DAB Transmitters NA6... and NL6...

Digital audio broadcasting – reliable and economical

Following numerous international DAB pilot projects, the actual introduction of digital audio broadcasting is now beginning. This means that existing transmitter networks will be expanded to provide full coverage. Rohde & Schwarz has developed new DAB transmitters for both VHF band III and L band that meet not only present but also future requirements and offer high transmission quality and profitability.

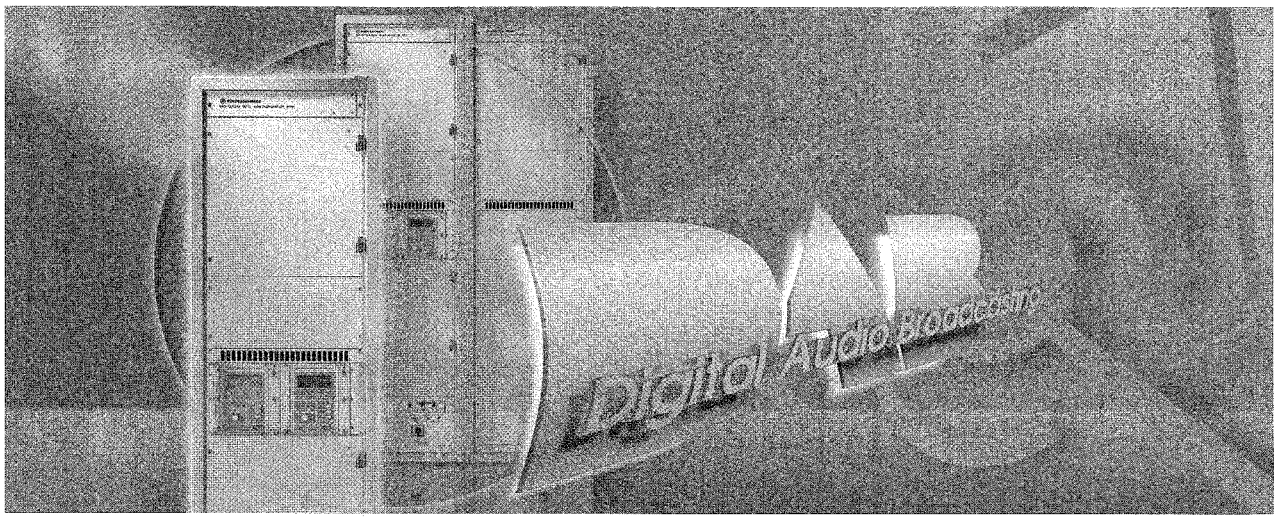

FIG 1 DAB Transmitters NA6... (band III) for 125 W to 2 kW are accommodated in 19-inch racks of 2 m height. Photo 43 070

The new DAB transmitters (FIG 1) are of modular design (FIG 2) and made up of the following **components:**

- DAB exciter,
- power amplifier,
- power supply,
- transmitter rack.

Band III transmitters are available with output power of 50 W to 2000 W (NA6... series), L band transmitters with output power of 50 W to 750 W (NL6... series). The entire DAB transmitter is controlled from a PC by means of software running under Windows or via a display on the exciter.

The **DAB exciter** with integrated COFDM modulator is able to process ETI (ensemble transport interface) input signals of the type ETI(NI, G703) and ETI(NA, G704) to ETS 300799. The output generated is a DAB signal to ETS 300401 at the RF (FIG 3). For monitoring purposes either the selected input signal can be output or the ETI(NI) signal after NA decoding and delay compensation. A FIFO in the input stage buffers input signal timing fluctuations with respect to the reference clock.

The subsequent NA/NI converter automatically detects whether an ETI(NI) or ETI(NA) signal is applied. An ETI(NA) signal requires deinterleaving and Reed-Solomon decoding. The time stamps contained in the signal are evaluated and used to control dynamic delay compensation (up to 1 s). The data stream can additionally be delayed by up to 750 ms by a static delay section. The ETI signal transports data channels, which may be used for configuration (TII, static delay, etc) of the transmitter network, in both the NA layer (NASC: NA signalling channel) and NI layer (MNSC: multiplex network signalling channel). These data are

