VHF FM Solid-State Transmitters SR600E1

Sound broadcasting at its very best

- Powerful FM transmitters of solid-state design with outstanding specifications
- Ultra-high reliability, e.g. through the use of microstrip technique in combiners and splitters
- Compact, clear modular design (all models in 19-inch rack)
- Ease of servicing thanks to modular design and reduced number of tuning elements
- High efficiency of at least 64% independent of output power
- High operating reliability thanks to tried-and-tested internal CAN bus
- Intelligent monitoring and fault detection system as well as remote control via BITBUS, modem or Internet
- Reduced stock of spares and high standardization level through the use of identical modules in all Rohde&Schwarz FM transmitters
- Solid-state broadband amplifiers with guard circuits and integrated harmonics filter
- Passive standby, (n+1) standby and exciter standby possible
- Operation up to SWR = 3
- Permissible AC supply voltage variation +15%/–20%

ROHDE&SCHWARZ

Characteristics

The Transmitters SR 610E1 for 10 kW, SR 605E1 for 5 kW and SR 602E1 for 2.5 kW belong to the fourth generation of fully solid-state Rohde & Schwarz VHF FM transmitters. The proven concept of the predecessor solid-state transmitter generation was developed further and substantially improved. The high-power FM transmitters in solid-state technique with output powers from 2 kW to 10 kW ensure broadcasting of sound programs in large areas. High reliability and the optimum price/performance ratio are distinguishing features of the transmitters. They emit AF, RDS (radio data system) and SCA (subsidiary channel authorization) signals such as DARC (data radio channel) in mono, stereo and composite mode.

The transmitters comprise the following modules:

- VHF FM Transmitter SU 135 (exciter)
- Power Amplifier VU 320
- Power combiners and splitters
- Power supply unit
- Fan set
- Transmitter rack

Internal communication takes place via a serial CAN (controller area network) bus. This bus has proved itself in harsh industrial environments and can easily be extended whenever required. The transmitters can be locally and remotely controlled.

Remote control can be implemented via:

- BITBUS
- Parallel interface
- Modem
- Internet

The transmitters can be configured to form the usual standby systems such as passive exciter standby, passive (1+1) and passive (n+1) transmitter standby.

The integrated forced-air cooling system ensures that the junction temperature of the output transistors does not exceed 120 °C to 130 °C. This is primarily for achieving a high MTBF.

The transmitters are in compliance with the requirements of the R&TTE Directive 1999/5/EC and the following standards:

- Safety: EN 60215
- EMC: ETS 300447
- RF requirements: ETS 300384

The transmitters also meet the:

- Standard specifications 5/1.0 parts 1 and 2, 5/1.1 and 5/3.1 of ARD and DTAG

Exciter

The synthesized Exciter SU 135 generates a frequency-modulated signal in the range 87.5 MHz to 108 MHz with a maximum output power of 20 W. AF, RDS or SCA signals are fed to the exciter as modulation signals. An additional module allows digital data in line with the bit-serial AES/EBU protocol to be processed instead of AF signals.

The transmitters are operated via menus, using the control and display elements on the exciter front panel. Settings such as transmit frequency, RF output power, operating and modulation modes, RF thresholds, module parameters, interfaces and system control can also be made in menus. Each of the six preset channels may be used to save the settings from the operating channel in non-volatile memory. For monitoring and control of the transmitters, various operating parameters of the VHF FM transmitter, such as air-pressure gradient, intake and

10 kW transmitter

outlet air temperatures or extensive absorber temperature, are registered and evaluated by the exciter. Measurement results and status (e.g. operating hours, system events) of the exciter as well as modulation data (e.g. frequency deviation, AF level), RF output power, reflected power and operating voltages of the VHF amplifiers are also evaluated and displayed. An error table supplements the monitoring functions. Should the control functions fail, the transmitter switches to a defined, risk-free state.

