R&S®TMV9evo AIR-COOLED VHF TRANSMITTER FAMILY

The best even better

Product Brochure
Version 04.00

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 latest transmitter generation stands for simplicity and endurance. DAB+ and DTV broadcasting has never been as straightforward and effortless as with the R&S®TMV9evo. Network operators benefit greatly from low operating costs throughout the product's lifecycle.

Front view of the R&S®TMV9evo

The air-cooled R&S®TMV9evo VHF medium-power transmitter delivers output power from 350 W to 4.3 kW for DAB+ and for digital TV standards (including ATSC 3.0). The R&S®TMV9evo is an ideal choice for network operators who demand both excellent quality of service and high operational efficiency.

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

Its long lifetime makes the R&S®TMV9evo a safe investment. The transmitter's effortless operation based on a superior level of automation creates less maintenance costs than any competitor's product.

Key facts

- Optimized in all aspects relating to operational cost
- Most mature VHF band III amplifier design
- Ensured quality of service
- Upgraded with the latest features from the proven R&S®Tx9evo platform
- Future-ready ATSC 3.0 support

BENEFITS AND KEY FEATURES

E5 – efficiency to the power of five

The R&S®Tx9 transmitter generation scores with efficiency at 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
▶ page 4

Operational efficiency in every aspect
▶ page 6

Compact design and easy operation
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Future-ready ATSC 3.0 support
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Rohde&Schwarz – the partner you can count on
▶ page 10

MODEL OVERVIEW

R&S®TMV9evo VHF transmitter family

Number of amplifiers	Output power (AVG) for digital TV and DAB+ standards [1] with Doherty and normal operation [2]	Rack included	Dimensions (W × H × D)	Possible MultiTX configurations
1	350 W	optional	483 mm × 198 mm (4.5 RU) × 550 mm; 19 in × 7.8 in × 21.6 in	up to 4 transmitters per rack
1	750 W	optional	483 mm × 198 mm (4.5 RU) × 550 mm; 19 in × 7.8 in × 21.6 in	up to 4 transmitters per rack
2	1.45 kW	optional	483 mm × 484 mm (11 RU) × 550 mm; 19 in × 19.25 in × 21.6 in	up to 3 transmitters per rack
3	2.2 kW	1 rack	600 mm × 2000 mm (42 RU) × 800 mm; 23.62 in × 78.74 in × 31.49 in	2 transmitters per rack
4	2.9 kW	1 rack	600 mm × 2000 mm (42 RU) × 800 mm; 23.62 in × 78.74 in × 31.49 in	no MultiTX configuration
5	3.6 kW	1 rack	600 mm × 2000 mm (42 RU) × 800 mm; 23.62 in × 78.74 in × 31.49 in	no MultiTX configuration
6	4.3 kW	1 rack	600 mm × 2000 mm (42 RU) × 800 mm; 23.62 in × 78.74 in × 31.49 in	no MultiTX configuration
10	6.95 kW	2 racks	1200 mm × 2300 mm (42 RU) × 800 mm; 47.24 in × 90.55 in × 31.49 in	no MultiTX configuration
12	8.3 kW	2 racks	1200 mm × 2300 mm (42 RU) × 800 mm; 47.24 in × 90.55 in × 31.49 in	no MultiTX configuration

[1] Supported standards: DAB+, DVB-T2, DVB-T, ISDB-T_B, DTMB, ATSC, ATSC 3.0.
[2] Before bandpass filter.

MOST MATURE VHF BAND III AMPLIFIER DESIGN

Superior efficiency thanks to 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 to the energy cost savings achieved on average by the installed transmitter base in this power class.

