

TV transmitters: the best even better

Thanks to their combined features, TV transmitters from Rohde & Schwarz already had a leading position worldwide, but now they have been improved even more.

Radical change in the broadcast industry

Terrestrial broadcast network operators are undergoing major changes since their main task of providing quality broadcast signals to as many households as possible is becoming increasingly demanding. Rising cost pressure, not least caused by competing transmission paths such as satellite, cable and IPTV, is forcing them to reduce costs and operate with minimal staff. In addition, conventional television is now competing with customized video offers from providers such as YouTube, Netflix and Amazon Prime for viewers and advertising revenue. These costs must be saved in other areas. For network operators this means finding the right balance between network reliability and signal quality expenses on the one hand, and reduced personnel and minimum operating costs on the other.

Successful in competition

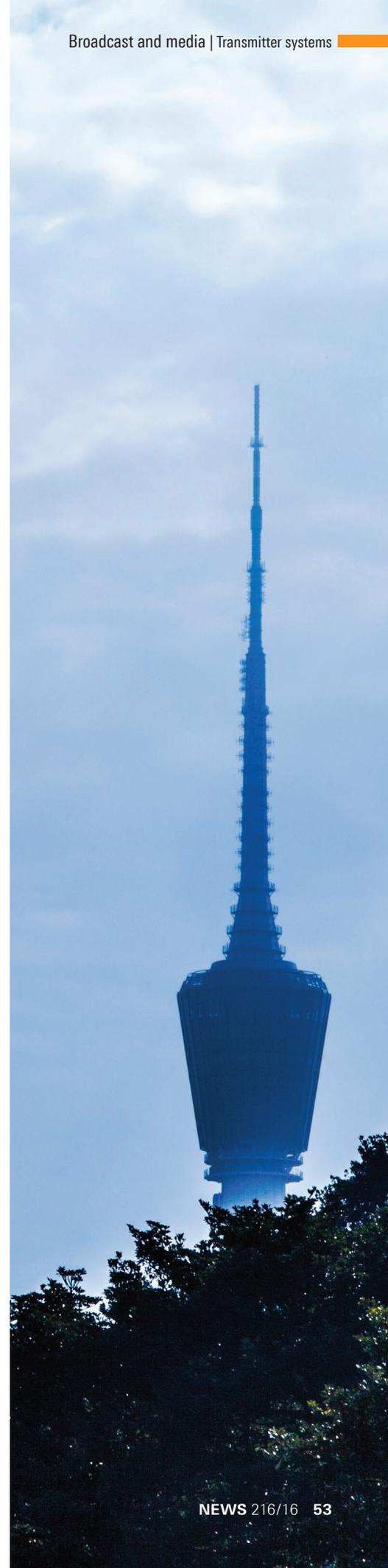
To succeed in this difficult market, network operators must use TV transmitters capable of exploiting the full cost savings potential. Rohde & Schwarz now offers such cost-effective transmitters since it was able to further improve on its already leading terrestrial TV transmitters. Thanks to numerous innovations, the new R&S®THU9evo, R&S®TMU9compact and R&S®TLU9 transmitters (Figs. 1 and 5) combine

outstanding signal quality with maximum availability and are easy to operate and maintain. Their high efficiency minimizes operating costs and their easy upgradeability, to accommodate new TV transmission standards for example, makes them future-ready. In addition, remote frequency changes at the push of a button are possible – without needing to make hardware modifications. This is what makes them the only terrestrial TV transmitters on the market to combine major operating efficiency and maximum flexibility.

Reduction of operating costs

Low energy costs

Energy costs are one of the biggest expenses for network operators. Therefore, savings in this area have the biggest impact. For this reason, Rohde & Schwarz introduced R&S®Multiband Doherty technology in the R&S®Tx9 transmitter generation in 2012. This highly efficient amplifier technology has become synonymous with energy cost savings for network operators worldwide. Today, thousands of amplifier modules employing R&S®Multiband Doherty technology are in use worldwide. Compared with conventional amplifier technology, they save more than 400,000 kWh of power every day – the daily consumption of a medium-sized European town.



The R&S®THU9evo, R&S®TMU9compact and R&S®TLU9 terrestrial TV transmitters are unrivaled in terms of energy efficiency and power density. They achieve energy efficiency of up to 40 % (COFDM) and 43 % (ATSC) in the UHF bands IV/V at the transmitter end, including the cooling system*. In addition, the transmitters also provide excellent efficiency values with outstanding performance and signal quality even with significantly reduced output power.

