1.0 IDENTIFICATION OF APPLICANT AND EQUIPMENT

1.1 Applicant:

Information Transmission Systems Corp.
375 Valley Brook Road
McMurray, PA 15317

The above name and address is printed on a label attached to the rear panel of the equipment.

1.2 Equipment and Model Number: ITS-5523

This information is provided on the front panel of the equipment.

1.3 ITS Corporation shall manufacture this product in quantities necessary to satisfy market demand.

2.0 TECHNICAL DESCRIPTION - MODEL ITS-5523

2.1 Introduction

The ITS-5523 is a digital transmitter operating at an output power of 5 watts average power. Functionally, it is comprised of a modulator (Comstream CM720M) and upconverter/amplifier tray. The modulator receives a 28 Mbit/sec,serial bit stream, consisting of multiplexed MPEG-2 transport streams, translates the signal to a Quadrature Amplitude Modulated (QAM) format, converts the digital information to analog, and modulates the signal to IF (44M Hz). The modulator tray's IF output is then routed to the upconverter/amplifier tray for IF signal processing, upconversion to the MDS/MMDS/ITFS frequency, and final amplification. The upconverter/amplifier tray utilizes ALC/AGC circuitry for automatic level control of the IF signal and automatic gain control of the output signal. Both modulator and upconverter/amplifier trays are 19-inch rack mount assemblies and can be supplied with or without a cabinet. It is supplied complete with cables and cabinet slides.

The power rating of this model is determined by the design of the final amplifier stage and the present regulations for out-of-band spurious product conducted emission. There is presently a pending change in these regulations that if approved by the Commission, would increase the output power capability. If this rule change is approved, a request for modification of this type acceptance will be filed.

Parameters and specification for operation of this unit are provided on the following pages, and a complete circuit description and alignment procedure are also included in this report. Refer to the overall system block diagram and the particular referenced schematics in the attached circuit description section of this report.

2.0 TECHNICAL DESCRIPTION

2.2 Technical Specifications

Type of Emissions... 6M00D7W
Frequency Range ....2150 to 2162 and 2500 to 2686 MHz (any 6 MHz channel)
Output Power Rating ....5 watts total average
DC voltage and total current of final amplifier stage .... 10 volts DC at 24 amps
(Class A - Not RF power dependent)

2.3 Performance Specifications

Operating Frequency Range...2150 to 2162 and 2500 to 2686 MHz
RF output - Nominal:
Power...5 watts average
Impedance ....50 ohms
Connector...Type N

Input: (Modulator) .... MPEG-2 Transport Stream

Out-of-Band Power...-38 dB max (at channel edge)
-60 dB max (0.5 MHz above channel edge and 1.0 MHz below channel edge)
Harmonic Products..-60 dB max

Electrical Requirements

Power Line Voltage
Modulator...90 to 264 VAC, 47 to 63 Hz
Upconverter/Amplifier..117 VAC, ±10%, 60 Hz or
220 VAC ±10%, 50 Hz
Power Consumption
Modulator...50 watts
Upconverter/Amplifier...175 watts

Environmental

Maximum Altitude
Modulator..10,000 feet (3,050m)
Upconverter/Amplifier...12,000 feet (3,660m)

Ambient Temperature
Modulator...0° to +50°C
Upconverter/Amplifier...0° to 50°C

Mechanical

Dimensions: (WxDxH)
Modulator.. 19" x 18"x 1.75" (48.3cm x 45.37cm x 4.45cm)
Upconverter/Amplifier... 19" x 21" x 8.75" (48.3cm x 53.3cm x 22.24cm)

Weight:
Modulator... 12 lbs. (5.44 kgs)
Upconverter/Amplifier... 30 lbs. (13.6 kgs)

2.0 TECHNICAL DESCRIPTION

2.4 Circuit Description

The ITS-5523 ITFS/MDS/MMDS Digital Transmitter can be subdivided further as follows:

Modulator Tray	-Digital data input card -IF output QAM modulator card -Front panel display and control -Power supply
Upconverter/Amplifier Tray	- Automatic Level Control - Automatic Gain Control - Channel Crystal Oscillator - Frequency Multipliers - Mixer - Bias Circuits - Amplifier Modules - Peak Detectors - Power Meter - Control Switch - Control Logic - Status Indicators - Power Supplies

2.0 TECHNICAL DESCRIPTION

2.4 Circuit Description

Modulator Tray

Due to proprietary concerns on the part of Comstream Corperation, the circuit description of the CM720M modulator will be presented on a system level.

