

R&S®TMU9/R&S®TMV9

Air-Cooled Transmitter Families

Maximum flexibility,
minimum TCO



R&S®TMU9/ R&S®TMV9 Air-Cooled Transmitter Families At a glance

The R&S®TMU9/R&S®TMV9 transmitter families offer unique flexibility by providing more than 50 different standard configurations. Featuring efficiency of up to 38 % (COFDM)/42 % (ATSC) for UHF and up to 46 % for VHF (COFDM-TV and DAB), it achieves the highest energy savings on the market. Plus, the simple system configuration allows quick startup. The high availability of the R&S®TMU9 ensures unsurpassed reliable operation. And its compact size saves space at the transmitter site.

The R&S®TMU9 air-cooled transmitters attain output powers in the UHF range from 300 W to 2.85 kW for digital standards and up to 4.75 kW for analog standards. In the VHF range, the R&S®TMV9 achieves up to 4.3 kW for digital audio broadcasting and digital TV, and up to 6 kW for analog TV. The transmitters are accommodated in only one rack, saving a lot of space at the transmitter site.

With efficiency values of up to 25 % (COFDM)/29 % (ATSC) for UHF and up to 33 % (COFDM-TV and DAB) for VHF in normal operation, the transmitters save a great deal of energy and significantly reduce CO₂ emissions. The Doherty architecture for boosting efficiency increases this figure to up to 38 % (COFDM)/42 % (ATSC) for UHF and up to 46 % (COFDM-TV and DAB) for VHF. As a result, the R&S®TMU9/R&S®TMV9 transmitters reduce energy costs by more than 40 % compared with conventional transmitters.

The transmitters feature unique system variability. Innovative configurations, such as MultiTX or N+1 systems in a single rack, and built-in bandpass filters, allow short delivery periods even for special transmitter configurations. Excellent efficiency and the integration of multiple transmitters into a single rack reduce the total cost of ownership (TCO) of a transmitter system by more than half over the system's lifetime.

Key facts

- Efficiency of up to 38 % for UHF and up to 46 % for VHF
- Unique flexibility
- Small footprint
- Quick startup, easy operation and high availability



R&S®TMU9/ R&S®TMV9 Air-Cooled Transmitter Families

Benefits and key features

Transmitters with exceptional efficiency

- Next level of efficiency thanks to Doherty technology
- Voltage regulation and crest factor reduction
- Adaptive digital equalization
- Efficient amplifier layout

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Unique variability

- Flexible system configuration
- R&S®TCE900 – the multitalent for use as a transmitter control unit and/or exciter
- IP transport stream feed for reducing infrastructure costs
- Simple switchover from analog to digital TV

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Small footprint

- Multiple transmitters in a single rack
- Compact coupler units integrate different functionalities
- Compact components with integrated cooling

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Easy handling and outstanding reliability

- Simple system configuration for quick startup and expansion
- Easy and efficient operation
- Innovative solutions for increasing availability

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E⁵ – efficiency to the power of five

The R&S®Tx9 transmitter generation scores with efficiency on five different levels:

■ Efficiency in energy

Economical: minimum power consumption for cost savings over system lifetime

■ Efficiency in space

Space-saving: several transmitters and additional components in one rack

■ Efficiency in operation

Smooth: installation, operation and maintenance

■ Efficiency in configuration

Customer-focused: modular solutions for flexible system configuration

■ Efficiency for a lifetime

Future-ready: can be expanded to accommodate new standards and technologies



Model overview

R&S®TMU9/R&S®TMV9 transmitter system							
Number of amplifiers	1	1	2	3	4	5	6
UHF							
Output power (RMS) for digital standards ¹⁾	300 W	600 W (normal operating mode), 570 W (Doherty operating mode)	1140 W	1710 W	2280 W	2850 W	–
Output power (sync peak) for ATV	500 W	1000 W	1900 W	2850 W	3800 W	4750 W	–
Dimensions in mm (in) (H x W x D)	310 x 483 x 550 (12.20 x 19.01 x 21.65)	310 x 483 x 550 (12.20 x 19.01 x 21.65)	490 (11 HU) x 483 x 780 (19.29 x 19.01 x 30.70)	2000 x 800 x 600 (78.74 x 31.49 x 23.62)			
Number of transmitters per rack (42 HU in a MultiTX system)	up to 6	up to 6	up to 3	2	1	1	1
Maximum N+1 configuration per rack	4+1	4+1	2+1	1+1	–	–	–
VHF							
Output power (RMS) for digital standards, 170 MHz to 230 MHz	350 W	750 W	1450 W	2200 W	2900 W	3600 W	4300 W
Output power > 230 MHz	350 W	700 W	1350 W	2050 W	2700 W	3350 W	4000 W
Output power (sync peak) for ATV 170 MHz to 230 MHz	600 W	1200 W	2350 W	3500 W	4650 W	5800 W	6900 W
Output power (sync peak) for ATV > 230 MHz	600 W	1100 W	2150 W	3200 W	4250 W	5300 W	6350 W



¹⁾ In Doherty operating mode from 470 MHz to 490 MHz, different output power stages apply: 300/550/1100/1650/2200/2750 W.

R&S®TMV9 transmitter with three amplifiers and an output power of 2.2 kW (DAB and DTV).

Transmitters with exceptional efficiency

Next level of efficiency thanks to Doherty technology

The R&S®TMU9/R&S®TMV9 broadcast transmitters even achieve excellent efficiency of up to 25% (COFDM)/29% (ATSC) for UHF and 33% (COFDM-TV and DAB) for VHF in the standard configuration.

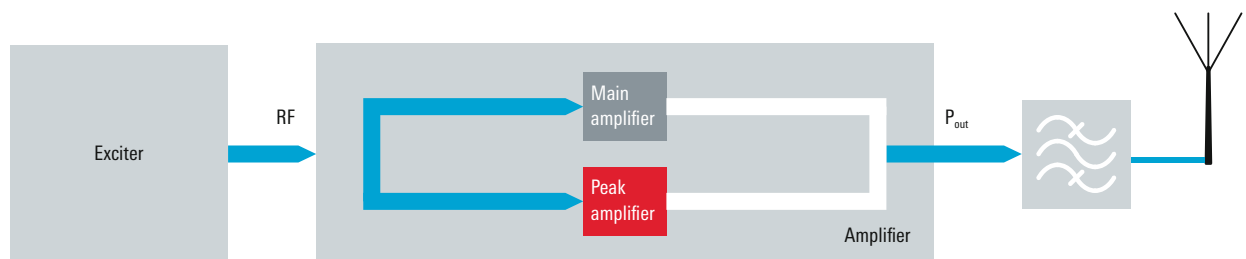
Featuring Doherty amplifier design, the R&S®TMU9/R&S®TMV9 attain the next level of efficiency. The transmitters set benchmarks, with up to 38% (COFDM)/42% (ATSC) for UHF and up to 46% (COFDM-TV and DAB) for VHF. The transmitters reduce energy costs by more than 40% compared with the average 20% efficiency of other transmitters on the market.

To attain these values, Doherty technology is the method of choice. This technology is based on an architecture invented in the 1930s by William H. Doherty. It has been used successfully in wireless communications for many years and helps to reduce energy costs.

The basic principle involves splitting signal amplification into two paths. In the main amplifier, only the average signal is amplified, and no power margins have to be reserved for peak signals in this path. The peak amplifier is only used when peaks occur in the signal. This architecture saves energy in both the main and the peak amplifier.

Rohde & Schwarz has revolutionized this technology with the R&S®TMU9/R&S®TMV9. For the first time, the amplifier has a broadband design while still making use of the basically narrowband Doherty architecture. Even in large transmitter networks that use many different frequencies, it is now possible to efficiently manage the spare parts inventory. Because no additional modules are required, the mean time between failure (MTBF) of the amplifiers remains unchanged when this technology is used.

Transmitter system with Doherty amplifier



The R&S®PMV901 amplifier features an output power of 750 W for DAB/DTV and 1200 W for ATV.



Voltage regulation and crest factor reduction

To significantly increase efficiency, Rohde&Schwarz has incorporated two other innovative approaches into its mix of technologies, in addition to the optimized system design.

