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R&S[®] NH/NV8600 UHF Transmitter Family

Liquid-cooled transmitters for analog and digital TV (DVB-T/-H, ATSC)

- ◆ Frequency range 470 MHz to 860 MHz
- ◆ Advanced LDMOS technology for power amplifiers
- ◆ Digital precorrection
- ◆ Liquid cooling system
- ◆ High redundancy
- ◆ Extremely compact design
- ◆ Cost-effective installation
- ◆ All standby concepts possible (single transmitter, active or passive output stage standby, exciter standby)



ROHDE & SCHWARZ

Introducing a new generation

The R&S® NH/NV8600 transmitter family represents a new generation of liquid-cooled UHF transmitters for analog and digital TV (DVB-T/-H, ATSC). The transmitters include the following main components:

- ◆ Exciter
- ◆ Power amplifier incl. power supply unit
- ◆ Transmitter rack

The UHF transmitters are available for analog TV with powers from 3.5 kW to 30 kW, for DVB-T/-H with powers from 1.3 kW to 11.8 kW, and for ATSC with powers from 1.8 kW to 16.5 kW (higher power ratings on request). Each amplifier has its own power supply unit that is integrated in the amplifier module and thus cooled by the liquid cooling system.

The amplifier power supply units are fed directly by the AC supply voltage, additionally increasing the availability of the transmitters. Parts exclusively made of stainless steel, aluminum, or plastic are used for the cooling system in the transmitter rack. The amplifier module is self-engaging and can be exchanged during operation, without liquid escaping from the closed cooling system and without impairing the operation of the other modules. A second exciter (standby) and an automatic switchover unit can be integrated into all transmitters.

Transmitter rack

The transmitters, which have an output power of up to 16 kW for analog TV combined and up to 6.1 kW for DVB-T/-H (8.5 kW for ATSC), are accommodated in a rack 600 mm wide. This means minimum space requirements, since components such as harmonics filters, power couplers, directional couplers, and lightning protection are also integrated in the transmitter rack. If more than eight amplifier modules are mounted in a transmitter rack, the bandpass filter for analog TV combined, DVB-T/-H, or ATSC is accommodated in a separate rack. For higher powers, only additional racks with the required amplifier plug-ins and couplers are needed. The connectors for modulation lines (VF, AF, or TS), for example, and the remote-control interface (messages and commands) are situated on the top of the transmitter rack. The connectors for the external cooling system can be at either the top or the bottom of the rack. To prevent different flow rates and the danger of clogging, a uniform line cross-section was used throughout the system.



Power amplifiers

Due to the use of advanced LDMOS technology, the power amplifiers offer high linearity, excellent efficiency, and a compact design. A power supply unit is integrated in each of the amplifier modules, which are self-contained units. Virtually no heat is given off to the rack, since all of the heat produced is dissipated via the liquid-cooled heat sink. Each amplifier module is thus self-monitoring and self-protecting. All relevant operating parameters and fault messages are transferred to the transmitter control unit via a CAN bus interface. The amplifier modules can be easily replaced during operation. Protective circuits against reflection, overtemperature, etc. are integrated; in normal operation at +25 °C ambient temperature, the junction temperature of the transistors is only approx. +128 °C. The increase in efficiency is due to the new circuit design with considerably lower thermal resistance (R_{th}), which results in higher output power.

R&S®Sx800 exciter

Using state-of-the-art technology, the new R&S®Sx800 multistandard exciter can be accommodated in a housing of only one height unit. It performs full signal processing from the video/audio input signal (analog TV) or the transport stream (digital TV) to the standard-compliant RF output signal. Its flexible concept helps to ensure high safety of investment.

The new R&S®Sx800 exciter contains the following main modules:

- ◆ Input interface
- ◆ Mainboard
- ◆ RF interface



R&S® VH8600A1 power amplifier

Input interface

For the analog TV standards, the input interface converts the analog video and audio input signals to digital signals for further processing. Optionally, the input interface encodes and modulates the NICAM sound subcarrier. NICAM signal processing supports the analog sound input, NICAM 728 data input, and NICAM sound subcarrier operating modes. The input interface also monitors the input sync pulse.

For the digital TV standards, the input interface is equipped with four ASI inputs (DVB-T/-H) or two SMPTE 310M and two ASI inputs (ATSC). This makes it a universal input stage – capable of handling all operating modes of the DVB-T/-H and ATSC standards.

The input interface monitors the packet synchronization and the data rate of the input signals. Input data buffers eliminate line-side jitter and wander effects. For operation in single-frequency networks (SFN), an MIP decoder in line with TS 101191 is included in the signal processing path. The decoder enables automatic delay compensation and automatic operating mode detection. Seamless, automatic input signal switching ensures redundant signal feed. The exciter can be converted from analog to digital at any time, involving only a minimum of effort.