The CM720M modulator tray generates a 64 QAM digital IF output which is used to drive the upconverter/amplifier tray. External, multiplexed 28 MBPS data is applied to the rear of the modulator tray using a shielded RJ-45 jack (J5). The digital data is received using an IC chip set known as TAXI® (Transparent Asynchronous Transmitter/Receiver Interface) on the Digital Data Input Card. TAXI is a registered trademark of Advanced Micro Devices (AMD).

The TAXI receiver operates in 10 bits-per-byte mode (8 data bits, 1 even parity bit, 1 active low-frame sync bit). The TAXI receiver reference clock (5 MHz) is fed to the modulator.

The digital bit stream of data from the Digital Data Card is fed to the Quadrature Amplitude Modulator (QAM) digital modulator on the Modulator Card. The data/clock signal is continuously monitored for the following:

1. Clock out of spec (more/less than 100 ppm of spec)
2. Loss of clock
3. Parity errors
4. Frame sync errors
5. Sync acquisition errors
6. TAXI decoding violations

The system is normally frequency locked to the input clock. If the input clock is not present, the system switches over to internal timing to preserve the output spectrum. When the system clock returns, the system will detect the presence of the clock and return to normal operation.

The outptut power of the modulator, which is monitored continuously , is adjustable form -27 dBm to -5 dBm.

The front panel of the CM720M modulator contains a seven-segment LED display, a LCD display, two LED fault indicators, control keys, and a numerical keypad to monitor and control the operating status of the tray. Also included on the front panel are IF and RF output test ports (refer to *Chapter 3: Front Panel Operation* of the Installation and Operation Manual, included in Exhibit II of this report, for a complete description of front panel operation).

The CM720M power supply is auto-ranging for AC inputs from 90 to 264 VAC and 47 to 63 Hz.

2.0 TECHNICAL DESCRIPTION

2.4 Circuit Description - continued

Upconverter/Amplifier Tray

The input to the Upconverter/Amplifier tray is the IF output from the CM720M modulator tray. The QAM digital IF output signal from the modulator is applied to the IF input jack (J2) on the rear of the tray. The IF input signal is fed to the IF Amplifier Board (1521-1101) which provides impedance matching capability (75Ω to 50Ω) and amplification of the IF signal. The output of the Impedance match Board is fed to the SAW Filter/Amplifier Board (1600-1209), which attenuates any spurious signals outside the channel bandwidth. The output of the SAW Filter/Amplifier Board is connected to the IF Delay Board (1165-1018), which contains two section of delay equalization to compensate for the Group Delay created by external channel filters.

The IF Delay Board output is fed to the Response Corrector Board (1034-1205). On this board are three adjustable notch filters which correct for nonlinearities in the IF response. The output signal (J5) is connected to the input of the ALC/AGC Board (1022-1102).

The signal enters the board at J1, and after a 2 dB pad, a IF band-pass filter, and a second 2 dB pad, is adjusted in level by the PIN Diode Attenuator/ALC circuitry similar to that used on the IF ALC board in the receiver. By controlling the gain of this attenuator, the IF output level of the board can be regulated, maintaining a constant IF output level, regardless of minor level changes in the IF input signal.

Next, the IF signal is fed to a loop through at J2 to a series of two boards. The first, the Linearity Corrector Board (1034-1201) pre-distorts the IF signal to compensate for compression in later stages of the system. The second board, the IF Phase Corrector Board (1227-1250) corrects for any phase error , which may be introduced by the amplifiers later in the system. The phase and linearity corrected signal reenters the ALC\AGC Board at J3 and after an IF filter identical to that used on the main input of the board (J1), is applied to a Wilkinson Splitter. The main output of the splitter is fed to an AGC PIN Diode Attenuator, which functions in the same manner as the ALC PIN Diode Attenuator. The AGC circuitry maintains a constant output level regardless of minor changes in the IF signal.

The AGC circuit can be bypassed by switch S2. When the AGC is disabled, the loss through the AGC PIN attenuator is adjusted by the Manual Gain potentiometer R101, which then directly controls the output in a manual fashion. The ALC/AGC Board output (J4) is fed to the input of the Response Corrector Board (1034-1205) with form and function identical to the Response Corrector Board above. The Response corrector Board output (J4) is connected to the IF input of the Upconverter Module (1519-1125).

