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DAB VHF Transmitter Family R&S[®] NA 7000

New generation of liquid-cooled DAB VHF transmitters

- ◆ Frequency range
174 MHz to 240 MHz
- ◆ MOSFET technology for
power amplifiers
- ◆ Digital precorrection
- ◆ Liquid cooling
- ◆ Redundancy of essential components
- ◆ Very compact design
- ◆ Cost-effective installation
- ◆ Exciter standby (option)

New generation of liquid-cooled DAB VHF transmitters

Fundamentals

The Transmitter Family R&S NA7000 developed by Rohde&Schwarz is a new generation of liquid-cooled DAB VHF transmitters for digital audio broadcasting (DAB Eureka Project 147). The transmitters consist of the following main components:

- ◆ Exciter
- ◆ Power amplifiers including power supply
- ◆ Transmitter rack
- ◆ Harmonics filter

The DAB VHF transmitters provide an output power range from 900 W to 3.6 kW (higher and lower power ratings on request). Each amplifier has its own power supply which is integrated into the amplifier module and therefore also liquid-cooled.

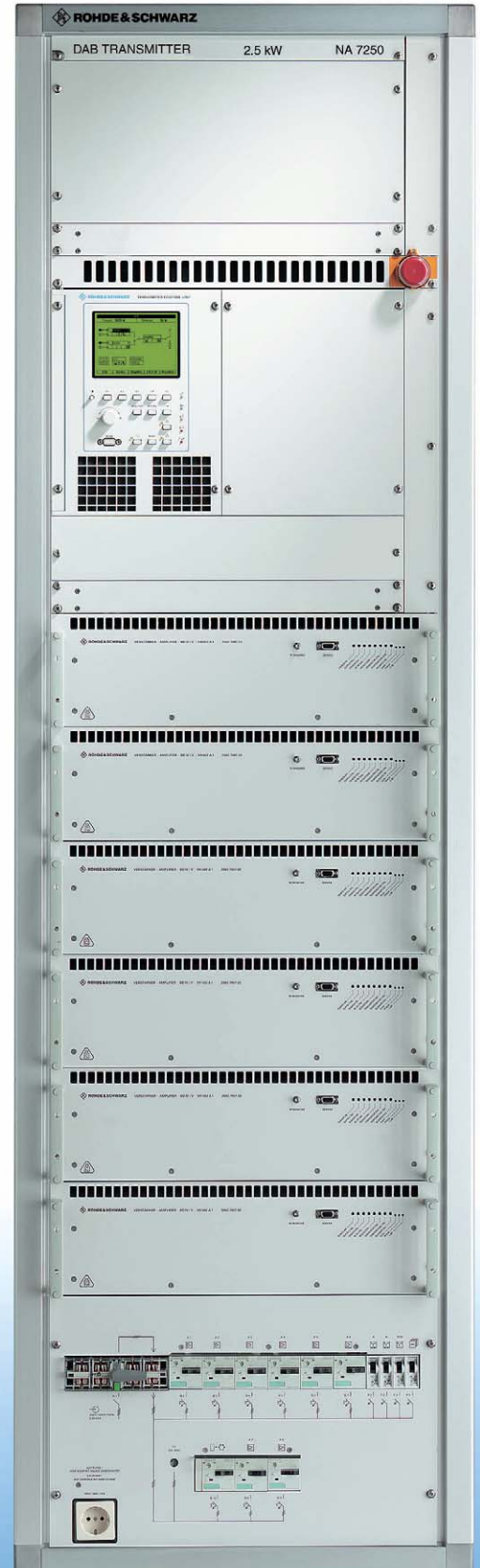
The amplifier modules are self-engaging and can be replaced during operation without losing any liquid from the closed cooling system and without impairing the functioning of the other modules. When an amplifier module is inserted into the rack, it is hooked up to the RF, control and cooling system lines by appropriate connecting elements. As the AC supply voltage is directly fed to the amplifier modules, additional auxiliary power supplies are not required. This enhances the availability of the transmitters.