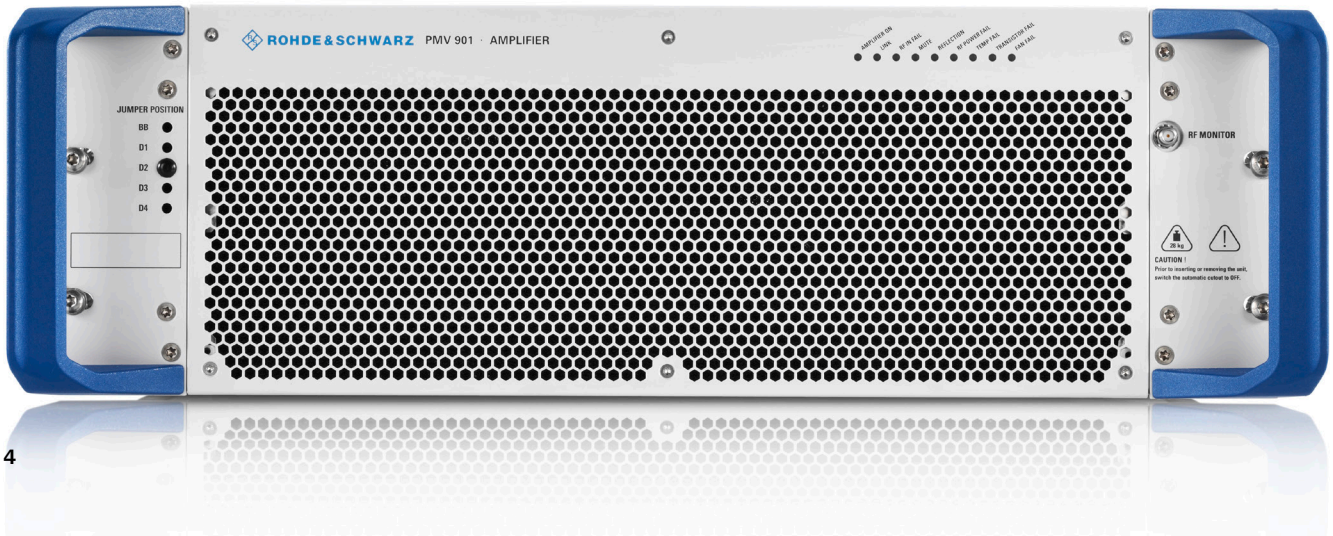
Years of experience and continuous development have given Rohde&Schwarz complete mastery over the Doherty technology, which the company has been able to deploy to the greatest advantage.

The Rohde&Schwarz Doherty technology was first introduced in the R&S®Tx9 transmitter generation 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 to conventional amplifier technology. This corresponds to the daily power consumption of a medium-sized European town.

Wideband amplifier design

Thanks to the latest Rohde&Schwarz Doherty technology, the R&S®PMV901 amplifier can be operated over the entire VHF band III frequency range without hardware modifications. Efficiency optimization for the various frequency bands is straightforward and easy. With the R&S®TMV9evo, network operators need not worry about channel changes.

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



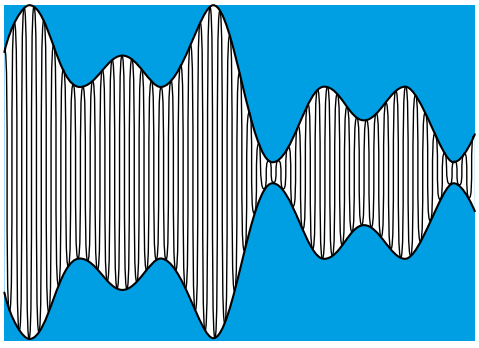
Optimum efficiency even after channel changes

Transmitters are normally 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.

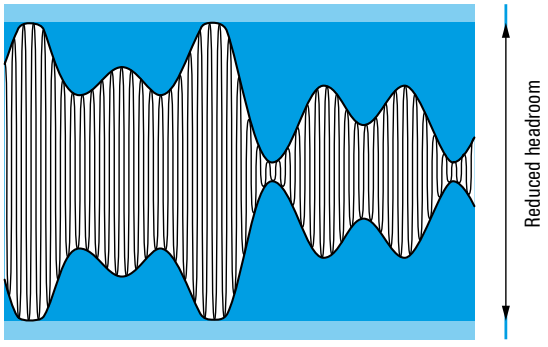
To allow network operators to exploit this technology to maximize energy economy, the R&S®TMV9evo offers the Rohde&Schwarz efficiency optimization feature. This intelligent algorithm, deployed either at the press of a button or adaptively, optimizes amplifier parameters while maintaining the required signal quality. 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 amplifiers, 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.