2.0 TECHNICAL DESCRIPTION

2.4 Circuit Description - continued

A UHF L.O. (local oscillator) signal is generated from the UHF Generator Board 1512-1101). This Board is comprised internally of a voltage controlled crystal oscillator circuit and x8 multiplier consisting of three x2 broadband doublers (2^3 = x8) which produces the local oscillator signal (LO) signal. The oscillator circuit is a modified Colpitts design and the crystal is mounted in an oven set at 60° C and operates at 1/24 of the local oscillator frequency. The output of the UHF Generator Board is applied to a x3 Multiplier and then to the input of a mixer which is located on the Upconverter Board. The voltage controlled crystal oscillator circuit within the UHF Generator Board is controlled by the VHF Generator Control Board which locks the L.O. signal to a precise external 10 MHz reference which is applied to the rear of the tray at jack J7. A channel oscillator signal is available at the front panel jack J9.

The PLL circuit on the VHF Generator Control Board divides a sample of the channel VCXO frequency and compares it to the reference frequency (50 KHz) also generated by the VHF Generator Control Board. The difference between the phase of the reference frequency and the divided down VCXO frequency sample causes the PLL IC to create an error output voltage called Automatic Frequency Control (AFC) voltage, which is used to bias a variable capacitor in the channel VCXO.

The Upconverter Module generates a RF signal from the difference between the L.O. signal and the IF signal (L.O. - IF). The output of the Upconverter Board is sent through a Four Stage Cavity Filter w/Trap (2000-1240), which attenuates any undesired signals that may have been generated by the Upconverter Board during the mixing process.

The output from the Four Stage Cavity Filter (2000-1240) is sent to the Three Stage Amplifier Module (1516-1108), which consist of three cascaded GaAs FET amplifiers (FLL-101 driving a FLL-351 driving a FLL200) with an overall gain of 36 dB. The output of the Three Stage Amplifier (J2) is connected to the 50 Watt Amplifier Module (1512-1107).

The signal is input to the 50 Watt Amplifier Module at J1 and amplified by GaAs FET Q101 (FLL2008-3). Then the signal is split four ways by three Wilkinson in phase couplers and amplified by GaAs FET amplifiers Q201, Q301, Q401, and Q501 (all FLL2008-3's). The signal is then combined by three Wilkinson in phase couplers and fed to the output of the module at jack J2. The output is fed to a Circulator Kit (A50), then to the RF output jack at the rear of the tray (J10).

Two 20 dB micro-strip directional couplers, located within the 50 Amplifier Module, provide a forward and reflected power sample of the final output signal. Both samples are sent to the Dual Peak Detector Board, which detects each sample and produces a forward and reflected metering voltage which drives the transmitters's front panel meter.

The DC biasing of each FET within the module is controlled and filtered by the corresponding daughter boards (D1, D2, D3, D4, and D5), which are soldered directly to the mother board. The DC bias drain to source currents are set by adjusting the negative gate to source voltages which are adjusted by potentiometers on the daughter boards.

The Six Section Bias Board (1519-1136) supplies the two amplifier modules with both +10 VDC (operating voltage) and -5 VDC (bias voltage).

2.0 TECHNICAL DESCRIPTION

2.4 Circuit Description - continued

The Transmitter Control Board (1555-1215) provides the capability to control and monitor the operating status of the transmitter. The board is designed to protect the transmitter in the event of the following faults: over temperature, loss or reduction in output power and loss of the -5 VDC GaAsFET bias voltage. The Transmitter Control Board also provides the capability to remotely control and monitor the transmitter status by providing external remote connections via the Connector assembly Board (1519-1102) jacks J12 and J13 at the rear of the tray.

The transmitter may be configured to be powered by either a 115 VAC/60 Hz or 230 VAC/50 Hz source. The AC source enters the tray at jack J1. The AC source passes through a line filter and is distributed to a terminal block (TB1). Varistors VR1, VR2, VR3 and VR4 provide transient and over voltage protection to the transmitter. The rear panel circuit breaker applies AC voltage to the input of the toroid transformer.

The toroid transformer provides (2) 15 VAC secondary windings. The first winding is sent to a full wave bridge rectifier which supplies a positive 18 VDC to several positive voltage regulators located on the DC Power Supply Board. The second winding is applied to the +12 VDC Power Supply Board which powers the 12 VDC cooling fan. The second winding is also applied to a full wave bridge rectifier circuit on the DC Power Supply Board whose output is sent to several negative voltage regulators. Two +12 VDC switching supplies (SPL250-1012) rated at 21 amperes are used to supply the GaAs FET amplifier modules with power.