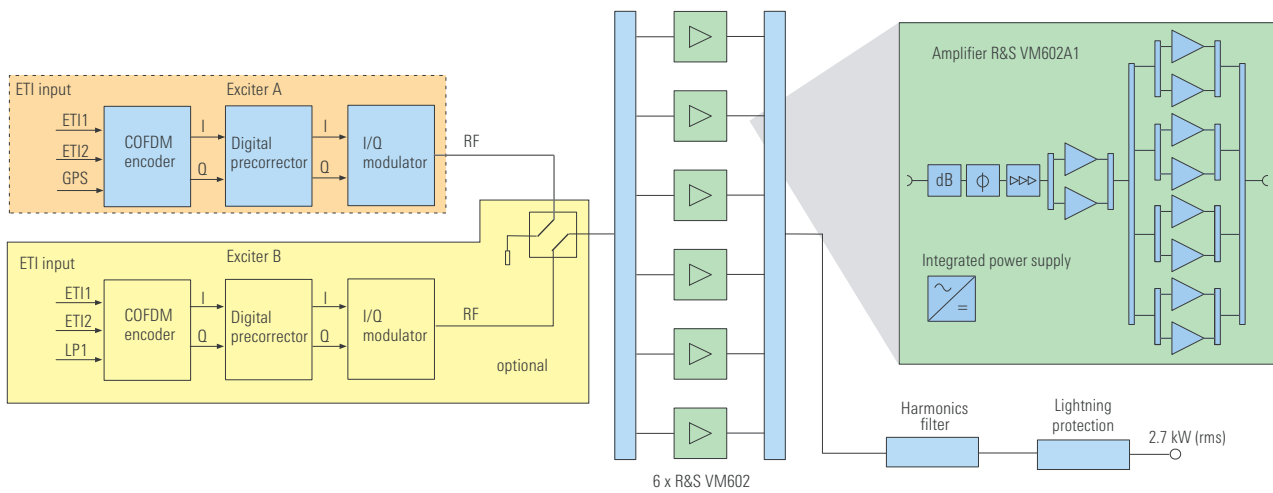
All transmitters can be equipped with a second exciter (exciter standby) and the associated automatic switchover unit. The DAB transmitters are designed according to the concept of the TV Transmitters R&S NM/NW 7000. This is very favourable in installation and maintenance when DAB and TV transmitters of this type are simultaneously operated at one location.

Transmitter rack

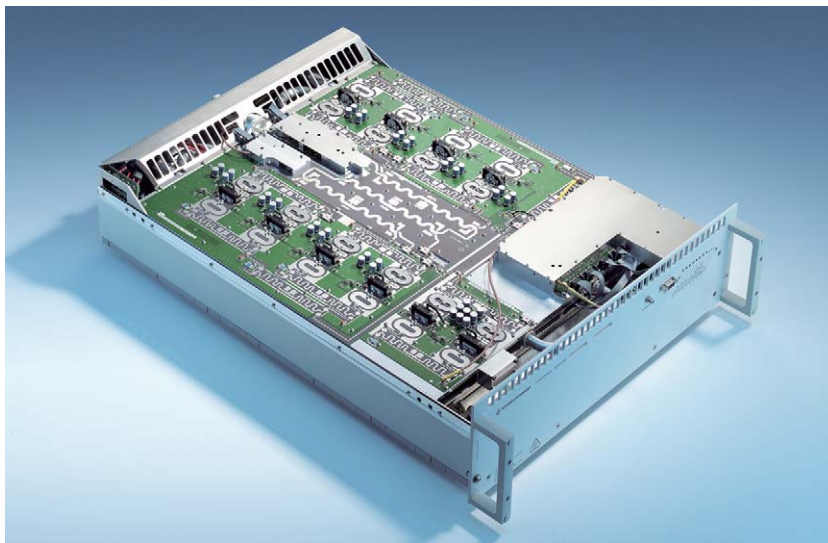
The transmitters are accommodated in a rack 630 mm wide, which means minimum space requirements. The connectors for modulation and reference signals (ETI, GPS) and the remote control interface are located on the top of the transmitter rack. The connectors for the cooling system can be located either on the top or at the bottom of the rack. The cooling system components inside the transmitter rack are exclusively made of stainless steel, aluminium or plastic. The uniform cross-section throughout the cooling system prevents different flow rates and consequently blocking.

An additional external output filter (on request, see specifications) is required to go on the air. This output filter is not integrated into the transmitter, but is located outside the transmitter rack.





Block diagram of 2.7 kW DVB-T transmitter



Power amplifiers

Owing to MOSFET technology, the power amplifiers feature high linearity, excellent efficiency and compact design. The power supply is integrated into the amplifier module, which is an enclosed unit. There is practically no heat dissipation in the rack, since a radial fan makes the air circulate inside the module. Residual

heat is conveyed to the cooling system via a heat exchanger.

