After the very positive response to the liquid-cooled, high-power transmitters of the NH/NV6000/7000 family [1] on the world market, Rohde & Schwarz now presents the compact, air-cooled Transmitter Family NH/NV7001 for medium power classes (FIG 1).

UHF Transmitter Family NH/NV7001

Medium-power transmitters for terrestrial digital and analog TV

Air-cooled, modular design

The transmitters of the NH/NV7001 family use the new Exciters SV/SH/SC700 for high-quality modulation of digital (DVB) or analog (ATV) TV signals. The Broadband Amplifiers VH650A2 with state-of-the-art LDMOS technology are used for amplification.

The NV7001 digital TV transmitters cover a power range from 200 W to 800 W (DVB-T) or from 250 W to 1 kW (ATSC). The transmitters of the NH7001 family provide 500 W to 2000 W of power for analog TV. The two transmitter families use identical components in the racks (FIG 2):

- One or two digital exciters (dual-drive option)
- Up to four broadband amplifier modules, each with an output power of 200 W for DVB-T or 500 W for ATV combined
- Up to four 2 kW switching power supply units
- Output filter (for ATV)

Exciters for digital and analog TV standards

The new Exciters SC/SH/SV700 used in analog and digital TV systems are notable for their compact design, flexibility and future-proofness. Optionally, two compact exciters can be accommodated in a 19" frame to implement modern redundancy concepts with considerably reduced space requirements.

They support the digital standards DVB-T (ETS300744) and ATSC (A54) as well as the analog standards B/G, D/K, M/N and I.

The TV exciters comprise an encoder, equalizer, modulator, synthesizer and a CCU for transmitter control. Due to their uniform structure and design they can be easily adapted to analog and digital TV standards. The exciters used for the various applications differ only in the encoder which processes the input signals and generates digital quadrature baseband signals in all cases. Subsequent signal processing is basically the same in all models and is carried out by a common hardware platform, which is optimally adapted to the individual applications. Thus, three types of TV exciters are available:

- SH700: used in analog high-power TV transmitter systems with separate video and audio amplification (split mode); NH7000 family
- SC700: used in analog TV transmitter systems with a common path for video and audio signals (combined mode); NH7001 medium-power transmitters
- SV700: for digital TV

Analog TV with SC700

The Exciters SC700 contain an encoder for analog TV signals. The video input signal is digitally processed irrespective of the selected TV standard. Signal processing including vestigial sideband filtering is therefore perfectly stable and not subject to aging. Switching to other TV standards is handled via software so that no exchange of hardware is required. The analog audio signals are also converted into digital signals.
and processed by a digital signal processor (DSP), e.g. dual-sound coding. One or two high-quality sound subcarriers are generated by subsequent digital frequency modulation. Various encoder modules are available for the different audio standards:

- The NICAM add-on module processes analog audio signals when acting as a coder modulator and processes a digital data stream when acting as a NICAM modulator.
- The BTSC add-on module with a bandwidth of 120 kHz for the N/M TV standards provides an audio input for routing the BTSC sound multiplex signal.

**Digital TV with SV700**

The Exciter SV 700 is used in digital TV systems. For DVB-T, data processing of the DVB encoder is in line with the DVB standard ETS300744. The encoder comprises an asynchronous serial interface (ASI) the data buffer and flexible clock processing of which enable the network operator to use standardized feed paths.

An automatic switchover unit supports the implementation of redundant feeder networks.

For use in single frequency networks (SFN), an SFN adapter integrated in the encoder accepts time reference pulses from an external or optionally integrated GPS receiver.

For ATSC/8VSB signals, the ATSC encoder operates according to the ATSC standard A54. Its input section also accepts ASI signals in addition to the commonly used SMPTE310 signals.

**Digital signal processing**

The digital baseband signals from the encoder are routed to the subsequent digital precorrector. The digital precorrector comprises a group-delay equalizer for correcting linear filter effects and a linearity equalizer for correcting nonlinearities of the power amplifiers. Both stages operate completely digitally so that the set signal parameters are maintained.