Amplifier

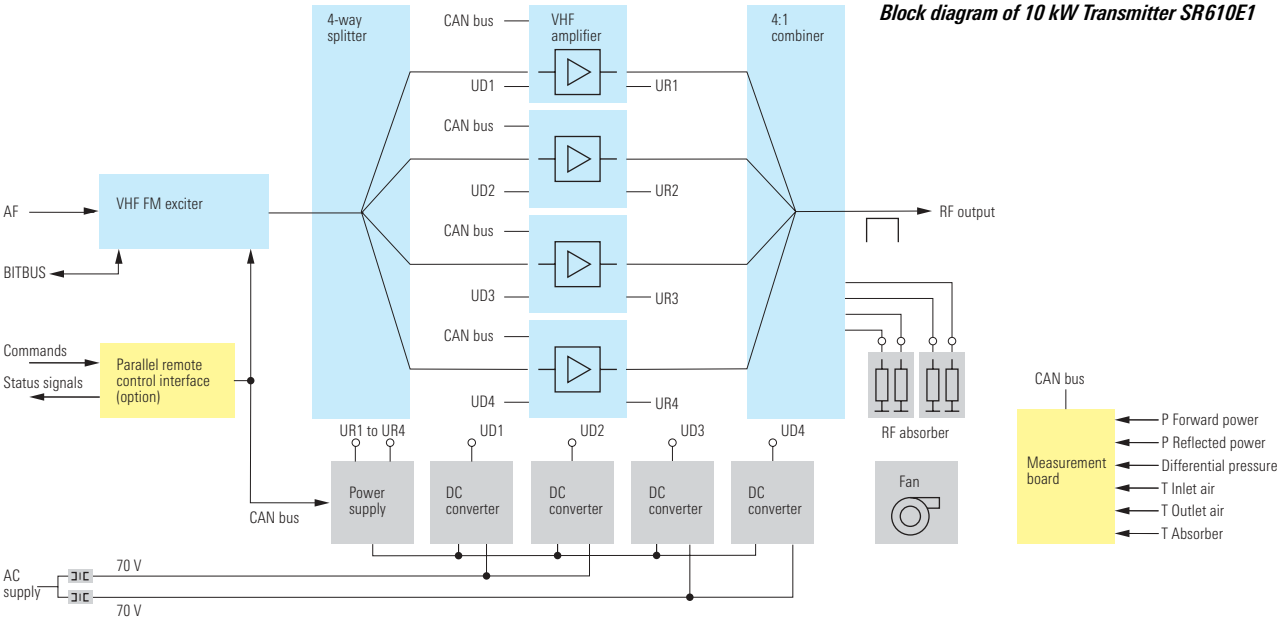
The 2.5 kW, 5 kW and 10 kW transmitters are provided with one, two or four Amplifiers VU320, where the signal is boosted to approx. 2.7 kW. The output amplifiers are of modular design, each consisting of nine identical 300 W basic modules and a 70 W preamplifier. The RF output power is set and regulated by varying the drain voltage of the output amplifiers. The harmonics filters in the amplifiers ensure an attenuation of harmonics of typically 76 dB. In the case of the Transmitter SR610E1 with 10 kW into 50 **Ω**, the 4:1 combiner sums the four input powers to a total power. All power combiners and splitters are in microstrip design and thus exhibit a low failure rate.

Power supply

The 2.5 kW and 5 kW transmitters use a single-stage power supply, i.e. a single transformer with rectifiers, while the 10 kW transmitter contains a dual-stage power supply consisting of two separate transformers with rectifiers. The 2.7 kW output amplifiers are each assigned a DC converter for generating the operating voltage required for the amplifiers. Since the output power is controlled via the operating voltage of the power transistors, an efficiency of at least 64% (without fan) is attained even in the event of a fault or operation below the rated power.

Transmitter rack

The 19-inch rack makes for economy of space, so the transmitters are particularly suitable for use in small-area transmitter stations. Air supply and RF connectors can optionally be fitted at the top or bottom of the rack. The transmitters are supplied with fans as standard. An external fan may be used provided the specifications are observed.



Block diagram of 10 kW Transmitter SR610E1

Specifications

Frequency			
Frequency range	87.5 MHz to 108 MHz		
Internal tuning	menu-controlled in 10 kHz steps		
External tuning	6 frequencies selectable		
Frequency drift	<500 Hz/year		
Center frequency offset at frequency deviation ±75 kHz	<5 Hz typ.		
Rated frequency deviation settable	±40 kHz, ±55 kHz, ±60 kHz or ±75 kHz		
Maximum frequency deviation	±125 kHz		
Class of emission	F3E		
Stereo emissions	to ITU-R Recommendation 450, paragraph 2 (pilot tone technique)		
RF output			
Nominal impedance	50 Ω		
Permissible SWR Rated power at	s ≤3 s ≤1.37		
Connector	1 5/8" EIA		
Spurious emissions (outside transmission bandwidth ±150 kHz)			
Harmonic suppression	≥70 dB, >76 dB typ.		
Out-of-band radiation (with modulation) 0.2 MHz from carrier 0.3 MHz from carrier	 <–110 dBc (1 Hz) <–126 dBc (1 Hz)		
Power of mixture products (without modulation)	<1 µW		
SSB noise density ≥2 MHz from carrier	 <–150 dBc (1 Hz)		
Transmission characteristics			
Mode	**mono**	**stereo**	**multiplex**
Signal input (loop-through connectors [LEMOSA] on front panel or XLR connectors on roof)	L	L and R	L (MPX)
Modulation frequency range	30 Hz to 15 kHz		30 Hz to 100 kHz
Input impedance	600 Ω or ≥2 kΩ, balanced/unbalanced, selectable with internal jumper		
AF input level for±40/75 kHz frequency deviation	–6 dBu to +15 dBu, settable by adjusting the deviation frequency		
Preemphasis (disconnectible, selectable with jumper)	50 µs/75 µs		–
Amplitude frequency response with reference to 400 (500) Hz 30 Hz to 15 kHz 30 Hz to 53 kHz 53 kHz to 75 kHz 75 kHz to 100 kHz	 ≤±0.25 dB – – –	 ≤±0.25 dB – – –	 – ≤±0.1 dB ≤±0.2 dB ≤±0.4 dB
Crosstalk between left and right channel of a stereo signal 100 Hz to 5 kHz <100 Hz, >5 kHz	 –	 ≥46 dB, 48 dB typ. rolloff of 6 dB/octave is permissible	 ≥46 dB[1)] rolloff of 6 dB/octave is permissible

