

# R&S® TMV9EVO AIR-COOLED VHF TRANSMITTER FAMILY

The best even better



Product Brochure  
Version 01.00

**ROHDE & SCHWARZ**

Make ideas real



# AT A GLANCE

The R&S®TMV9evo VHF transmitter represents the next level of development for the successful family of medium power transmitters. The new transmitter stands for simplicity and endurance. DAB+ and DTV transmission has never been as straightforward and effortless as with the R&S®TMV9evo. Network operators benefit highly from low operating costs throughout the product's lifecycle.

The air-cooled R&S®TMV9evo VHF medium-power transmitter has output power levels from 350 W to 4.3 kW for DAB+ as well as for DTV standards (including ATSC 3.0). The R&S®TMV9evo is an ideal choice for network operators who demand both excellent quality of service and operational efficiency on any level.

As a member of the successful R&S®Tx9 transmitter generation, the R&S®TMV9evo minimizes total cost of ownership (TCO) with its unrivaled long-lived transmitter design, a high degree of automation and efficiency of up to 50% for DTV and 49% for DAB+.

The new adaptive efficiency optimization feature ensures maximum energy cost savings even after channel changes or output power adjustments.

With its long product lifetime, the investment in an R&S®TMV9evo pays out much longer. The transmitters' effortless operation based on a superior level of automation creates less maintenance costs than any competing product.

## Key facts

- ▶ Optimized in any operational cost aspect
- ▶ Most mature VHF band III amplifier design
- ▶ Ensured Quality of Service
- ▶ Upgraded with latest features of R&S®Tx9evo platform
- ▶ Future-ready ATSC 3.0 support



# BENEFITS AND KEY FEATURES

## E<sup>5</sup> – efficiency to the power of five

The R&S<sup>®</sup>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



## Most mature VHF-band III amplifier design

- ▶ Superior energy efficiency thanks to the R&S<sup>®</sup>PMV901 amplifier with enhanced Doherty technology
- ▶ Wideband amplifier architecture
- ▶ Best energy efficiency even after channel changes
- ▶ [page 4](#)

## Operational Efficiency on any level

- ▶ Stringent focus on long-lived transmitter design
- ▶ Continuous control of transmitter's key performance indicators
- ▶ Innovative redundancy concepts at all levels
- ▶ [page 6](#)

## Compact design and easy operation

- ▶ Compact, expandable exciter
- ▶ Easy and efficient operation
- ▶ [page 8](#)

## Future-ready ATSC 3.0 support

- ▶ [page 9](#)

## Rohde & Schwarz – the partner you can count on

- ▶ Quality transmitters since 1949
- ▶ Spare parts availability far beyond 10 years
- ▶ [page 10](#)

# MODEL OVERVIEW

R&S <sup>®</sup> TMV9evo VHF transmitter system			
Number of amplifiers	Output power (AVG) for digital TV and DAB+ standards in Doherty and normal operation <sup>1)</sup>	Dimensions (W × H × D)	Possible MultiTX configurations
	(DAB+, DVB-T2, DVB-T, ISDB-TB, DTMB, ATSC, ATSC 3.0)		
1	350 W	483 mm × 198 mm (4.5 HU) × 550 mm; 19 in × 7.8 in × 21.6 in	up to 4
1	750 W	483 mm × 198 mm (4.5 HU) × 550 mm; 19 in × 7.8 in × 21.6 in	up to 4
2	1.45 kW	600 mm × 2000 mm (42 HU) × 800 mm; 23.62 in × 78.74 in × 31.49 in	up to 3
3	2.2 kW		up to 2
4	2.9 kW		no MultiTX configuration
5	3.6 kW		
6	4.3 kW		

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

# MOST MATURE VHF-BAND III AMPLIFIER DESIGN

## Superior energy efficiency thanks to the R&S®PMV901 amplifier with enhanced Doherty technology

Focusing on the challenges faced by network operators has always been one of the driving principles behind transmitter development at Rohde&Schwarz. Customer satisfaction and the market success experienced with the R&S®TMV9 are proof of how well the platform satisfies this principle. One of the primary challenges for network operators is and will remain the reduction of operating costs. The R&S®TMV9evo incorporates all of the proven and valued strengths of the R&S®TMV9 platform, while taking key characteristics such as product lifetime and operational efficiency to the next level.