Voltage regulation considerably boosts efficiency. Only Rohde&Schwarz offers this. The control mechanism in the transmitter control unit allows transmitter efficiency to be optimized for all digital TV standards. The signal is decoupled by the directional coupler at the transmitter output, routed back to the R&S®TCE900 exciter and analyzed. At the same time, the supply voltage for the power transistors is iteratively adjusted via the power supplies in the amplifiers. Voltage regulation considerably boosts efficiency especially when a transmitter operates at reduced output power.

With the R&S®TCE900 exciter, Rohde&Schwarz is the first manufacturer to offer a reduction of the crest factor for all COFDM standards. The crest factor is reduced to 8 dB without any negative impact on MER, improving the total transmitter efficiency. For DVB-T2, the tone reservation method defined in the standard can alternatively be used to reduce the crest factor.

Adaptive digital equalization

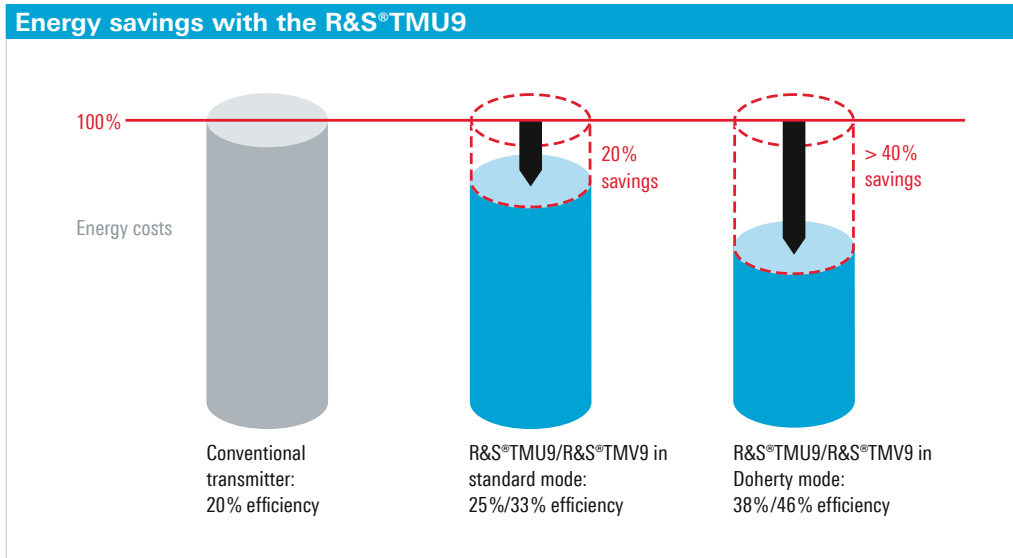
All R&S®TMU9/R&S®TMV9 configurations feature adaptive digital equalization (ADE) to equalize the transmitter system quickly, easily and at any time. ADE can be used either once when the system is put into operation or adaptively.

Efficient amplifier layout

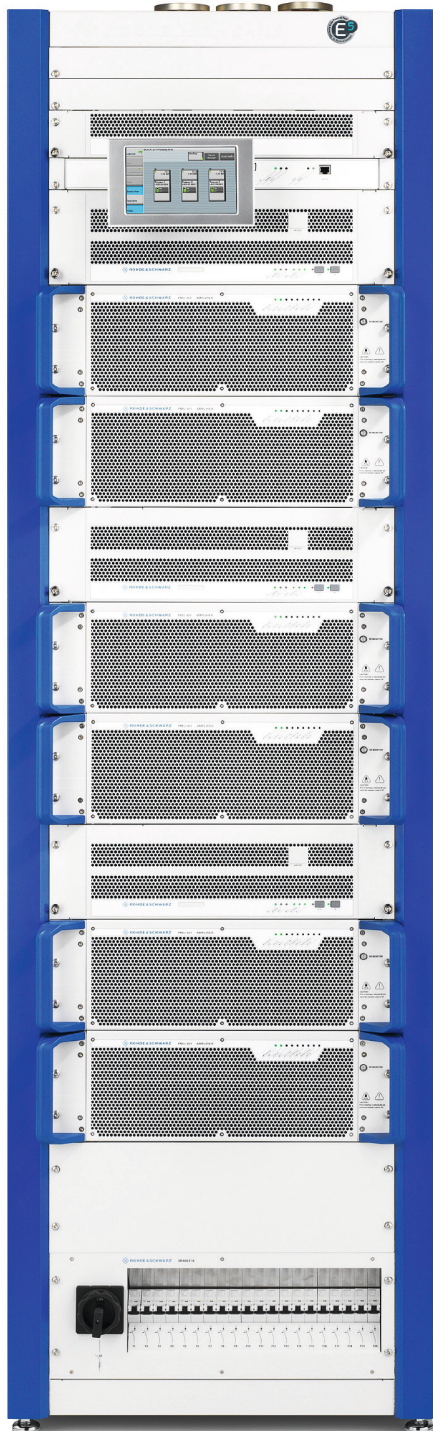
Featuring output power of 570 W for UHF and 750 W for VHF, the amplifier achieves outstanding power density. The power transistors use sophisticated 50 V LDMOS technology. The close cooperation between Rohde&Schwarz and the semiconductor manufacturer and the optimal matching of the transistors result in excellent efficiency and proven long-term stability of the amplifier section.