Low infrastructure costs

Apart from energy costs, infrastructure accounts for the majority of costs incurred during the lifecycle of a transmitter system. These costs are reduced thanks to the small footprint of Rohde&Schwarz transmitters which have the highest power density on the market for solid-state transmitters. The R&S®THU9evo, for example, generates output power of up to 17.4 kW (COFDM) and up to 19 kW (ATSC) from a single 19" rack. In comparison to the high power density of its predecessor, the R&S®THU9, this corresponds to a further 30 % improvement. The R&S®TMU9compact and R&S®TLU9 transmitters also reduce space requirements by at least 30 % in comparison to their predecessors.

Highly integrated components for signal generation and system control push the new transmitter's compactness to extremes. The new shared R&S®TCE901 exciter platform provides signal processing as well as transmitter and system control functionality at the same time. In addition, the exciter offers numerous functions and options such as a built-in satellite receiver or integrated system components for N+1 configurations, which make additional equipment unnecessary. This reduces space requirements for R&S®Tx9 systems by more than 50 % compared with conventional transmitters in this power class.

* Before the introduction of Doherty technology by Rohde&Schwarz in 2012, a maximum COFDM efficiency level of 25 % was the norm.

Fig. 1: Top – the R&S®TLU9 UHF low-power TV transmitter with output power levels from 5 W to 200 W. Bottom – the air-cooled R&S®TMU9compact UHF medium-power TV transmitter with output power levels from 400 W to 600 W in 3 HU or 6 HU, consisting of an R&S®TCE901 exciter and an R&S®PMU905 amplifier (400 W in this case).



Efficient service concept

Service intervals and maintenance significantly influence a transmitter network's operation. This is why the new transmitters were developed with long service intervals and easy maintenance in mind. Thanks to their modular design, most modules can be replaced directly on site which minimizes technical and logistical complexity during servicing (Fig. 2). Individual components can also be used across models in the entire R&S®Tx9 transmitter family, simplifying spare parts handling and cutting spare parts stocking expenses.

An absolute innovation is the ePaper display of the R&S®PMU905 amplifier, which displays the selected Doherty range even if the amplifier is without power – simplifying spare part inventory management because there is no need to switch on the amplifier or open its housing.

Maximum on-air time

The widely used R&S®Tx9 transmitter generation from 2011 featured extremely low failure rates. The new TV transmitters follow the same design principles, are partially based on their tried and tested components, and ensure reliability and high signal quality. The R&S®TCE901 exciter, for example, directly generates the digital TV signal using FPGA and TX-DAC, which dispenses with the need for the analog I/Q modulator and avoids its potential amount of errors.

Thanks to a new integrated monitoring feature for temperature and humidity, network operators are able to control their transmitters' operating conditions and maximize their lifetime – keeping downtime to a minimum.

In addition to maximum robustness, the new transmitters offer a unique feature that minimizes the negative effects of mains voltage interruptions. An integrated exciter backup battery powers the CPU and the signal processing

Fig. 2: Modules that are easy to replace on site speed up and simplify service and repair.



Redundancy configurations for maximum availability

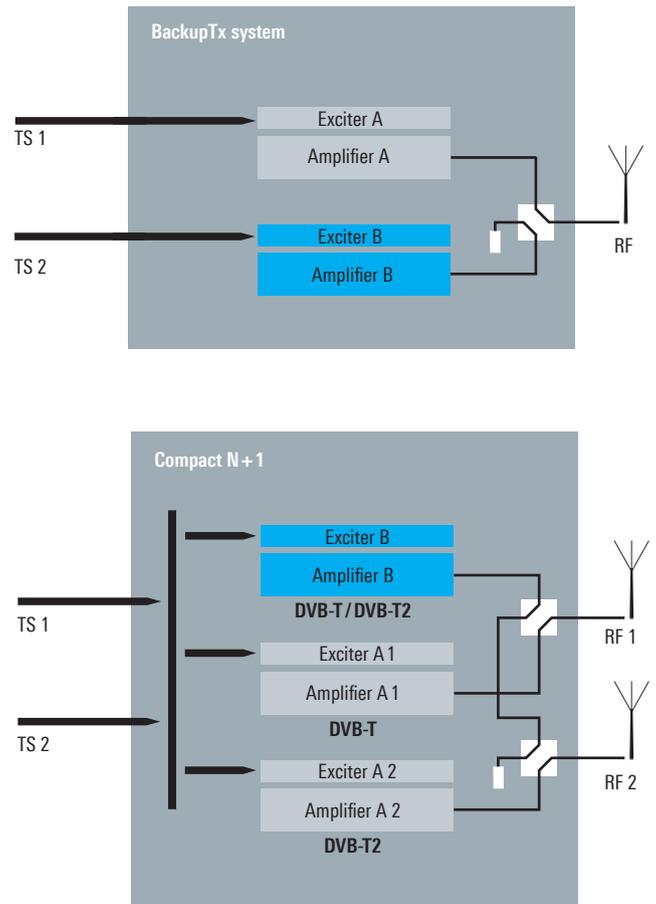


Fig. 3: Sophisticated redundancy concepts – the blue standby components simultaneously take over function of the system control.

components during voltage interruptions, ensuring that interruptions of up to 10 seconds do not result in a complete reboot of the transmitter. This reduces off-the-air time, without requiring a full-featured uninterruptible power supply (UPS).