The introduction of the Rohde&Schwarz Doherty technology in the R&S®Tx9 transmitter generation has revolutionized the broadcast transmitter market. The R&S®TMV9evo sets the benchmark with an efficiency of up to 50%. It reduces energy costs by 30% and more compared with the average efficiency of the installed base in this power class.

Years of experience and continuous development have given Rohde&Schwarz complete mastery over the Doherty technology, which the company has been able to deploy to the greatest advantage.

The Rohde&Schwarz Doherty technology was first introduced in the R&S®Tx9 generation of transmitters in 2012. This amplifier technology has since become synonymous with energy cost savings for many network operators. Thousands of amplifier modules employing Rohde&Schwarz Doherty technology are now in use around the world. Each and every day, Rohde&Schwarz technology saves in excess of 1 000 000 kWh compared with conventional amplifier technology. This corresponds to the daily power consumption of a medium-sized European town.



The R&S®PMV901 amplifier (750 W) offers the highest efficiency and most mature thermal design in its class.

## Wideband amplifier architecture

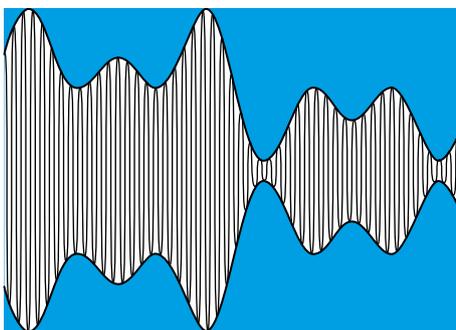
Thanks to the latest Rohde&Schwarz Doherty technology, the R&S®PMV901 amplifier can be operated over the entire frequency range of VHF band III without modifications. Optimizations for the various frequency bands are straightforward and easy. With the R&S®TMV9evo, network operators are optimally prepared for channel changes.

## Best energy efficiency even after channel changes

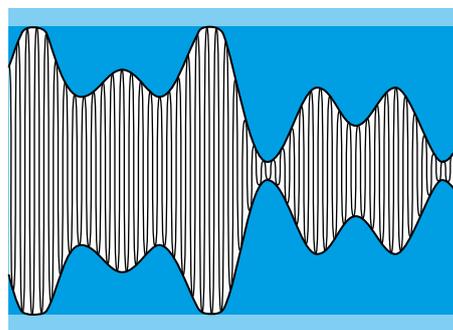
Normally, transmitters are not operated at their full nominal power. Conventional transmitters experience a significant reduction in efficiency at reduced power. This is where another intelligent R&S®TMV9evo technology comes into play. The R&S®TMV9evo transmitter family features power agile efficiency, i.e. transmitter efficiency remains optimal even at reduced power. This is made possible through complete control of the Doherty amplifier circuits, intelligent control of amplifier parameters, and highly advanced precorrection.

To allow network operators to use this potential to maximize energy economy, the R&S®TMV9evo offers a new feature: Rohde&Schwarz efficiency optimization. This intelligent algorithm, deployed either at the press of a button or adaptively, optimizes amplifier parameters to meet specific signal quality requirements. Whether changing channels or adjusting the transmitter output power, Rohde&Schwarz efficiency optimization ensures that the system delivers maximum efficiency at all times.

The R&S®TMV9evo also offers improved adaptive precorrection (ADE). This technology has consistently been optimized for Rohde&Schwarz Doherty amplifier characteristics, making it the most effective and fastest precorrection technology on the market. With these advanced R&S®Tx9evo technologies, network operators are optimally prepared for channel changes and output power adjustments.



**Without efficiency optimization**  
■ Unadjusted power amplifier parameters  
■ Low efficiency



**With efficiency optimization**  
■ Adaptively adjusted power amplifier parameters  
■ High efficiency

Reduced headroom

Adaptive efficiency optimization minimizes energy costs for all operating scenarios

# OPERATIONAL EFFICIENCY ON ANY LEVEL

## Stringent focus on long-lived transmitter design

Like all other R&S®Tx9 transmitters, the R&S®TMV9evo offers an excellent level of quality. Based on decades of transmitter design experience and built with high-quality components, it offers unmatched reliability and excellent signal quality. For example, the R&S®TCE901 exciter uses direct digital RF generation to deliver TV signals.