Adaptive efficiency optimization minimizes energy costs in all operating scenarios



Without efficiency optimization
- ► No adjustment of power amplifier parameters
- ► Low efficiency



With efficiency optimization
- ► Adaptively adjusted power amplifier parameters
- ► High efficiency

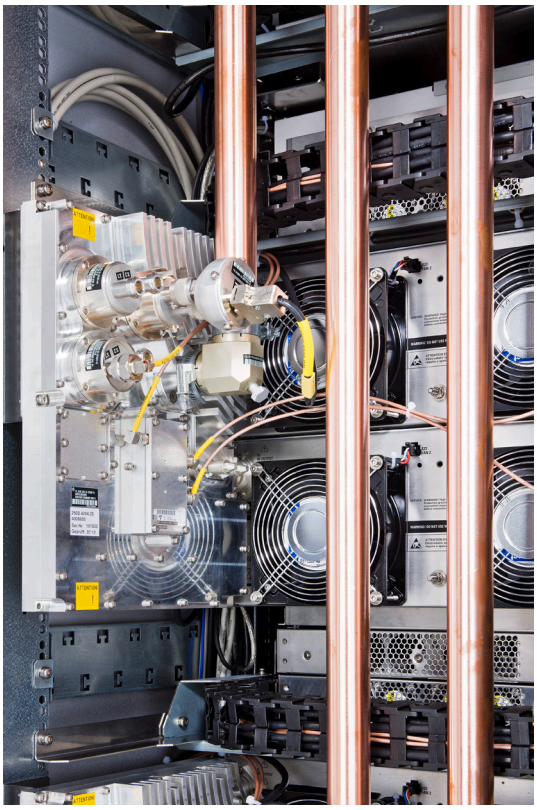
OPERATIONAL EFFICIENCY IN EVERY ASPECT

Consistent focus on long-lived transmitter design

Like all other R&S®Tx9 transmitters, the R&S®TMV9evo offers excellent quality. Based on decades of experience in transmitter design and built with high-quality components, it offers unmatched reliability and outstanding 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 transmitter platform, which has 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 family meets the needs of network operators, both in terms of minimal operating costs and maximum availability. Transmitter development at Rohde&Schwarz has always been focusing on the challenges faced by network operators. Key features such as the Rohde&Schwarz efficiency optimization and built-in performance analysis 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.

R&S®TMV9evo MultiTX configuration



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 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 provide 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 in infrastructure complexity. This means a new level of simplicity and a reduction in 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, preventing a reboot of the transmitter for interruptions of up to 10 seconds. The battery effectively reduces off-the-air time, offering an economic alternative to using an uninterruptible power supply (UPS).

Optional power supply redundancy for the amplifiers also helps increase availability. If one of the power supplies fails, the standby unit 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.