Mainboard

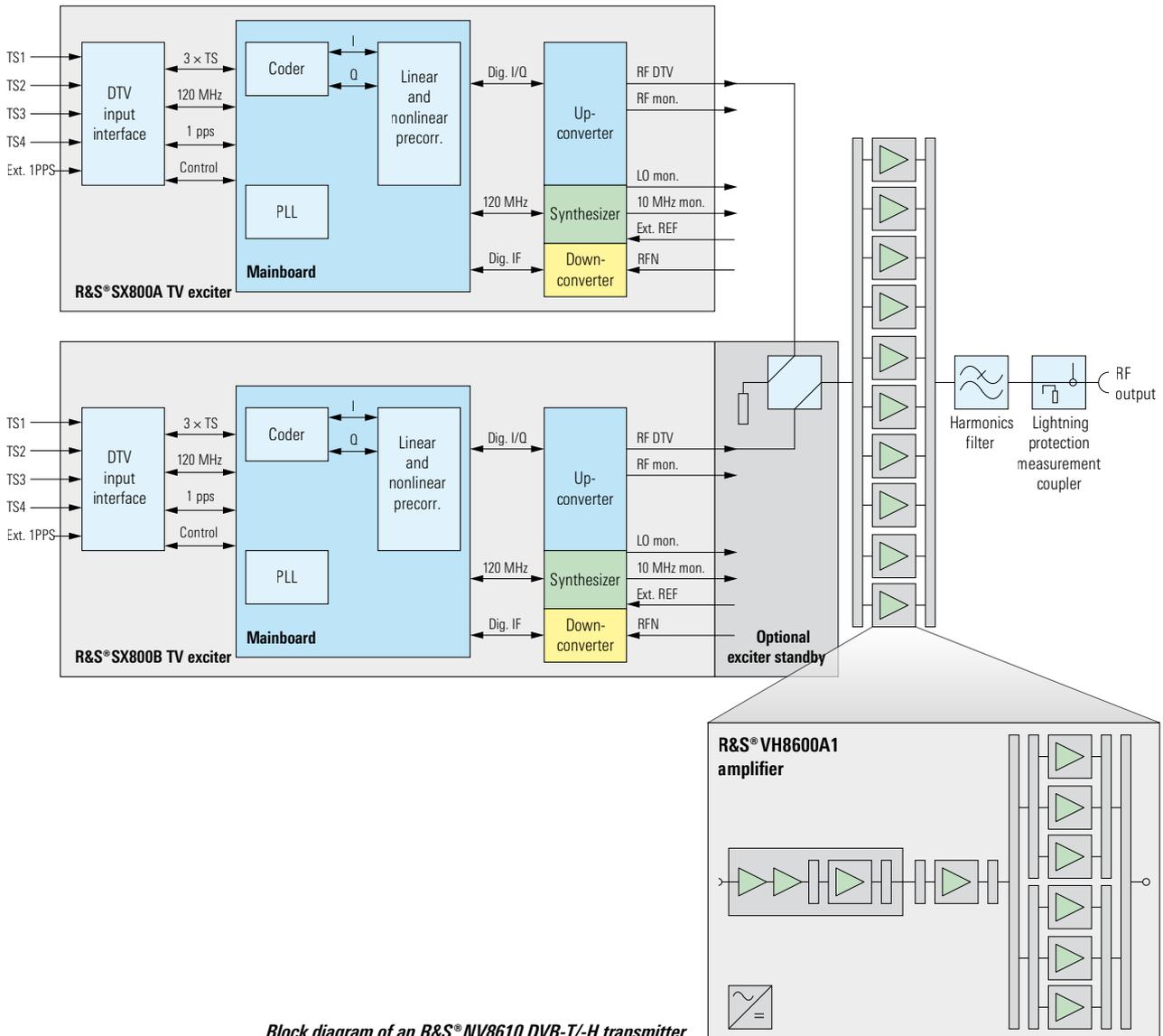
The mainboard digitally processes and modulates the signals from the input interface in line with the corresponding TV standard. This provides maximum stability and allows easy precorrection.

The signals are modulated by using the appropriate algorithm for analog or digital TV. The resulting digital in-phase and quadrature (I and Q) signals are taken to a precorrector. Linear precorrection compensates for group delay and frequency response, which occur in power filters in the RF path, for example. Nonlinear precorrection corrects distortion products generated in the amplifiers. The digital precorrection method implemented here ensures 100% reproducibility. For the digital standards, automatic/adaptive precorrection is available as an option.

