VTX2KW

THEORY OF OPERATION

Introduction

The VTX2KW Television Transmitter is a TV transmitter capable of providing 2 kW of visual RF power and 200 watts of aural power at the output of the transmitter. The transmitter is comprised of a precision modulator and upconverter, 4 way power splitter, 4 solid state common amplification RF power amplifiers operating in parallel, a 4 way power combiner, 4 DC power supplies, RF filter to eliminate spurious products and harmonics, cooling system, AC voltage distribution system, control and monitoring system for the human interface, and all necessary hardware to assemble the transmitter into the transmission facility. The transmitter system is housed in one 19 inch rack.

System Operation

RF SIGNAL GENERATION

Video and audio are fed to the high quality TV modulator/upconverter where the high quality TV visual and aural signals are produced. The upconverter converts the modulated TV signal to its desired channel and eliminates the image frequency product. The signal is fed to a 4 way splitter that distributes an in-phase and equal amplitude signal to each of the 4 power amplifiers. Each power amplifiers accepts the RF signal and is capable of producing a 600 watt peak of sync NTSC TV waveform. The 4 way combiner accepts all 4 RF signals and combines the signals to one common output connector. The output signal from the combiner feeds a directional coupler. The output signal from the directional coupler passes through a bandpass filter that reduces all out of channel intermodulation products and harmonics to an acceptable level consistent with FCC rules.

POWER SUPPLY SYSTEM

The incoming main three phase AC power passes through a circuit breaker control panel that distributes the power to various assemblies throughout the transmitter. From the circuit breaker panel, separate single phase AC lines are fed to the modulator/upconverter, driver, control and monitoring system, and air cooling system, as well as auxiliary outlets for the transmitter. The VTX2KW utilizes 4 power supplies. Input AC voltage is fed to each of the DC power supplies via one power supply frame designed to house all of the power supplies. Each one of the DC power supplies converts the AC line voltage to approximately 31 volts DC. Its voltage is held constant independent of modulated RF waveform type and overall load. All of the DC outputs from the power supplies are connected in parallel. The power supplies share the load current required by the amplifier group. The entire load current required by the power amplifiers

can be provided by 4 power supplies. The parallel connection and smart circuitry of the power supplies allows all power supplies to share the load. This combination will also allow one power supply to fail and the transmitter can still operate at full power under normal picture content.

SOLID STATE POWER AMPLIFIER

Each solid state power amplifier (PA) consists of 2 stages of amplification using LDMOS technology. The power gain of each power amplifier is approximately 35 dB. Within each power amplifier, the first stage serves as a low distortion linear amplifier that increases the power of the combined visual and aural signal roughly 13 dB. This output signal is routed to 4 parallel configured final amplifiers. The driver and final amplifier transistors receive DC voltage from the power supply frame elsewhere in the rack via connections on the rear of the amplifier. VSWR and over-temperature protection is provided in order that the transistors are not damaged from high reflected power operating conditions. The heatsink temperature is monitored and whenever it exceeds a pre-determined temperature, a front panel LED indicator is illuminated and the power amplifier module shuts off. Integral fans provide direct cooling air to the amplifier heatsinks to ensure that the heat is removed efficiently from the PA modules. When the temperature decreases back below the threshold, the power amplifier automatically re-enables to the “On” state.

POWER SUPPLY

The power supply architecture is a very efficient DC switching power supply unit. Each power supply is hot-pluggable and is inserted and removed from the front of the transmitter. The unit accepts voltage from a 50 or 60 Hz source. The output voltage is tightly regulated in order to eliminate any amplitude modulation on the output RF signal. Current limit protection is built in to the power supply should it accidentally encounter a very high current demand. Each power supply is cooled by internal fans.

RF SPLITTER AND COMBINER

The RF splitter is an assembly that separates the RF signal into equal amplitude and in-phase signals for each port. The RF combiner reverses the process and combines all amplifier outputs together.

Each group of input cable, power amplifier, isolator and output cables is matched for the same transmission phase angle and amplitude to be present at the RF combiner input

RF FILTER

The RF filter is a multiple section bandpass filter designed to pass signals in the designated channel and reject all others. Connections for the RF

input and output are made through 50 ohm connectors. The filter is tuned to a specific TV channel.

CONTROL AND MONITORING SYSTEM

The control and monitoring system of the transmitter provides the following functions:

- Forward Visual, forward Aural, and combined reflected power output level monitoring
- Status lights for all power amplifier modules
- Metering for all power amplifier currents
- RF sample port for monitoring the forward signal using separate test equipment
- Power Amplifier enable/disable switch

AIR COOLING SYSTEM

An exhaust fan on the top of the cabinet provides cooling for the system. Cool air is drawn through the front of the transmitter by highly reliable fans in the individual amplifier modules and exhausted at the back of the amplifiers. The exhaust fan pulls the warm air from the amplifiers up to the top of the cabinet.