Mode	mono	stereo	multiplex
Harmonic distortion (THD+N), harmonics up to 300 kHz	30 Hz to 15 kHz	30 Hz to 15 kHz	30 Hz to 75 kHz
at ±40 kHz frequency deviation	≤0.1%, 0.05% typ.	≤0.1%, 0.05% typ.	≤0.06%[1]
at ±75 kHz frequency deviation	≤0.1%, 0.05% typ.	≤0.1%, 0.05% typ.	≤0.1%[1]
at ±100 kHz frequency deviation	≤0.5%, 0.10% typ.	≤0.5%, 0.10% typ.	≤0.2%[1]
Intermodulation distortion	5 kHz to 15 kHz	5 kHz to 15 kHz	5 kHz to 53 kHz
at ±75 kHz frequency deviation	d2 to ≤0.1%	d2 to ≤0.1%	d2 to ≤0.05%[1]
	d3 to ≤0.1%	d3 to ≤0.1%	d3 to ≤0.05%[1]
S/N ratio, referred to f_{mod} = 500 Hz and ±75 kHz frequency deviation, quasi-peak measurement	**mono**	**stereo** (with stereocoder)	**stereo** (without stereocoder)
unweighted	≥72 dB	≥72 dB	≥72 dB[1]
weighted	≥72 dB	≥72 dB	≥72 dB[1]
S/N ratio, referred to f_{mod} = 500 Hz and ±40 kHz frequency deviation, quasi-peak measurement	**mono**	**stereo** (with stereocoder)	**stereo** (without stereocoder)
unweighted to DIN 54405	≥66 dB	≥66 dB	≥66 dB[2]
weighted to CCIR Rec. 468-2	≥66 dB	≥66 dB	≥66 dB[2]
Auxiliary frequencies			
Pilot tone frequency	19 kHz ±1 Hz		
Amplitude	–9.6 dBu ±2 dB		
Output XLR connector, X12 on roof	selectable with jumper, 5 V TTL squarewave signal, mark-to-space ratio 2:1 or MPX signal or 2 V (V_{pp} sinewave)		
Auxiliary carrier frequency	38 kHz ±2 Hz		
Additional signals			
RDS (radio data system) and SCA (subsidiary channel authorization) or SWIFT (DARC) system for wireless infotainment forwarding and teledistribution			
RDS input	RDS XLR (X12, 5-contact) roof-mounted		
SCA input	XLR (X13, 3-contact) roof-mounted		
SCA2, SCA3 input	BNC connector at rear of exciter >2 kΩ		
Frequency range	53 kHz to 100 kHz		
Input impedance	600 Ω or ≥2 kΩ, 7.6 kΩ typ., selectable with jumper		
Interfaces			
BITBUS	the BITBUS interface is described in the cited standards		
Parallel remote-control interface	for messages and commands		

1) To be specified when placing the order.
2) Depending on external coder used.

General data

AC supply voltage	230 V or 400 V, 3 x neutral[1)]
AC supply frequency	50 Hz or 60 Hz[1)]
Permissible voltage variation	+15%/–20%
Power consumption of fan	approx. 820 VA (type RD6)
Power ratio	>0.95
Cooling	air cooling by built-in or external fan
Maximum pressure gradient in cooling system	800 Pa
Rated temperature range	+1 °C to +45 °C
Operating temperature range	–10 °C to + 50 °C
Storage temperature range	–40 °C to + 70 °C
At heatsink temperature >100 °C	power reduction
Permissible air pressure	650 hPa to 1060 hPa
Maximum altitude	3000 m above sea level
Permissible relative humidity	≤95% at 26 °C
Permissible external electric field strength	≤10 V/m
Colour of front panel	telegrey, RAL 7047
Colour of rack panelling	telegrey, RAL 7047
Colour of rack frame	aluminium-anodized
Labelling	symbols, German/English
Dimensions (W x H x D)	580 mm x 2026 mm x 1000 mm

Model-specific data

	SR602E1	**SR605E1**	**SR610E1**
Rated output power	2.5 kW	5 kW	10 kW
Weight	300 kg	350 kg	550 kg
Power consumption without fan at SWR = 1	approx. 4.3 kVA	approx. 8.3 kVA	approx. 16.0 kVA
Rated air volume at 1000 hPa air pressure	7 m^3/min	10 m^3/min	16 m^3/min

[1)] To be specified when placing the order.

Ordering information

Designation	**Type**	**Order No.**
VHF FM Solid-State Transmitters	SR602E1	3528.2101.02
	SR605E1	3528.2053.02
	SR610E1	3528.2001.02

Certified Quality System
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