RF interface

The RF interface first converts the digital I and Q signals to analog base-band signals. These signals are double-converted in a subsequent modulator section to yield the final modulated signal. A synthesizer supplies the frequencies required for upconversion. It can, of course, be locked to an external reference frequency. The high-quality reference oscillator ensures that the required frequency accuracy

for SFNs is maintained even if the external reference fails. The RF interface can optionally be equipped with a demodulator that processes the amplified and/or filtered RF signal so that it can be analyzed for automatic/adaptive precorrection. For this purpose, the exciter is equipped with two inputs that allow the signal to be tapped ahead of and after the power filter without external switches being required.



Block diagram of an R&S NV8610 DVB-T/H transmitter

Special characteristics of the R&S®Sx800 exciter

General

- ◆ Integrated digital linear and nonlinear precorrection
- ◆ Digital signal processing for analog and digital TV

Digital TV

- ◆ DVB-T/-H, ATSC
- ◆ All ASI modes
- ◆ SMPTE 310 M
- ◆ Suitable for single-frequency networks (SFN) and multifrequency networks (MFN)
- ◆ Hierarchical modulation (DVB-T/-H)
- ◆ Seamless input switching
- ◆ MIP monitoring
- ◆ Automatic/adaptive precorrection (optional)

Analog TV

- ◆ B/G, D/K, M/N, I standards
- ◆ PAL, SECAM, and NTSC
- ◆ FM mono, dual-sound/stereo IRT or, optionally, NICAM

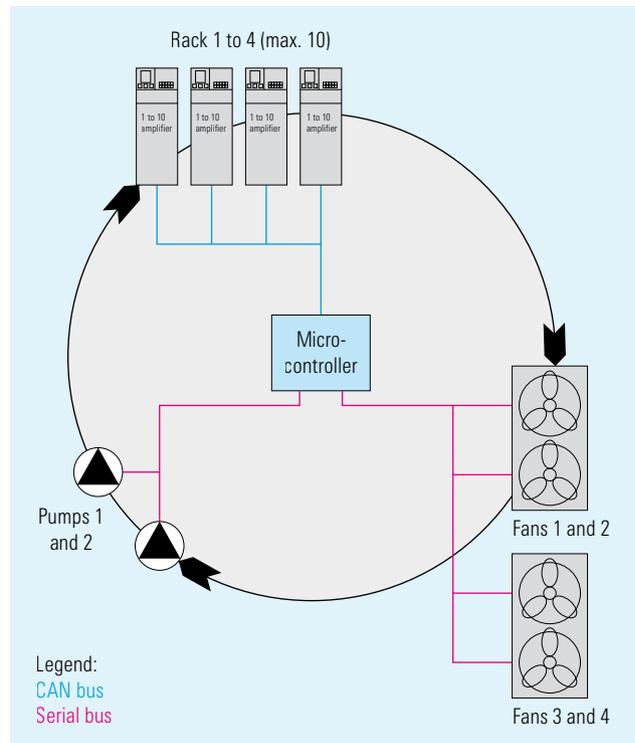
R&S®NetCCU®800 transmitter control unit

The innovative R&S®NetCCU®800 transmitter control unit handles both internal and external communications and provides all control functions. Featuring only two height units, it operates as a transmitter control unit plus an IP interface. The R&S®NetCCU®800 clearly shows the current status of the transmitter system on a color display. All transmitter and/or amplifier parameters required for diagnostics can be retrieved locally as well as remotely from anywhere in the world via a standard (IP) protocol and standard software (web/SNMP browser). This enables the status of unattended transmitter sites to be accurately evaluated, and any servicing that may be needed to be optimally prepared. This data can also be retrieved via the local IP interface of the R&S®NetCCU®800.

Cooling system

The standard cooling system (as an external unit outside the transmitter rack) consists of one pump unit per transmitter rack. The pump unit contains two series-connected pumps and a control unit ensuring full redundancy. A heat exchanger for each pump unit is installed outside the transmitter room. For redundancy reasons, the heat exchanger is fitted with two fans in active standby. AntifrogenN is used as the cooling agent. To save energy, the motor speed of the pumps and the fans on the heat exchanger is regulated by the control unit depending on the outside temperature.