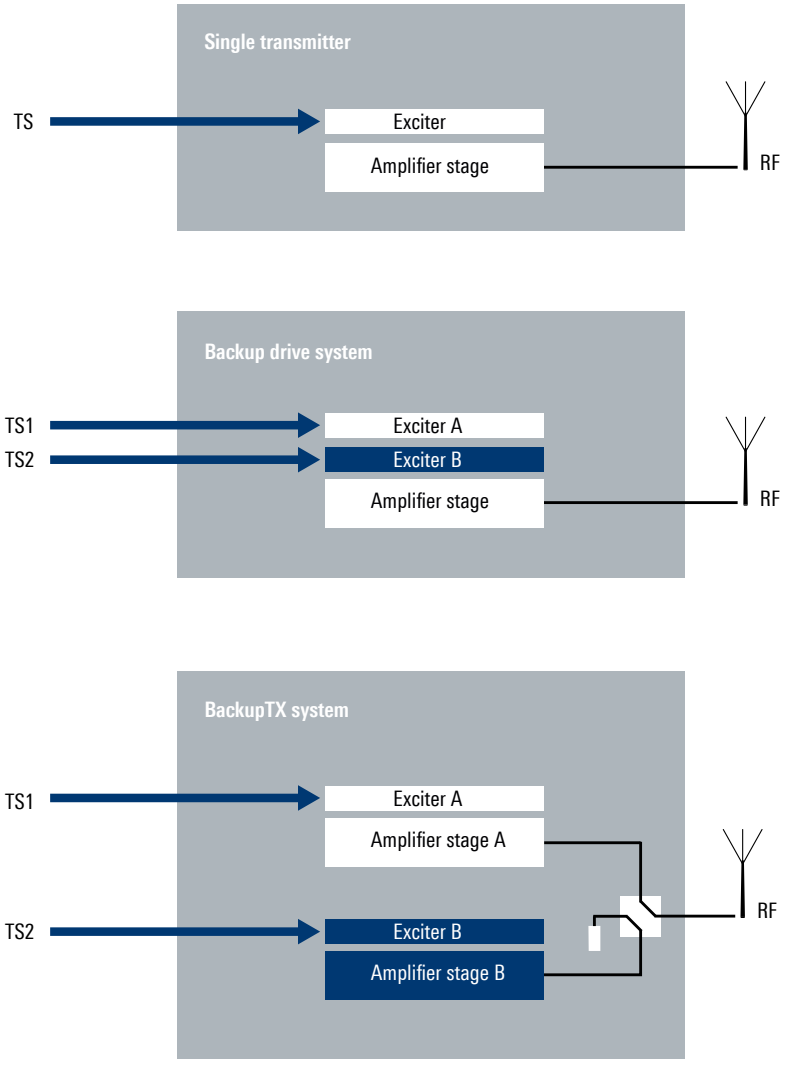
At the transmitter level, the R&S®TMV9evo uses the familiar backup drive redundancy concept deployed by the R&S®TMV9 transmitter family and comprising only two R&S®TCE901 exciters. The passive exciter monitors and controls the active exciter, making a centralized control unit superfluous. The backup 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 R&S®TCE901 exciter, which 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 system availability.

The R&S®TCE901 exciter 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 the DAB+ and DAB digital audio standards as well as the DVB-T, DVB-T2, ISDB-T/ISDB-T_B, DTMB and ATSC digital TV standards. Together with the R&S®SDE900 software based encoder, it provides a future-ready solution for ATSC 3.0. Multiple standards can be implemented 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.

MultiTX configurations

The MultiTX concept makes it possible to install up to four transmitters in a single rack.

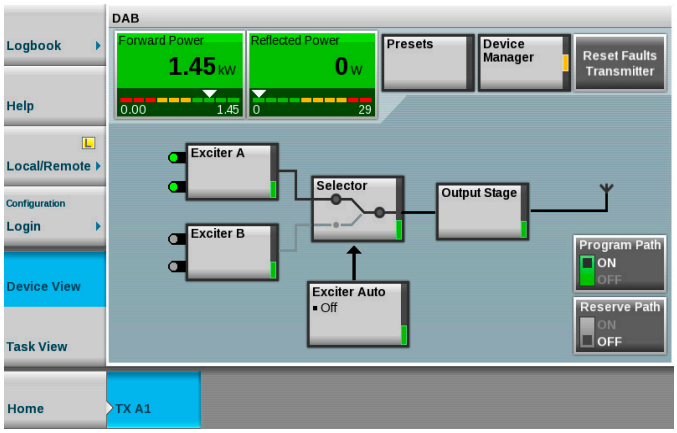
Easy and efficient operation

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 and intuitive to operate. The home screen provides a complete overview of the current operational status of the transmitter and its components. The optional R&S®TDU901 transmitter display unit allows fast and convenient 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, different transmitters from the R&S®Tx9evo generation are installed in a broadcast network, the well-designed, 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 that 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 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 high degree of flexibility in their service offerings. It was designed to evolve together with broadcasters' future requirements. To optimally address network operators' needs for flexibility, Rohde&Schwarz took a revolutionary approach to implementing this broadcast standard. The R&S®SDE900 is a purely software based solution – ideal for network operators to make optimal use of ATSC 3.0. Based on a high-performance IT server, it enables network operators to fully leverage the capabilities of the standard and flexibly respond to future signal processing requirements.