The amplifiers also contain circuits for protection against reflection, excessive temperature and the like; under normal operating conditions the junction temperature of the transistors is only around +120°C at an ambient temperature of +25°C.

Exciter

Each exciter consists of the following modules:

- ◆ COFDM encoder for DAB
- ◆ RF conditioning and modulator
- ◆ Controller
- ◆ Central control unit
- ◆ Motherboard
- ◆ Power supply
- ◆ GPS module (option)

The very compact design of the modules makes it possible to accommodate two complete exciters, including the automatic switchover units, in a 19" frame of 7 height units. Each exciter has its own power supply, ensuring full redundancy. The fully digital precorrection can be reproduced 100%, and adjustments are not required if this module has to be replaced.

For replacing the exciter or its individual modules, the digital precorrection values can be output and saved externally. After replacement, the saved values are loaded to the exciter, which completely restores the precorrection facility without any adjustments being necessary.

Central control unit

The entire transmitter is controlled via an external PC software running under Windows or via a display integrated into the central control unit.

The central control unit, which is accommodated in the exciter rack, controls and monitors the entire transmitter. It enables the user to access the parameters of the entire system, and especially those of the built-in encoders, by means of the control panel. This also means that only one interface is required to remote-monitor all functional units of the transmitter.

Cooling system

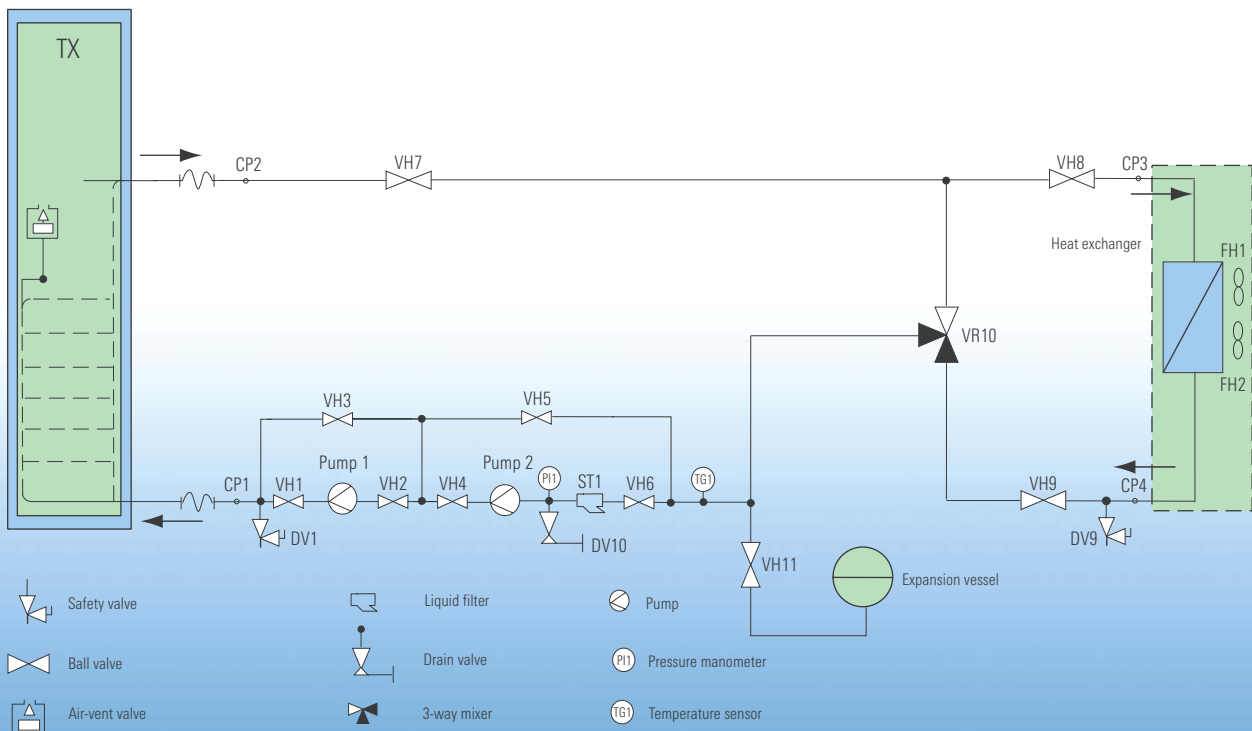
The liquid cooling system makes the transmitters immune to air pollution and significantly reduces the noise level. In comparison with air cooling, liquid cooling increases the transmitter output power per amplifier.