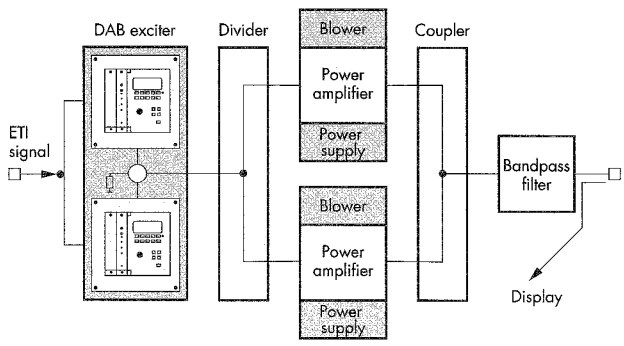

FIG 2 Layout of 500 W DAB transmitter (250 W redundant)

extracted from the data stream and taken to the controller for evaluation. The NA/NI converter then applies the delayed data stream to the next functional unit: the first DSP. This DSP analyzes the incoming signal, obtaining configuration information and detecting dynamic reconfigurations. If the error rate is too high in the checksums for control data and information, the modulator output signal is switched off. Then follow convolutional coding and time interleaving. For test purposes a PRBS (pseudo-random binary sequence) can be inserted in a subchannel.

The second DSP generates the transmission frame according to the DAB mode selected as well as the DAB time signal. It also produces the desired TII pattern in the null symbol and adds a guard interval to the computed DAB symbols. The subsequent FIR filters limit the spectrum and increase the sampling rate from 2.048 MHz to 32.768 MHz. The digital precorrector is able to correct the current amplitude and phase of the signal and to influence the frequency response. The time signal can thus be tuned optimally to the power amplifier characteristic. The signal is then converted to band III frequency by direct modulation (without IF). For output in L band the signal is upconverted to L band frequency. The reference frequency is derived from the integrated GPS receiver or applied externally.

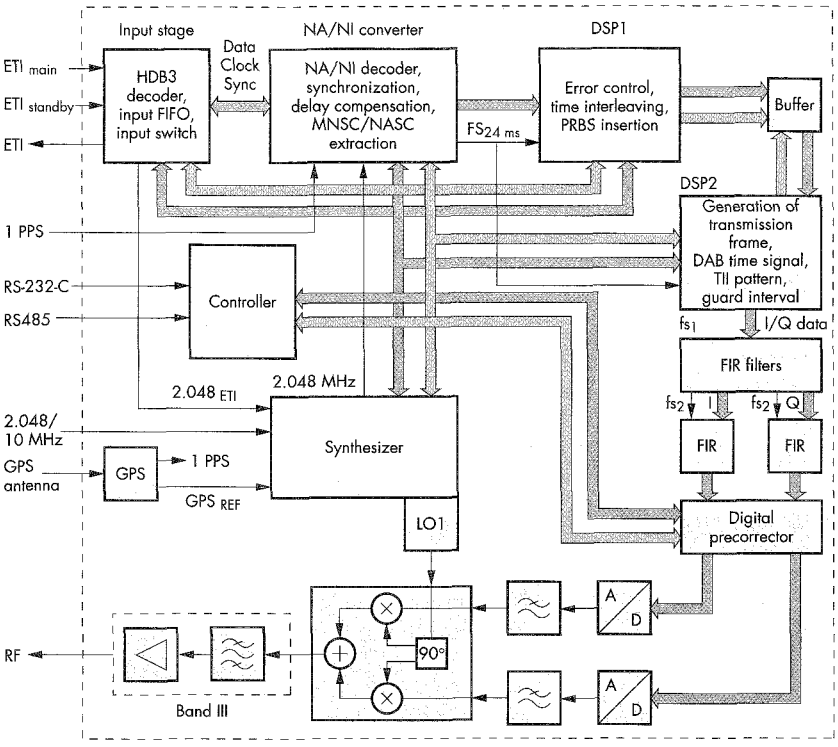

FIG 3 Block diagram of DAB exciter

The **power amplifiers** are characterized by high linearity and efficiency as well as compact design. The band III amplifiers are built with MOSFETs, those for L band with bipolar transistors. These power transistors feature high peak-power margins, so power peaks caused in the DAB signal through the use of the multicarrier method and phase shift keying will not cause intermodulation products or increased bit error rates of the DAB signal. A special feature is the circulator installed at the power amplifier output, preventing all kinds of slow or fast reflections that might destroy the power transistors. New, patented power couplers minimize power loss in the event of amplifier failure. With conventional couplers, transmitter output power is reduced by 6 dB for example if one of two amplifiers fails, but with the new couplers power reduction is only 3.5 dB.

Each complete amplifier plug-in of the new DAB transmitters has a separate **power supply**, and each plug-in forms a self-contained mechanical unit. This concept automatically ensures redundancy for the supply voltages of the amplifiers. To keep cabling in the transmitter rack to a minimum and to ensure high operational reliability, the power supplies are designed for one voltage only. The amplifiers generate all the other voltages they require internally, which again makes for redundancy. The power supplies are designed as short-circuit-proof, primary switched-mode regulators for three-phase or optionally single-phase operation depending on the total power consumption of the transmitter. Due to the high efficiency of more than 85%, a small built-in blower is sufficient to provide proper cooling. The power supplies can be replaced without interrupting the running program by undoing the plug-and-socket connection (provided that power supply and amplifier are redundant).