The R&S®TMV9evo is based on the R&S®TMU9 /R&S®TMV9 medium-power transmitters, which have been a market success since 2012. Thousands of R&S®TMx9 transmitters are in operation around the world. This exceptional success is a clear statement of how the R&S®TMx9 transmitter platform meets the needs of network operators, both in terms of minimal operating costs and maximum availability. Transmitter development at Rohde&Schwarz always focuses on the challenges faced by network operators. Key features such as the R&S Efficiency Optimization and built-in performance analysis capabilities were targeted for improvement in the R&S®TMV9evo, while all of the field-proven strengths of the R&S®TMx9 platform were maintained, including MultiTX and highly optimized, low-attenuation RF power components.

The broad base of installed R&S®TMx9 systems exhibits extremely low failure rates. Based on this established platform, the R&S®TMV9evo demonstrates the same level of proven reliability, keeping off-the-air time to a minimum.

## Continuous control of transmitter's key performance indicators

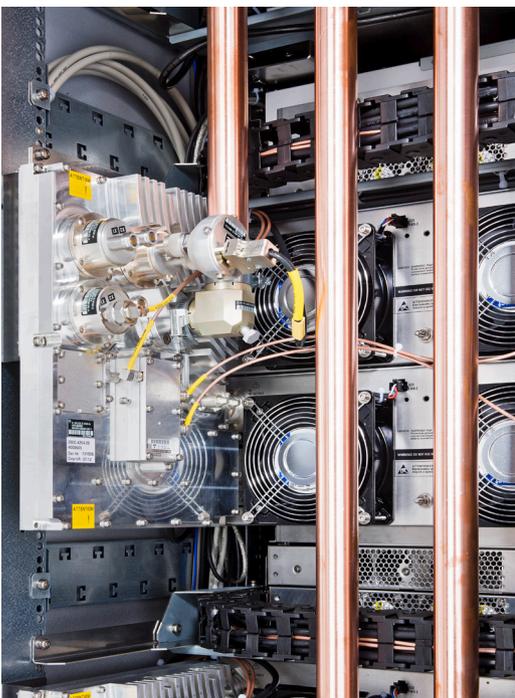
The R&S®TMV9evo is able to track its performance with built-in analysis capabilities such as efficiency measurement and integrated signal analysis. These features offer instant feedback about operational parameters through self-monitoring to ensure a consistently high quality of service combined with lowest operational costs.

The integrated signal analysis function continuously measures and outputs shoulder distance and MER values. Operators benefit from this feature because they have full control of the signal quality without having to invest in additional measuring equipment. Furthermore, the R&S®TMV9evo offers broadcast network operators maximum operational convenience. The straightforward definition of boundaries for operational parameters allows a superior level of automation and a significant reduction of infrastructure complexity. That characterizes a new level of simplicity and decreases maintenance costs.

## Innovative redundancy concepts at all levels

The R&S®TMV9evo comes with an optional, integrated exciter backup battery, a feature that is unique in this power class. The battery minimizes the negative effects of mains voltage interruptions. It powers the CPU and the signal processing components during voltage interruptions, ensuring that interruptions of up to 10 seconds do not result in a time-consuming reboot of the transmitter. The battery effectively reduces off-the-air time without requiring a full-featured uninterruptible power supply (UPS).

