EXHIBIT B

OPERATIONAL DESCRIPTION

NV7930E/V OFDM/DMQ-T (MEDIAFLO) 9.3-KILOWATT TRANSMITTER

SV7000 Transmitter Operational Description/Functional Overview

Following is a brief description of the NV7000 series transmitter. A much more detailed description of the transmitters' functionality, operation and mechanical layout can be found in Exhibit K, NV7930 Installation and Commissioning Manual; Exhibit L, NV7930 Operating Manual; Exhibit M, NV7930 Maintenance Manual Volume 1; and Exhibit N, NV7930 Maintenance Manual Volume 2 that accompany this application.

The NV7000 series transmitter may be viewed in two parts. The exciter portion generates the desired carrier frequency and modulates it with the intelligent information of interest. The power amplifiers increase the exciter's output signal level to that desired for transmission.

SV700 Exciter:

The SV 700 processes the received MPEG transport stream in ASI or SMPTE 310 format. The utilized data packets are extracted from the data stream and coded and modulated in line with ETS 300744. The OFDM/ DMQ-T (MediaFLO) signal is then generated at the transmit frequency and fed to the output stage. Since the exciter is able to synchronize the output signal to an external reference (e.g. GPS = global positioning system) with a view to frequency and time, the transmitter can be used in MFNs (multi-frequency networks = single transmitters operating at different frequencies) and in SFNs (single frequency networks).

The exciter comprises the following, modules: encoder, equalizer/pre-corrector, modulator and synthesizer. The modules are interconnected via the motherboard and are powered from their own switching power supply (one per exciter).

Encoder:

The encoder accepts up to two MPEG transport streams (TS). The selected input signal is first read into a buffer (FIFO) for clock decoupling and then coded and modulated according to the DVB standard. Baseband signals are thus obtained which are forwarded to the equalizer.

At the same time the encoder evaluates the MIP (megaframe initialization packet) and so synchronizes the transmission time of the data packets with the aid of a time reference like GPS (SFN automatic). The DVB / transmission parameters can also be read from the MIP and used to configure the encoder (TPS automatic).

The encoder also contains a microcontroller which drives the whole exciter and handles communication with the CCU (central control unit). A program memory is provided as a peripheral for the microcontroller. This means that all the exciter firmware and software is stored at one location and an update can be performed via the serial interface without replacing any hardware.

The coder extension board is an add-on encoder module. With this option proprietary modulation standards such as DMQ-T (MediaFLO) can easily be installed on the exciter by only transferring an FPGA configuration file to the unit.

Equalizer/Pre-Corrector:

The equalizer/pre-corrector consists of a linear equalizer and a non linear equalizer. Pre-correction is performed at digital baseband level. The linear pre-corrector corrects the phase and frequency response of any power filter that is used. The non linear equalizer separately corrects the amplitude and the phase of the time signal as a function of amplitude. A limiter can be added to linearity pre-correction to optimize the efficiency of the transmitter.

An optional data recorder allows recording of the RF signal and thus automation of the pre-correction operation.

The pre-emphasized digital baseband signals are subsequently converted into analog signals and applied to the modulator. The modulator generates the DVB/DMQ-T signal at the RF by direct quadrature modulation. The signal is filtered and amplified and then fed to the output stages.

Synthesizer:

The synthesizer generates the center carrier frequency required for modulation. A Global Positioning System receiver module may be fitted as an option. It acts as a reference for frequency generation and is used as a time reference for single frequency network operation.

Central Control Unit (CCU):

The CCU provides for control and monitoring of the transmitter and for operator interface. Internally it communicates with the exciter modules over and internal RS485 buss and to the amplifiers via a rack controller in each transmitter cabinet and to the pump system controller via a proprietary buss. External communications are via the front panel keyboard/display unit, via an optional parallel interface, via an RS232 connection using optional software on a local (or remote via dial-up modem) interface or via the optional NetCCU 700 linked into it via an RS485 connection.

Exciter Motherboard(s):

The motherboard(s) interconnect(s) the exciter modules and links the exciter to the CCU. The motherboards provide the mechanical and electrical interface to the transmitter rack (with cooling system, power supplies and amplifiers) for transmitter control. The modules are powered through the motherboard via a switching power supply; one supply for each exciter. The motherboard comes in several models:

Model 03: motherboard of main exciter (motherboard A)
Model 04: motherboard of standby exciter (motherboard B)

Power Amplifiers Section

The power amplifier system takes the low level modulated output of the exciter and amplifies it to the level desired for transmitting.

Power splitter:

Each transmitter cabinet has a power splitter at its input that divides the signal from the exciter into equal parts to feed the up to eight power amplifiers contained within. It also decouples the power amplifier inputs in order to avoid disturbing reflections from faulty units. In multi-cabinet transmitters another power divider is utilized to divide the exciter output into equal parts for distribution to the transmitter cabinets. And in transmitters with a second exciter there is an RF switch before all of the splitters to select which of the two exciters is utilized. In all multi-cabinet transmitters provisions are made to adjust the relative signal phasing between the cabinets.