Transmitters with output power upwards of 125 W (band III) or 100 W (L band) are accommodated in **19-inch racks** 2000 mm high and only 800 mm deep. The output bandpass filter is integrated in the rack. For band III the transmitter and filter comply with the spectrum mask for critical areas. Where the amplifier and power supply are redundant, the air cooling system is redundant too. This means that two blowers are integrated in the transmitter rack. Cooling air can be taken from and expelled to the transmitter room or taken and/or expelled externally. Air intakes and outlets are provided for this purpose at the top and

bottom of the rack. The 50 W transmitters for band III and L band are accommodated in 19-inch racks 1000 mm high and 600 mm deep.

Rainer Steen; Cornelius Heinemann; Peter H. Frank

Condensed data of DAB Transmitters NA6.../NL6...

Frequency range	174 MHz to 240 MHz (band III) 1.452 MHz to 1.492 MHz (L band)
DAB modes	I, II, III, IV
Output power	50 W to 2000 W (band III) 50 W to 750 W (L band)
Input signal	ETI(NI) or ETI(NA)
Standard	ETS 300 401
Power supply	3 x 400 V ±10%

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Method and equipment for transmission of digital sound signals in terrestrial broadcasting networks

The invention relates to and is based on a method and equipment used to transmit digital sound signals from recording studios to the individual stations of a terrestrial broadcasting network. In future systems for digital audio broadcasting it will be necessary to transmit a large number of programs from the recording studios of the broadcasters to the stations of the terrestrial networks that are planned nationwide.

It is the aim of the invention to create a simple method and equipment for the achievement of the above. This aim is established by a method according to the main claim. Further expedient developments according to this invention especially as far as the equipment for applying this method is concerned, namely in a DAB network, in a common terrestrial VHF FM transmitter network and other extended DSR methods result from the subclaims.

The assumption is made that the DS1/DSR method known for the supply of consumer broadcast receivers via a satellite transmitter is best suited for sending sound signals from a recording studio to the individual stations of a broadcasting network. A DS1/DSR method of this kind only allows transmission of 16 individual programs however, since the familiar DSR coder only offers 16 DS1 channels. As future broadcasting networks will have to send considerably more programs to the individual transmitter stations at the same time, the invention provides for additional data reduction of the sound signals to be transmitted in the recording studio in combination with this DS1/DSR method and by taking psycho-acoustic phenomena of the human ear into account. The MUSICAM method (masking pattern adapted universal subband integrated coding and multiplexing) for example is suitable for this. It is used to transmit sound signals on narrowband channels like telephone lines between recording studios and transmitters. Combination of a DS1/DSR satellite transmission method with such a familiar means of data reduction allows transmission of not just 16 programs to the individual stations of a DAB network, for instance, but even a multiple of this figure. The method according to the invention is highly economical too, since it can be implemented using commercial equipment. The method is also very suitable for supplying the individual stations of a DAB network since, depending on the degree of data reduction, three to seven times as many programs can be transmitted as with DS1/DSR, which is limited to one stereo program (or two mono programs) per DS1 channel and to 16 stereo programs per DSR channel.

Likewise, the method according to the invention is also suitable to supply a common terrestrial VHF FM transmitter network or a so-called compatible DAB network in which only one digital program signal is emitted per transmitter in the frequency band normally used for a VHF FM transmitter.

For the method according to the invention a common satellite transmission system is preferred as the broadband transmission system, but transmission can also be via a broadband cable network.

The method can also be used to extend the well-known digital sound-broadcasting system DSR (extended DSR, EDSR) by simply equipping the consumer receiver required for DSR satellite reception with a corresponding MUSICAM decoder chip comprising selection logic. The user of such a receiver can select the required data-reduced sound signals from the digital sound signals transmitted with the method according to the invention and listen to them. The known DSR transmission system can thus be expanded to a multiple of the programs offered up to now.

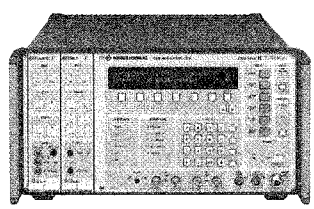
Extract from patent specification
EP 0 510 247 B1

Patent applied for by Rohde & Schwarz on 02 August 1991

Issue of patent published on 12 June 1996

Inventor: Paul Dambacher

Used with DSR Modulator SFP (photo), Audio Coder DCA, Digital Sound Receiver DSRE, Digital Sound Converter DSRU, MUSICAM Codec MUSIC



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