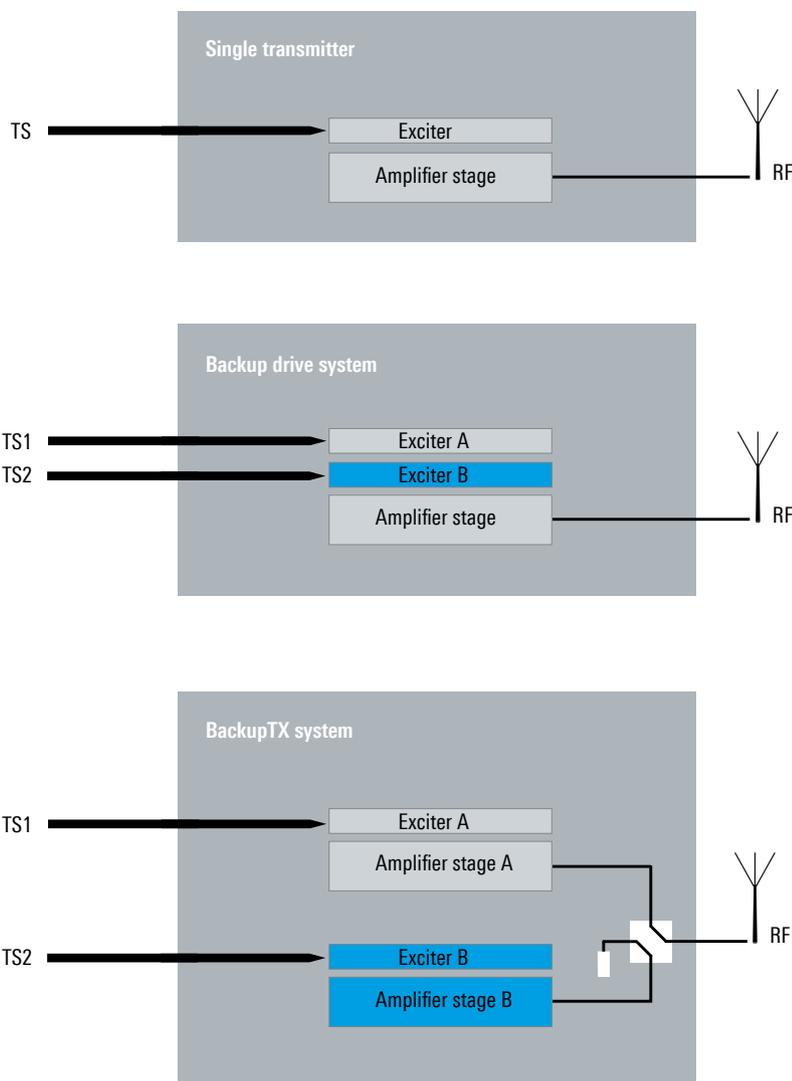
Optional power supply redundancy for the amplifiers also helps increase availability. If one of the power supplies fails, the other delivers the full current. This ensures interruption-free transmission even if a power supply or a phase in the feed network fails. Redundant power supplies are hot-pluggable and can be easily replaced during operation.



At the transmitter level, the R&S®TMV9evo uses the familiar backup drive redundancy concept from the R&S®TMV9 transmitter family comprising only two R&S®TCE901 exciters. It operates without a centralized monitoring unit since the passive exciter monitors the active exciter. The backup drive configuration offers the functionality and convenience of a classic exciter redundancy configuration and increases transmitter availability. At the system level, the R&S®TMV9evo offers an innovative redundancy configuration: BackupTX.

In a BackupTX system, two R&S®TMV9evo transmitters operate in a fully symmetrical 1+1 configuration. The two transmitters monitor each other, making extra hardware for system monitoring and control unnecessary. Doing away with a separate, governing control unit eliminates the risk of a single point of failure. The BackupTX configuration offers the functionality and convenience of a classic passive standby configuration and also increases the availability of transmitter functionality. BackupTX systems require considerably less space than conventional 1+1 systems.

R&S®TMV9evo redundancy configurations for maximum availability: The standby components (blue) additionally perform the functions of system monitoring and control.



# COMPACT DESIGN AND EASY OPERATION

## Compact, expandable exciter

The R&S®TMV9evo transmitter family comes with the new R&S®TCE901 exciter platform. The exciter offers an even higher level of integration than the previous R&S®TCE900 model. It integrates signal processing as well as transmitter and system control functionality. The R&S®TCE901 offers numerous functions and options that eliminate the need for equipment such as an integrated satellite receiver or integrated system components for N+1 configurations. This saves space and increases the system's availability.

The new R&S®TCE901 exciter platform supports the latest functionality implemented in the R&S®TMV9evo, such as adaptive efficiency optimization and performance analysis capabilities.

The R&S®TCE901 is multifunctional and extremely versatile. It supports DAB+ and DAB digital radio standard as well as DVB-T, DVB-T2, ISDB-T/ISDB-TB, DTMB and ATSC digital TV standards. Together with the R&S®SDE900, it provides a future-ready solution for ATSC 3.0. Multiple standards can be installed in a single exciter, allowing switchover between transmission standards (e.g. from DVB-T to DVB-T2) at the push of a button without any hardware modifications. The R&S®TCE901 is also well prepared to handle future transmission standards.