The same amplifier can be used both in conventional mode and for systems with increased efficiency.

A technology first, passively cooled power supplies are used in the new air-cooled amplifiers, contributing to system efficiency and increasing availability.



Unique variability



MultiTX system with
three R&S™TMU9
1.14 kW transmitters
in one rack.

Flexible system configuration

The R&S™TMU9/R&S™TMV9 broadcast transmitters offer unique flexibility. Because the system can be flexibly configured, more than 50 different standard system configurations are available, allowing a short delivery period even when special configuration requirements need to be met.

The new MultiTX concept makes it possible to install up to six transmitters in one rack. Even complete N+1 systems can be accommodated in a single rack.

Transmitters with up to two amplifiers can also be ordered without a rack, allowing installation in racks where space is still available or in a rack acquired on-site. Bandpass filters, dummy antennas and other accessories can also be integrated into the transmitter rack, saving additional space.

Various air ducting configurations can be implemented, allowing the transmitter to operate both with and without ducted exhaust air. If the exhaust air is ducted, the system comes with a kit that has a pressure monitor and ensures constant cooling even if air intake fluctuates.

R&S™TCE900 – the multitalent for use as a transmitter control unit and/or exciter

The R&S™TMU9/R&S™TMV9 transmitter families use the R&S™TCE900 platform introduced with the R&S™THU9 UHF TV transmitter family. This cross-family platform allows network operators who use multiple R&S™Tx9 transmitters from the difference to easily and economically manage their spare parts inventories. Thanks to the system's modularity, network operators with both DAB and TV networks can look forward to cost savings since they will require fewer spare parts.

By inserting supplementary specific plug-in boards, the base unit can be configured as a transmitter control unit or as an exciter, resulting in unprecedented flexibility for network operators. To reconfigure the R&S™TCE900 on-site for another application, the user simply needs to exchange the modules. The platform also offers free option slots for expanding its functionality (e.g. by adding a satellite receiver).

When configured as a transmitter or system control unit, the R&S®TCE900 ensures smooth operation of the transmitter system. The R&S®TCE900 connects to the different system components via plug-in boards: Depending on the configuration, the cooling-system interface connects the exhaust air duct system, while the transmitter interface connects to the exciters. The control unit uses the connected exciters to communicate with the amplifiers, the directional coupler and other system modules via CAN bus.

In the exciter configuration, a coder board for base-band signal processing and an RF board for RF modulation are added to the R&S®TCE900 base unit. The exciter is extremely versatile. It can be used for the DVB-T, DVB-T2, DVB-H, ISDB-T/ISDB-T_B, DTMB, ATSC and ATSC Mobile DTV digital TV standards as well as for analog TV. Equipped with the appropriate coder board, the exciter is ideal for the DAB/DAB+ digital audio broadcast standards and T-DMB Mobile TV applications. All these transmission standards are available as software options for easy retrofitting. It is therefore no problem to install multiple standards in one exciter (e.g. DVB-T and DVB-T2). The exciter configuration also includes a GPS receiver that can be easily activated via option key.