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 in different reception scenarios (e.g. fixed and mobile reception).

By design, the R&S®SDE900 can easily accommodate broadcast standard evolutions. Operators benefit from a safe investment and can optimally exploit their valuable spectrum assets since the Rohde&Schwarz solution allows flexible adaptation to broadcasters' future operational roadmaps.

The R&S®SDE900 is designed as a plug-in rackmount module for R&S®Tx9evo generation transmitters, allowing a smooth migration to the ATSC 3.0 standard. The R&S®SDE900 software based encoder delivers the I/Q data. The field-proven R&S®TCE901 exciter uses this data to generate the COFDM waveform and applies the most powerful precorrection on the market, delivering the excellent signal quality expected from Rohde&Schwarz.

Server based exciter solution

Real-time ATSC 3.0 software based encoder running on a high-performance server

COFDM waveform generation

ROHDE&SCHWARZ – THE PARTNER YOU CAN COUNT ON

Quality transmitters since 1949

Rohde&Schwarz has developed and produced quality transmitters for more than 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 the commitment to achieve short-term, quarterly results. It plans for the long term, which greatly benefits customers. Purchasing Rohde&Schwarz products is a safe investment.

10-year spare parts availability

Rohde&Schwarz ensures its customers spare parts availability for 10 years after product delivery. Broadcast network operators can count on professional, expert support from Rohde&Schwarz during the entire life of their transmitters.

Rohde&Schwarz transmitters offer investment protection unparalleled on the broadcast market.

SPECIFICATIONS

Specifications		
Digital TV		
Standards		DVB-T, DVB-T2, ISDB-T_B, DTMB, ATSC, ATSC 3.0
Channel bandwidth	DVB-T	5 MHz, 6 MHz, 7 MHz, 8 MHz
	DVB-T2	1.7 MHz, 5 MHz, 6 MHz, 7 MHz, 8 MHz
	ISDB-T/ISDB-T_B, DTMB	6 MHz, 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_B	2 × BTS (BNC, 75 Ω), 2 × TSoIP (Gigabit Ethernet)
	ATSC	2 × SMPTE 310M (BNC, 75 Ω)/2 × ASI (BNC, 75 Ω), 2 × TSoIP (Gigabit Ethernet)
	ATSC 3.0	2 × STL or TSoIP (Gigabit Ethernet)
	DVB-S/DVB-S2 signal feed (optional)	2 × F (75 Ω)
Digital audio broadcasting		
Standards		DAB, DAB+
Channel bandwidth		1.5 MHz
Inputs		2 × ETI (BNC, 75 Ω/high impedance) 2 × EDI (Gigabit Ethernet)
General data		
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 ± 10%, 3 wires + PE (L1/L2/L3/PE); 240 V ± 10%, 2 wires + PE (L1/L2/PE); 50 Hz to 60 Hz ± 5%
Maximum installation altitude		2000 m above sea level (> 2000 m on request)
Operating temperature range		+1 °C to +45 °C
Relative humidity		max. 95%, noncondensing
Synchronization		
Reference frequency		10 MHz, 0.1 V to 5 V (V_{pp}) 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
Product conformity		
EU legislation	for details, see user documentation	EU: in line with Data Act – Regulation (EU) 2023/2854
Immunity [1)]	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)
Operation		
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

[1)] To satisfy more stringent requirements, appropriate measures must be implemented 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 find the best solution for you.
Contact your local Rohde&Schwarz sales office for more information, www.sales.rohde-schwarz.com

Service at Rohde&Schwarz
You're in great hands

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

Rohde&Schwarz

The Rohde&Schwarz technology group is among the trailblazers when it comes to paving the way for a safer and connected world with its leading solutions in test&measurement, technology systems and networks&cybersecurity. Founded more than 90 years ago, the group is a reliable partner for industry and government customers around the globe. The independent company is headquartered in Munich, Germany and has an extensive sales and service network with locations in more than 70 countries.

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

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