The standard cooling system (which comes as an external unit outside the transmitter rack) consists of one pump unit per transmitter rack. It comprises two series-connected pumps for full redundancy, a control unit and a mixer. A cooler for each pump unit is installed outside the transmitter room. For reasons of redundancy, the cooler is also equipped with two fans that operate in active standby. The cooling agent used is AntifrogenN.

More DAB products from Rohde & Schwarz

- ◆ DAB Transmitter Family R&S NA/NL6000 for medium output power
- ◆ DAB STI Ensemble Multiplexer R&SDM001
- ◆ DAB Test Transmitter R&S SDB601
- ◆ Digital Sound Broadcast Data Inserter R&S DSIP020
- ◆ DBC WebCarousel™ R&S DTVCAR
- ◆ DAB MOTCarousel R&S MOTCAR

Block diagram of cooling system



Specifications

Common data for R&S NA7000

Frequency range	174 MHz to 240 MHz
RF output	1 ⁵ / ₈ " EIA
Permissible SWR	<1.5
Power supply	3 × 400 V AC ±15%, 50/60 Hz ±2%
Fuse	max. 63 A
Ambient temperatur range (transmitter rack)	+1°C to 40°C
Ambient temperatur (cooler)	-30°C to +50°C
Permissible relative humidity	95% (at 26°C, no-condensing)
Max. installation altitude	2000 m above sea level (>2000 m on request)
Dimensions (W × H × D, 1 rack)	630 mm × 2167 mm × 1200 mm

Interfaces

2 × RS-232-C

configuration and operation via external computer with graphical user interface (GUI) on front-panel interface, remote control (on transmitter top) parallel interface (option, on transmitter top) with R&S Netlink (option) 1/2.048/5/10 MHz, 0.1 V to 5 V (V_{pp}) or TTL (BNC), 1 pps input, antenna connector for built-in GPS receiver (option) ETI signal, RF test point exciter, RF test point at each amplifier, RF test point at transmitter output before filter

RS-485/Bitbus Parallel

SNMP/HTTP

External frequency and clock reference

Test points

Transmission characteristics

DAB modes	I, II, III, IV
Modulation inputs	XLR, BNC, 75 Ω or 120 Ω, with impedance transformer >2 kΩ (BNC, option) for ETI(NI, G.703) and ETI(NA, G.704), automatic switchover
Correction	digital after IFFT and FIR filter
IF	without direct modulation
Frequency stability	better than 1 × 10 ⁻⁹ with GPS, after GPS failure better than 1 × 10 ⁻⁷ in 24 h
Frequency response in DAB block	<1 dB
Output spectrum	masks to EN 302 077-2 or EN 300 401 with additional output filter (on request)
Shoulder distance ±970 kHz before filter	corrected >35 dB
Static delay compensation	max. 1 s, in steps of 488 ns
Dynamic delay compensation	max. 1 s, in steps of 488 ns

Output filter

additionally required, external

Minimum requirements that must be met by an external output filter to comply with the permissible output spectrums

fc = Center frequency of DAB Block	Uncritical mask (attenuation)	Critical maske (attenuation)	Supercritical mask (attenuation)
fc ± 0.97 MHz	0	>8 dB	>8 dB
fc ± 1.75 MHz	>9 dB	>40 dB	>40 dB
fc ± 2.2 MHz	>18 dB	>38 dB	>58 dB
fc ± 3 MHz	>34 dB	>34 dB	>54 dB
fc ± 3 to 10 MHz	>56 dB	>56 dB	>56 dB
174 to 400 MHz, except fc ±10 MHz	>44 dB	>44 dB	>44 dB



Type-specific data

Type	R&S NA7090	R&S NA7140	R&S NA7180	R&S NA7230	R&S NA7270	R&S NA7360
Output power without filter ¹⁾	0.9 kW	1.4 kW	1.8 kW	2.3 kW	2.7 kW	3.6 kW
Number of amplifiers	2	3	4	5	6	8
Power consumption with pump rack and cooler (approx.)	6 kW	8 kW	10 kW	12 kW	14 kW	18 kW
Efficiency without output filter	15%	17,5%	18%	19%	19%	20%
Order numbers						
Single transmitter	3500.7009.04	3500.7109.04	3500.7209.04	3500.7309.04	3500.7409.04	3500.7509.04
Transmitter with exciter standby	3500.7009.24	3500.7109.24	3500.7209.24	3500.7309.24	3500.7409.24	3500.7509.24

¹⁾ Other power classes on request.



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