In the R&S®TMU9/R&S®TMV9, the R&S®TCE900 can combine the functionalities of a transmitter control unit and an exciter, allowing a complete transmitter rack to operate with a single R&S®TCE900 as control unit and exciter. This saves space and increases the system's MTBF.

IP transport stream feed for reducing infrastructure costs

Due to its cost-effectiveness, IP technology is also gaining ground in broadcast networks. For all digital standards, the R&S®TCE900 exciter optionally offers feeding two transport streams redundantly via Gigabit Ethernet interfaces. This also applies to DAB. Transport streams can be fed in via IP at any time using the EDI standard, eliminating the need for external IP-to-ASI/ETI gateways. Because it is integrated in the transmitter control unit, this solution saves money and space, and simplifies feed monitoring.

Simple switchover from analog to digital TV

In the years to come, many operators will switch over from analog transmission to digital TV. The R&S®TMU9/R&S®TMV9 broadcast transmitters facilitate this transition. When the exciter is fed with both analog and digital input signals, switchover can take place locally (by pressing a key) or remotely.



R&S®TMU9 with 1.14 kW
DTV output power in dual drive
in a MultiTX group.

Small footprint

Multiple transmitters in a single rack

The new MultiTX concept makes it possible to accommodate up to six transmitters in a 42 HU rack. Functioning as a system control unit, the R&S®TCE900 optionally monitors the transmitters and establishes a connection to the monitoring room via web interface or SNMP. If exhaust air is ducted, the R&S®TCE900 also monitors the exhaust air duct. If this is not desired, multiple autonomous transmitters can be integrated into a rack without shared monitoring.

Each transmitter in a multitransmitter group can be operated in dual drive configuration. A MultiTX system can also be quickly and easily expanded by installing an additional transmitter.



N+1 configurations can also be implemented in a single rack. For example, a 4+1 system with an output power of up to 570 W (UHF) and 750 W (VHF) can be configured in just one rack, making it possible to save up to three racks or more than 3 m² per transmitter system (compared with existing systems). As a result, an enormous amount of costs can be saved when leasing site surface.

Compact coupler units integrate different functionalities

The new 6-in-1 coupler unit includes the coupler unit, an input signal splitter, harmonics filter, lightning protection, power absorber and the measuring systems. The harmonics filter is already integrated into the R&S®TMV9 amplifier. Lightning protection, coupler unit, power absorber and measuring systems are combined into one module. Each coupler unit has an optional connector for integrating a customer test point. The module is located directly behind the amplifiers, saving space and reducing the attenuation in the system. The compact design allows fast system startup and makes it possible to add a transmitter to the rack quickly and easily.

Compact components with integrated cooling

The compact R&S®PMU901/R&S®PMV901 amplifiers, only 3.5 height units in size, achieve an output power of up to 570 W for UHF and 750 W for VHF. This saves space in the rack for installing other components or additional transmitters. Two integrated fans in the amplifiers that can be exchanged during operation allow the transmitter system to operate without an exhaust air system. Ducted exhaust air can be optionally added to the configuration.

The R&S®TCE900 also significantly contributes to the system's compactness. The entire backup drive setup requires only three height units, saving more space. Integrated long-life fans allow reliable operation. They do not need to be replaced.

6-in-1 coupler unit for coupling two R&S®PMU901 amplifiers.

Easy handling and outstanding reliability

Simple system configuration for quick startup and expansion

The transmitters come fully cabled; only feed cables, power supply and system monitoring need to be added. Together with the self-engaging connection of the amplifier with the coupler, power supply and signal feed, the R&S®TMU9/R&S®TMV9 can be put into operation fast and easily.

The R&S®TCE900 is accessible from the front, allowing new plug-in boards to be added quickly and easily.

Easy and efficient operation

Each R&S®TMU9/R&S®TMV9 is equipped with a status display on the R&S®TCE900 rackmounts, where the transmitter status can be read off at any time. The buttons on the front panel make it quick and simple to switch from remote to local operation and to switch the transmitter on and off.

The optional R&S®TDU900 transmitter display unit allows fast, intuitive operation of the transmitter system via a 7" touchscreen. The retractable unit automatically slides out of the housing simply by giving it a slight push. It can be conveniently turned to the desired position, for fast, user-friendly operation.