With the Compact N+1 and BackupTx systems (Fig. 3), the transmitters offer sophisticated redundancy concepts

at system level. Compact N+1 is the enhanced version of the well-known N+1 configuration. In a BackupTx system, two R&S®TLU9 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.

Transmitter network operation – as simple as possible

The new terrestrial TV transmitters offer the same ease and convenience as the R&S®Tx9 transmitter family via a 7" touchscreen (Fig. 4) or web interface which reduces training effort for operating personnel if multiple transmitter families are used in the same network. The straightforward GUI displays the structure and system status at a glance



Fig. 4: The R&S®TLU9 low-power TV transmitter is easy to operate and configure via the touchscreen of the optional R&S®TDU901 transmitter display unit.

The new transmitters at a glance



R&S®THU9evo
Liquid-cooled UHF high-power TV transmitter with output power levels from 1 kW to 106 kW in one to six racks:

- ▀ Minimized operating costs for every application
- ▀ Low space requirements
- ▀ Highest output power in this class

R&S®TMU9compact
Air-cooled UHF medium-power TV transmitter with output power levels from 400 W to 600 W in 3 HU or 6 HU:

- ▀ 50 % lower operating costs than the predecessor model
- ▀ Smooth integration
- ▀ Minimum service costs
- ▀ Very high availability



R&S®TLU9
UHF low-power TV transmitter with output power levels from 5 W to 200 W in 1 HU or 2 HU:

- ▀ 25 % lower operating costs than the predecessor model
- ▀ Very high availability
- ▀ Future-ready design
- ▀ Minimum service costs



and offers network operators the convenience they want and need when installing, commissioning and operating transmitters. Touching the transmitter components on the touchscreen provides direct access to the related parameters.

Moreover, the R&S®THU9evo, R&S®TMU9compact and R&S®TLU9 transmitters offer intelligent technologies to optimize transmission. They feature power agile efficiency, i. e. transmitter efficiency remains optimal even at reduced power. Previously, this optimization required specialist know-how and could only be performed by Rohde&Schwarz transmitter production at the Teisnach plant.

The newly developed intelligent R&S®Efficiency Optimization feature ensures the potential to maximize energy economy under all transmitter operating conditions. It optimizes the parameters of the amplifier for maximum efficiency at the push of a button, whether changing channels, signal quality or the transmitter output power.

Challenge: digital dividend II

The release of the 700 MHz band for mobile radio (digital dividend II) requires TV transmitter network operators to switch parts of their networks to new frequencies. Usually, this should be achieved without procurement of new transmitters. Often, conversion must take place by a certain deadline, when all transmitters of a single-frequency network (SFN) along with subsequent RF components such as filters, combiners and antennas have to be switched over to a different frequency or replaced – a lot of work within a relatively short period of time. In such situations, strategies to minimize the effort to switchover are appreciated.

The R&S®Tx9 transmitters can be very easily adapted by a single switchover command in the GUI. The implementation of the intelligent R&S®Multiband Doherty technology allows Doherty configurations to be operated over the entire frequency range without modifications. Adjusting the Doherty frequency range at the amplifier is only required to achieve maximum efficiency. Thus, it can be planned as a subsequent measure with lower resource costs over a longer period of time. In addition, Doherty transmitters from Rohde&Schwarz are the only transmitters on the market to offer the highest efficiency over the entire frequency range. Even with a switch to the lower channels in the UHF band at system level, efficiency levels of 38 % or more can be achieved. No other competitor products on the market can offer this combination of maximum efficiency in all channels and simultaneous flexibility.

Summary

The new R&S®THU9evo, R&S®TMU9compact and R&S®TLU9 TV transmitters are uniquely compact and energy-efficient, which ensures minimized operating costs. Outstanding product quality and innovative redundancy concepts allow network operators to benefit from a high degree of availability. In addition, the transmitters can be easily integrated into existing infrastructures and are identical to operate thanks to their systemwide concept. Thus, the new transmitters are unique on the world market.

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Fig. 5: Liquid-cooled R&S®THU9evo UHF high-power TV transmitter with output power levels from 1 kW to 106 kW in one to six racks.