Block diagram of the cooling system



Specifications

Common data for the R&S®NH/NV8600

Frequency range	470 MHz to 860 MHz
Power supply	3 × 400 V ±15 %, 47 Hz to 63 Hz
Max. installation altitude	2000 m above sea level (up to 3000 m on request)
Indoor temperature range	+1 °C to +45 °C
Outdoor temperature range	−30 °C to +50 °C
Permissible relative humidity	95 %, without condensation
Inputs	
Analog	2 × video (BNC, 75 Ω), 2 × audio (XLR, 3-contact)
DVB-T/-H	4 × ASI (in pairs, prepared for hierarchical modulation)
ATSC	2 × SMPTE 310 (BNC, 75 Ω)
Local and remote control	
Local control	
Color display and keys	front-panel operation via graphical user interface (GUI)
RJ-45	PC operation via standard web browser
Remote control	
RJ-45	IEC 864-2 via Ethernet, standard
RJ-45	network management interface (web server and/or SNMP agent), optional
Parallel interface	floating contacts for messages and commands, optional
BITBUS	bus interface in line with IEC 864-2, optional
Analog TV	
TV standards	B, G, D, K, M, N, I
Color transmission	PAL, NTSC, SECAM
Sound transmission	dual-sound coding in line with IRT or FM single sound and NICAM 728 (−13 dB/−20 dB) or FM single sound (−10 dB)
DVB-T/-H	coding and modulation in line with EN 300744/EN 302304
IFFT mode	2k and 8k, 4k for DVB-H on request
Useful symbol duration	224 μs (2k), 896 μs (8k), or 448 μs (4k)
Modulation	QPSK, 16QAM, or 64QAM
Guard interval	1/4, 1/8, 1/16, or 1/32 of useful symbol duration
Inner code rate	1/2, 2/3, 3/4, 5/6, or 7/8
Hierarchical coding	option on request
ATSC	in line with Doc. A53/1995
Modulation	8VSB
Symbol rate	10.76 MHz
Data rate	19.39 Mbit/s
Trellis coding	2/3
Reed-Solomon encoder	207/187/10

Specifications of the R&S®NH8600 (analog TV combined)

	R&S®NH8602	R&S®NH8603	R&S®NH8604	R&S®NH8606	R&S®NH8612	R&S®NH8620
RF output power ¹⁾	3.5 kW	5 kW	7.5 kW	10 kW	20 kW	30 kW
Number of vision/sound amplifiers	2	3	4	6	12	20
Cooling	liquid-cooled					
Dimensions (W × H × D)	600 mm × 2000 mm × 1100 mm (23.6 in × 78.7 in × 43.3 in)				1200 mm × 2000 mm × 1100 mm (47.2 in × 78.8 in × 43.3 in)	
RF connectors	EIA 1 5/8"			EIA 3 1/8"		EIA 4 1/2"
Reference frequency	10 MHz, 0.1 V to 5 V (V _{pp}) or TTL, BNC					
Bandwidth	6 MHz, 7 MHz, 8 MHz					

Specifications of the R&S®NV8600 (DVB-T/-H, ATSC)

R&S®	NV8602	NV8603	NV8604	NV8605	NV8606	NV8608	NV8610	NV8612	NV8616	NV8020
RF output power ²⁾ (DVB-T/-H)	1.3 kW	1.9 kW	2.6 kW	3.1 kW	3.7 kW	5 kW	6.1 kW	7.2 kW	9.7 kW	11.8 kW
RF output power ³⁾ (ATSC)	1.8 kW	2.7 kW	3.7 kW	4.4 kW	5.2 kW	7 kW	8.5 kW	10.1 kW	13.6 kW	16.5 kW
Number of amplifiers	2	3	4	5	6	8	10	12	16	20
Cooling	liquid-cooled									
Dimensions (W × H × D)	600 mm × 2000 mm × 1100 mm (23.6 in × 78.7 in × 43.3 in)						1200 mm × 2000 mm × 1100 mm (47.2 in × 78.8 in × 43.3 in)			
RF connectors	EIA 1 5/8"					EIA 3 1/8"				
Reference frequency	10 MHz, 0.1 V to 5 V (V _{pp}) or TTL, BNC									
Bandwidth	5 MHz, 6 MHz, 7 MHz, 8 MHz for DVB-T/-H; 6 MHz for ATSC									
Reference pulse	1 Hz, TTL, BNC									

¹⁾ Other power ratings on request.

²⁾ Average power specification: at <510 MHz approx. 10% lower power, at >662 MHz approx. 5% higher power.

³⁾ Average power specification: at <510 MHz approx. 5% lower power, at >662 MHz approx. 6% higher power.



More information at
www.rohde-schwarz.com
(search term: NH8600, NV8600)



www.rohde-schwarz.com

Europe: +49 1805 12 4242, customersupport@rohde-schwarz.com
USA and Canada: +1-888-837-8772, customer.support@rsa.rohde-schwarz.com
Asia: +65 65 130 488, customersupport.asia@rohde-schwarz.com