An Ethernet connector, available with and without an R&S®TDU900, allows the transmitter to be operated locally via the web interface. The transmitter can also be operated remotely via web interface or integrated into a network management system via SNMP.

Innovative solutions for increasing availability

The backup drive redundancy concept known from the R&S®SCx8000 transmitter family has been enhanced for the R&S®TMU9/R&S®TMV9. All configuring can be done centrally via exciter A. As a result, a single IP address suffices for configuring and monitoring the system. This concept also makes it possible to directly address the second exciter via a separate IP address, allowing convenient remote diagnosis and eliminating unnecessary visits to the transmitter site.

This redundancy concept not only saves space, it also increases the system's availability because it requires only two modules.

Optional power supply redundancy for the amplifiers also helps to increase availability. Normally, each of the two power supplies delivers half of the necessary current. If one of the power supplies fails, the other delivers the full current. This ensures interruption-free transmission even if a power supply or a phase in the feed network fails. The power supplies can be easily replaced during operation.



Transmitter status display on the front panel via LEDs.

Specifications

Specifications		
Digital TV		
Standards		DVB-T, DVB-T2, DVB-H, ISDB-T, ISDB-T _B , ATSC, ATSC Mobile DTV, DTMB
Channel bandwidth	DVB-T, DVB-H	5/6/7/8 MHz
	DVB-T2	1.7/5/6/7/8 MHz
	ATSC	6 MHz
	ISDB-T/ISDB-T _B	6/8 MHz
	DTMB	8 MHz
Inputs	DVB-T, DVB-H, DVB-T2, DTMB	2 × ASI (HP/LP), 75 Ω BNC, 2 × RJ-45
	ATSC	2 × SMPTE310M or 2 × ASI, 75 Ω BNC, 2 × RJ-45
	ISDB-T/ISDB-T _B	2 × BTS, 75 Ω BNC, 2 × RJ-45
Digital radio/Mobil TV in the VHF band		
standards		DAB, DAB+, T-DMB
Channel bandwidth		1.536 MHz
Inputs		2 × ETI, BNC 75 Ω/high impedance, 2 × RJ-45
Analog TV		
standards		B/G, D/K, M ²⁾ , N ²⁾ , I, I1
Color transmission		PAL, NTSC, SECAM
Sound transmission		IRT dual-sound coding, FM single sound and NICAM728 (–13 dB/–20 dB) (optional), FM single sound (–10 dB)
Inputs		1 × video (75 Ω BNC), 2 × audio (XLR)
General data		
Frequency range	UHF bands IV/V	470 MHz to 862 MHz
	VHF band III	170 MHz to 255 MHz
Supply voltage		■ 230 V; 2 wires + PE (L1/N/PE) ± 15% ■ 400 V/230 V; 4 wires + PE (L1/L2/L3/N/PE) ± 15% ■ 240 V; 2 wires + PE (L1/L2/PE) ± 10% ■ 208 V; 4 wires + PE (L1/L2/L3/N/PE) ± 10%
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
Immunity ¹⁾	to fast transients and bursts in line with EC61000-4-4	< 2 kV (AC supply), < 1 kV (signal inputs)
	to surges in line with EC61000-4-5	symmetrical < 1 kV (e.g. L1-L2), asymmetrical < 2 kV (e.g. L1-N)
Synchronization		
Reference frequency		10 MHz, 0.1 V to 5 V (V _{pp}) or TTL, BNC
Reference pulse		1 Hz, TTL, BNC
Operation		
Display unit with touchscreen and LEDs	optional	local operation and display
Ethernet interface, RJ-45		local, remote, standard web browser
	optional	network management interface via SNMP
Parallel remote interface	optional	floating contacts for messages and commands

¹⁾ With built-in AC overvoltage protection; more stringent requirements must be satisfied by implementing appropriate measures in the stations.

²⁾ Single sound.

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

Your local Rohde&Schwarz expert will help you determine the optimum solution for your requirements.
To find your nearest Rohde&Schwarz representative, visit www.sales.rohde-schwarz.com

Service that adds value

- ▮ 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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