Broadband Power Amplifier:

The VH602A2 liquid-cooled solid state UHF Power amplifier is utilized in the NV7000 series transmitter. Each amplifier provides an output power of 440 W . The amplifiers are broadband, meaning that one amplifier can be used at any of the operating frequencies (470 – 860 MHz) without any modifications or tuning. The soft failure characteristic of the solid state transmitter is mainly provided by connecting the PAs in parallel. Failure of one PA reduces the output power in a predefined limit but doesn't cause interruption of the program transmission. Self protecting circuits have been implemented in the PAs against problematic situation (overheating, high VSWR, etc.)

Each power amplifier includes its own integral power supply. Each three-phase power supply module is designed for a maximum power load of 4.8-kilowatts. The input voltage to the power supply is 400”Y”/230 volts AC, 50/60 Hz and its DC output to the amplifier is 32-volts. The supplies are a “switching” design with a switching frequency of 30-kilohertz.

Cabinet Power Combiner:

A combiner of Wilkinson design is utilized to combine the outputs of all power amplifiers in a transmitter cabinet into one output signal. The combiner is built-up in triplate hybrid technique and does not require any tuning. The power amplifier signal output is connected automatically to the combiner input when inserting the PA module into the rack. The power combiner forms a common unit with the coolant collector thus providing for sufficient cooling. A harmonic filter is also utilized in each cabinet between the output of the combiner and either its input to the final transmitter combiner or the transmitter output directional coupler assembly.

Transmitter Output Combiner:

In transmitters that are made up of more than one cabinet the cabinet outputs need to be combined into one. In two cabinet models a 3-dB hybrid is utilized. It three cabinet designs a 3-dB hybrid is used to combine two of the cabinets into one signal and then a 4.77-dB combiner is utilized to combine the third cabinet with the first two.

Output Directional Coupler:

A precision directional coupler assembly is utilized between the output of the last combiner and the transmitter’s output terminal. Sample ports on this coupler are utilized for various functions such as forward and reflected power monitoring and to obtain sample signal(s) for the exciter(s) non-linear equalizer/pre-corrector functions. Additional ports are possible for the customer’s designated uses.

RF Detector Module:

The forward and reflected samples from the output directional coupler are directed to the appropriate input ports on the RF Detector Module. The samples are conditioned and rectified and then made available to the exciter Command Control Unit.

Channel “Mask” Filter:

A sharply tuned filter is utilized on the output of the transmitter to insure that the bandwidth occupied by the transmitter signal is in compliance with the requirements of Part 27 of the Rules and is considered to be part of the transmitter system. A directional coupler at the output of this filter is utilized to obtain an appropriate signal sample for the exciter'(s) linear equalizer/pre-corrector functions.

Mechanical Design

Transmitters in the NV7000 family with power ratings of up to 3.4-kilowatts output are housed in a single cabinet measuring 63-centimeters (24.8-inches) wide, by 120 centimeters (47.24-inches) deep, by 216.7-centimeters (85.31-inches) high. The cabinet contains one or two exciter(s) in a single exciter cabinet frame, up to 8 power amplifier modules, each with an integral power supply, and all other components included as part of the transmitter except for the channel "mask" filter which is installed externally, and the cooling system [pump stands and heat exchangers]. Transmitters with higher power outputs capabilities are installed in two or more cabinets with the cabinet outputs combined as described on the previous page.

Exciter:

The exciter is accommodated in the exciter cabinet frame which is part of the first transmitter rack. Up to two exciters can be fitted in the one cabinet frame. Exciter A is accommodated in the left half of the frame, exciter B in the right. The Central Control Unit (CCU), Synthesizer A, Modulator A, Equalizer/Precorrector A and Encoder A are the order of the modules from left to right. On the right hand side the CCU power supply always occupies the first module location. If the B exciter is present the module order (minus the CCU) repeats. The modules are inserted upright into the exciter cabinet frame and plugged into their respective motherboards which are screwed to the rear of the frame. Below the cabinet frame is a fan box for each exciter. The fan box has two fans for each exciter on the front side and the respective exciter's power supply to the rear.

Transmitter Cabinet:

Each transmitter cabinet holds up to eight liquid-cooled power amplifiers. The amplifiers are installed horizontally on trays and slide in from the front. When fully engaged, connections are made to each amplifier from the rear of its respective tray for: AC power, RF drive input, RF output, amplifier control and monitoring and coolant flow in and out.

Running vertically in the approximate center of the backs of those trays is the cabinet RF output combiner. Part of that combiner assembly is the coolant collection manifold (return coolant from the amplifiers). Mounted on that manifold are the reject loads for the combiner, thus insuring adequate cooling of those loads should the need arise. On the left side of the cabinet near the rear (when facing the cabinet from the front) is the coolant inlet distribution manifold for the amplifiers.

The last major system in each cabinet is the AC power distribution located at the bottom front of the cabinet. The first cabinet also houses a main disconnect switch for the entire transmitter and the AC power quality sensor for the entire transmitter. The cabinet is secured from the outside via the use of covers on the sides and the rear rather than doors. The covers are secured in place by screws.

On two cabinet transmitters the 3-dB hybrid used to combine the cabinet outputs is located at the bottom of the right-hand cabinet near the rear left side. The reject load for that hybrid combiner is also located in the bottom of that same cabinet towards the front. On three cabinet models the cabinet combiner is located externally to the cabinets, generally on the top of the cabinets, or elsewhere in close proximity to the cabinets as the requirements at the installation site may dictate.