchangers: If one of the two fans fails, the other fan can continue to adequately cool the transmitter system by being operated at full power.

The cooling system is decisive for the overall energy balance and the reliability of the transmitter system.

## Standby systems for all requirements

To safeguard availability, the R&S®NH/NV8600 transmitter family can also be configured for different standby systems. Apart from exciter standby, passive transmitter standby and active output-stage standby, (N+1) standby systems are predominantly installed in digital networks. Up to eight main transmitters can be backed up by one common standby transmitter. The necessary settings of the main transmitter are stored in the standby transmitter. They are selected and activated by a higher-level control unit in the event of a fault so that the main transmitter that is affected is immediately substituted by the standby transmitter.

# Specifications

Specifications		
<b>Digital TV</b>		
TV standards		DVB-T, DVB-H, ATSC, ATSC Mobile DTV, ISDB-T, ISDB-T <sub>tr</sub> , DTMB, MediaFLO™
Inputs		4 × BNC, 75 Ω
<b>Analog TV</b>		
TV standards		B/G, D/K, M, M1, N, I, I1
Color transmission		PAL, NTSC, SECAM
Sound transmission		dual-sound coding in line with IRT or FM single sound and NICAM728 (−13 dB/−20 dB) or FM single sound (−10 dB)
Inputs		2 × video (BNC, 75 Ω), 2 × audio (XLR, 3-contact)
<b>General data</b>		
Frequency range	UHF bands IV/V	470 MHz to 862 MHz
Power supply	with three-phase amplifiers (standard)	3 × 400 V ± 15% <sup>1)</sup> , 47 Hz to 63 Hz
	with single-phase amplifiers (optional, for R&S®NV8602 to R&S®NV8610)	3 × 208 V − 10%/+ 15% <sup>1)</sup> or 240 V − 15%/+ 10% <sup>2)</sup> , 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
Relative humidity (max.)		95%, non-condensing
<b>Immunity</b> <sup>3)</sup>	to fast transients and burst in line with IEC 61000-4-4	< 4 kV (AC supply), < 1 kV (signal inputs)
	to surges in line with IEC 61000-4-5	balanced < 2 kV (e.g. L1-L2) unbalanced < 4 kV (e.g. L1-N)
<b>Synchronization</b>		
Reference frequency		10 MHz, 0.1 V to 5 V (V <sub>pp</sub> ) or TTL, BNC
Reference pulse		1 Hz, TTL, BNC
<b>Operation</b>		
Display, keypad and status LEDs		local operation and display
Ethernet interface, RJ-45		convenient operation, local or remote, via standard web browser
	optional	network management interface via SNMP
Parallel remote-control interface	optional	floating contacts for messages and commands

<sup>1)</sup> To be connected to an AC supply network with Y, 3w + N + PE.

<sup>2)</sup> To be connected to an AC supply network with 120/240 V, 2w + N + PE.

<sup>3)</sup> With integrated AC supply overvoltage protection; more stringent requirements must be covered by additional on-site measures.

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.

# Ordering information

Designation	Type	Order No.
<b>Typical configuration of a DVB-T transmitter with 6.4 kW and exciter standby</b>		
<b>DVB-T transmitter, configured as an R&amp;S®NV8610V, UHF bands IV/V, 470 MHz to 862 MHz, 6.4 kW output power, with exciter standby</b>		
DTV Transmitter (base unit)	R&S®NV8610x	2101.4503.50
Power Kit	R&S®ZR810S1	2098.5109.30
Power Distribution Kit	R&S®ZR810S2	2098.5209.20
RF Power Kit	R&S®ZR810R1	2098.5250.29
10 × UHF Power Amplifier	R&S®VH8600A1	2100.6002.02
2 × R&S®Sx800 Exciter, configured as DVB-T exciter	R&S®Sx800	2095.1502K50
Installation Kit for R&S®Sx800 Exciter	R&S®ZR800T1	2099.1007.23
Installation Kit for R&S®Sx800 Exciter Standby	R&S®ZR800V1	2099.1507.04
Transmitter Control Unit	R&S®NetCCU®800	2095.8007K02
<b>Cooling system for an R&amp;S®NV8610V DVB-T transmitter</b>		
Pump Unit	R&S®ZK810S1	2103.1001.34
Cooling Circuit Accessories	R&S®ZR860Z1	2103.0505.14
Heat Exchanger	R&S®KL862	2103.0728.25

Your Rohde&Schwarz sales partner will be glad to help you find the optimum solution.

You can find your local contact at

[www.sales.rohde-schwarz.com](http://www.sales.rohde-schwarz.com)

## Service you can rely on

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

## About Rohde & Schwarz

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

## Environmental commitment

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

Certified Quality System  
**ISO 9001**

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