## Easy and efficient operation

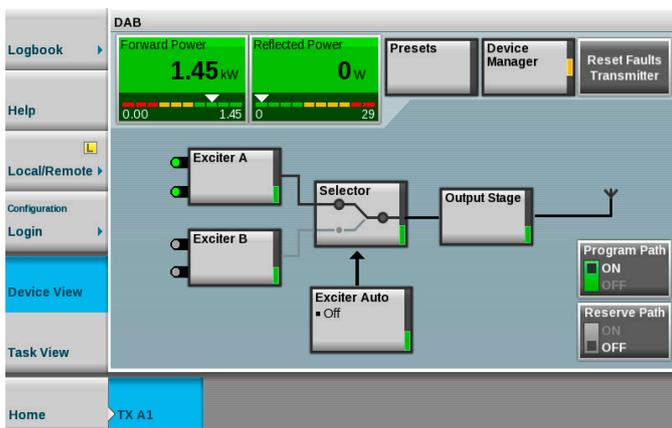
The R&S®TMV9evo graphical user interface (GUI) offers broadcast network operators the convenience they want and need when installing, commissioning and operating transmitters. The transmitter is simple to operate and intuitive to control since it always provides a clear picture of the current operational status. The home screen provides a complete status overview of the transmitter and its individual components. The optional R&S®TDU901 transmitter display unit allows fast, intuitive operation of the transmitter system via a 7" touchscreen. In addition, a web interface is available that makes it possible to operate the transmitter either locally or remotely, or to integrate it into a network management system via SNMP.

Whether via touchscreen or web interface, the user benefits from the same convenient GUI used throughout the R&S®Tx9evo transmitter generation. If multiple transmitter families from the R&S®Tx9evo generation are installed in a broadcast network, the well-designed and uniform GUI significantly reduces training effort for service personnel.

The task-based menu shows the different tasks that can be performed with the transmitter. The tasks and their individual steps are presented in a well-structured layout so they can be accomplished in a minimum of time. For example, when putting the transmitter into operation, the operator is guided through the configuration of the different devices and given help when entering parameters and changing settings.

The device-based menu provides a graphical view of the transmitter structure. The user simply touches a component to directly access its parameters.

The user simply touches a transmitter component to directly access its parameters.



# FUTURE-READY ATSC 3.0 SUPPORT

## R&S®SDE900 server-based exciter solution

The ATSC 3.0 broadcast standard was defined to give broadcast network operators a great degree of flexibility in their service offerings. It was designed to evolve together with broadcasters' future requirements. To optimally address network operators' future needs for flexibility, Rohde&Schwarz revolutionized how a broadcast standard is implemented. The R&S®SDE900 has a pure software-based approach that ideally prepares network operators for ATSC 3.0. Based on a high-performance IT server, it enables network operators to optimally leverage the full capabilities of the standard and flexibly respond to signal processing requirements of the future. The Rohde&Schwarz exciter solution fully supports ATSC 3.0 features such as multiple physical layer pipes (PLP), multiple subframes and SFN capabilities for optimal utilization of valuable spectrum. The R&S®SDE900 also supports ATSC 3.0 layered division multiplexing (LDM), helping network operators maximize coverage for different reception scenarios (e.g. fixed and mobile reception).

By design, broadcast standard evolutions can easily be accommodated. Operators benefit from a secure investment and can optimally capitalize on their valuable spectrum assets even in the broadcasting days after tomorrow.

The R&S®SDE900 is designed as a plug-in, rackmount module for the R&S®Tx9 generation of transmitters, making it an easy upgrade path to the ATSC 3.0 standard. The R&S®SDE900 software-based encoder generates the I/Q modulation data. The field-proven R&S®TCE901 exciter generates the COFDM waveform based on the I/Q data and applies the most powerful precorrection on the market with the high level of signal quality expected from Rohde&Schwarz.

### Server-based exciter solution



# ROHDE & SCHWARZ – THE PARTNER YOU CAN COUNT ON

## Quality transmitters since 1949 – decades of experience in transmitter design and production

Rohde&Schwarz has developed and produced quality transmitters for almost 70 years. During this time, the transmitters have been continuously enhanced with new and improved functionality.