The baseband signals are subsequently converted into analog signals and mixed to the RF by direct modulation. The mixer frequency is supplied by a synthesizer which can be synchronized to external references or the optional internal GPS receiver.

**Operation from display or PC**

The transmitter is operated from the central control unit (CCU) via the menu-supported graphical display. All parameters can additionally be controlled from a PC via an RS-232-C interface. Furthermore, the exciter can also be remote-controlled and monitored via an RS-485 interface, a modem or TCP/IP/SNMP interface (option NetLink [2]).

**High-efficiency power amplifiers**

Due to the lateral diffused metal oxide silicon (LDMOS) power transistors featuring high gain and linearity, a high efficiency, compact design and a continuous broadband characteristic is achieved for the Power Amplifiers VH650A2 between 470 MHz and 862 MHz. A control system prevents the other modules from being overdriven if one amplifier fails, thus ensuring that all amplifiers remain at the same level and operating point. The amplifier plug-in (FIG 3) comprises guard circuits protecting it against reflection and overtemperature. The main components such as preamplifiers and output amplifiers with current sensors are installed on an extremely effective, patented heat sink. With this heat sink, the heat produced by the amplifiers can be effectively dissipated with relatively little air.

Transistor currents and various internal voltages can be measured via a service connector on the front panel. The output power is set with the aid of a reference voltage generated by the CCU.
“On air” also during power failure

Every amplifier is provided with a 2 kW switching power supply. This redundant unit ensures continuous transmission even if a power supply unit or an amplifier fails. A special feature of each switching power supply is that it consists of two separate 1 kW power supplies, which together feed the preamplifier and separately feed each half of the output amplifier. If a 1 kW power supply fails, the respective amplifier plug-in continues to operate with a quarter of its output power. Switching power supplies are primary-switched, short-circuit-proof, 3-phase regulators with internal cooling. Power supplies and amplifiers can be replaced during transmitter operation without causing a program failure.

Flexible cooling

The cooling air for the transmitter can be taken in at the bottom or the top of the 19" standard rack, or air can be taken from the room at the rear of the rack. In the latter case, the rear panel acts as an air filter. The outgoing air is expelled at the top.

Two fans with long life are installed in the rack for cooling the amplifiers by two parallel air streams. A fan can therefore be replaced during operation without leading to a program failure.

The required output filter can be accommodated in the upper half of the rack where the output directional coupler and an optional relay remote-control interface are also installed.

Condensed data of NV/NH7001

<table>
<thead>
<tr>
<th>Frequency range</th>
<th>470 MHz to 862 MHz</th>
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<tbody>
<tr>
<td>RF output power</td>
<td>200 W to 800 W (DVB-T)</td>
</tr>
<tr>
<td></td>
<td>250 W to 1 kW (ATSC)</td>
</tr>
<tr>
<td></td>
<td>500 W to 2 kW (analog TV)</td>
</tr>
<tr>
<td>TV standards</td>
<td>digital: DVB-T ETS 300 744, ATSC/8VSB A 54</td>
</tr>
<tr>
<td></td>
<td>analog: B/G, D/K, M/N, I</td>
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<tr>
<td>Colour transmission</td>
<td>PAL, SECAM, NTSC</td>
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<tr>
<td>Sound transmission</td>
<td>dual-sound coding to IRT or</td>
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<tr>
<td></td>
<td>FM single sound and NICAM 728 (–13 dB /–20 dB) or</td>
</tr>
<tr>
<td></td>
<td>FM single sound (–10 dB) or</td>
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<tr>
<td></td>
<td>BTSC multiplex signal (–10 dB)</td>
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<td>Interfaces</td>
<td>RS-232-C, RS-485, modem, TCP/IP/SNMP (NetLink)</td>
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<tr>
<td>Transmitter dimensions (W x H x D)</td>
<td>570 mm x 2004 mm x 800 mm</td>
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</tbody>
</table>

More information and data sheet at www.rohde-schwarz.com (search for NV7001)

REFERENCES