The company stands for quality, precision and innovation in all fields of wireless communications. As an independent, family-owned company, Rohde&Schwarz finances its growth from its own funds. The company is not bound by short-term, quarterly results. It plans for the long term, which greatly benefits customers. Purchasing Rohde&Schwarz products is a safe investment for the future.

## Spare parts availability even 10 years after product discontinuation

Rohde&Schwarz ensures its customers spare parts availability for a period of 10 years from the time a product is discontinued. For new products such as the R&S®TMV9evo, this means ensured spare parts availability far beyond 10 years. Broadcast network operators can count on professional, expert support from Rohde&Schwarz during the entire service life of their transmitters.

Rohde&Schwarz transmitters offer safety of investment that is unparalleled on the broadcast market.



# SPECIFICATIONS

Specifications		
<b>Digital TV</b>		
Standards		DVB-T, DVB-T2, ISDB-T <sub>B</sub> , DTMB, ATSC, ATSC 3.0
Channel bandwidth	DVB-T	5/6/7/8 MHz
	DVB-T2	1.7/5/6/7/8 MHz
	ISDB-T/ISDB-T <sub>B</sub> , DTMB	6/8 MHz
	ATSC, ATSC 3.0	6 MHz
Inputs	DVB-T, DVB-T2, DTMB	2 × ASI (BNC, 75 Ω), 2 × TSoIP (Gigabit Ethernet)
	ISDB-T/ISDB-T <sub>B</sub>	2 × BTS (BNC, 75 Ω), 2 × TSoIP (Gigabit Ethernet)
	ATSC	2 × SMPTE 310M (BNC, 75 Ω) 2 × TSoIP (Gigabit Ethernet)
	ATSC 3.0	2 × STL or TSoIP (Gigabit Ethernet)
	DVB-S/S2 signal feed (optional)	2 × F (75 Ω)
<b>Digital audio broadcasting in the VHF range</b>		
Standards		DAB, DAB+
Channel bandwidth		1.5 MHz
Inputs		2 × ETI (BNC; 75 Ω/high impedance) 2 × EDI (Gigabit Ethernet)
<b>General data</b>		
Frequency range	VHF band III	170 MHz to 254 MHz
Supply voltage		230 V ± 15%, 2 wires + PE (L1/N/PE), 400 V/230 V ± 15%, 4 wires + PE (L1/L2/L3/N/PE), 208 V ± 15%, 3 wires + PE (L1/L2/L3/PE), 240 V -15%/+10%, 2 wires + PE (L1/L2/PE), 50 Hz to 60 Hz ± 5%
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
Immunity <sup>1)</sup>	to fast transients and bursts in line with IEC 61000-4-4	±2 kV (AC supply) ±1 kV (signal inputs)
	to surges in line with IEC 61000-4-5	symmetrical: ±1 kV (e.g. L-N), asymmetrical: ±2 kV (e.g. L-PE, N-PE)
<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
GPS/GLONASS receiver sensitivity	optional	-144 dBm to -5 dBm, SMA
Integrated OCXO		bridges reference signal interruptions for up to 24 h
<b>Operation</b>		
Status panel with buttons and LEDs		local operation
Transmitter display unit with touchscreen	optional	local display and operation
Ethernet interface, RJ-45		web interface: local, remote; network management interface via SNMP
Parallel remote interface	optional	floating contacts for messages and commands

<sup>1)</sup> More stringent requirements must be satisfied by implementing appropriate measures at the transmitter site.

To comply with the applicable standards and limit values for the suppression of out-of-band emissions and 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](http://www.sales.rohde-schwarz.com)

## Service that adds value

- ▶ Worldwide
- ▶ Local und personalized
- ▶ Customized and flexibel
- ▶ Uncompromising quality
- ▶ Long-term dependability

## Rohde & Schwarz

The Rohde & Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, monitoring and network testing. Founded more than 80 years ago, the independent company which is headquartered in Munich, Germany, has an extensive sales and service network with locations in more than 70 countries.

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

## Sustainable product design

- ▶ Environmental compatibility and eco-footprint
- ▶ Energy efficiency and low emissions
- ▶ Longevity and optimized total cost of ownership

Certified Quality Management

**ISO 9001**

Certified Environmental Management

**ISO 14001**

## Rohde & Schwarz training

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

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PD 3608.0356.12 | Version 01.00 | September 2019 (rf)  
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