8. OPERATIONAL DESCRIPTION - MODEL Axcera-CU1100BTD

8.1 General Description

The CU1100BTD is a complete 1100-watt UHF solid-state, digital television transmitter. It operates at a nominal output power of 1100 watts average.

8.2 Technical Specifications

Type of Emission 6M00K1D

Frequency Range .... 470 MHz to 608 MHz and 614 to 806 MHz

Output Power.. 1100 watts average

8.3 Performance Specifications

Operating Frequency Range .... 470 MHz to 608 MHz and 614 to 806 MHz

RF output - Nominal:
- Power .... 1100 watts average
- Impedance .... 50 ohms
- Connector .... "7/8" EIA

Regulation of Output 3%
Signal-to-Noise Ratio (SNR) .... 30 dB or better
Carrier Frequency Stability ....±1000 Hz

Out of Band:
Compliant with FCC Simple or Stringent Mask
(Measured in 30 KHz RBW, relative to total average power)

Data Interface:
Input Rate.. 19.39 Mbps, 6 MHz Channel
Input Interface.. SMPTE 310M (ASI optional)

<u>Electrical Requirements</u>

Power Line Voltage ....230 volts, 50/60 Hz
Power Consumption .... 6300 watts

<u>Environmental</u>

Maximum Altitude .... 8,500 feet
Operational Temperature Range .... 0°C to +50°C

Mechanical

Dimensions:
Width .... 22.00”
Height .... 55.00”
Depth .... 34.00”
Weight... 300 lbs

8.4. System Overview

The CU1100BTD is made up of the trays/assemblies listed in Table 8-1.

Table 8-1. CU1100BTD Major Trays and Assemblies

MAJOR ASSEMBLY DESIGNATOR	TRAY/ASSEMBLY NAME
A1	50W Driver Tray
A2	Power Amplifier Tray
A3	Power Amplifier Tray

8.4.1 Driver Tray

The Transmitter accepts an RF On Channel signal (-79 to –8 dBm) and converts it to a DTV RF On Channel output signal at 1100 Watts. The transmitter provides linear and nonlinear correction capability for the transmission path as well as internal test sources that are used during initial transmitter installation.

8.4.1.1 (A1) 8 VSB Demodulator Board (1308275)

The RF input to the Transmitter is connected to the J1 BNC connector located on the rear panel of the tray. This RF signal is wired to (A1) the 8 VSB demodulator board (1308275), which generates a SMPTE-310 output at J13. The (A1) 8 VSB demodulator assembly receives an off air 8 VSB signal on any VHF or UHF channel and demodulates this to an MPEG-2 transport stream that is per the SMPTE-310M standard. The input to the assembly is at an “F” style connector on the shielded tuner and can be at a level of –78 dBm to –8 dBm. The tuner (TU1) down converts the RF channel to a 44 MHz IF signal. This IF signal is the input to the digital receiver chip U1. The digital receiver chip subsequently decodes the IF and delivers an MPEG-2 transport stream, on a parallel data bus, to a programmable logic array, U8. U8 clocks the asynchronous MPEG data from the receiver chip and outputs a synchronous data stream at a 19.39 MHz rate to buffer/driver U11. U11 subsequently drives the output at J13 to a lower level that is AC coupled out of the board and is cabled to J42 on the 8 VSB Modulator Board.

8.4.1.2 (A2) 8 VSB Modulator Board (1304883)

The (A2) 8 VSB Modulator Board (1304883) accepts the SMPTE-310 MPEG data stream input at the SMA connector J42 and produces a 6 MHz wide IF output, at the IF Output Jack J38. The IF output is centered at 44 MHz using a pilot carrier of 46.69 MHz generated on the board.

This SMPTE-310 MPEG data stream input is applied to a high-speed window comparator U21 that adjusts the level to a low voltage TTL signal to be used by the

Altera FPGA, U3. The SMPTE-310 signal is input to the FPGA to recover the clock and the data. A portion of the clock and recovery circuit is performed by a high-speed comparator, U17, which functions as an external delay circuit.

The FPGA subsequently uses the SMPTE-310 clock and data as the input to the channel coder contained inside the FPGA. The channel coder is a series of DSP blocks defined by the ATSC standard for 8 VSB data transmission. These blocks include the data randomizer, Reed Solomon Encoder, data interleaver, trellis coder, and sync inserter.

The channel coder portion, inside the FPGA, generates the 8 distinct levels in an 8 VSB transmitter. These levels are subsequently input to a linear equalizer that provides for frequency response correction in the transmission path. The linear equalizer is a 67-tap FIR filter that is loaded with tap values from the microcontroller, U1, located on this board. The output of the linear equalizer is then input to two pulse shaping filters, an in phase (I) and a quadrature (Q) filter that are also located inside the FPGA. The pulse shaping filters are FIR filters that have fixed tap values that are preset inside the FPGA. The output of the pulse shaping filters is then applied to a Pre-Distortion Linearizer chip, U4, which can be used to correct for nonlinearities in the data transmission path. The output of the Pre-Distortion chip is gain scaled and output to a dual D/A converter, which output a baseband I and Q analog signal.

The baseband I and Q signals from the D/A converter are applied to differential analog filters that remove some of digital artifacts from the D/A conversion process. The output of the I channel filter is then mixed with the pilot frequency, 46.69 MHz, using mixer U30. The output of the Q filter is mixed with the pilot frequency that is phase shifted 90 degrees using mixer U34. The mixers are current driven devices so that when the outputs of U30 and U34 are connected together, they provide a combined output. This combined output is subsequently input to a final differential output filter which provides the final IF output at the SMA connector, J38. To maintain signal integrity, the IF output is connected to the SMA connector J39 with a small semi-rigid cable assembly. The final IF output then appears at J1-2B.

The 46.69 MHz pilot, that is used in the mixing process is generated from a 46.69 MHz VCXO, U37, that is phase locked to a 10 MHz reference. The VCXO and the 10 MHz are divided down to a common frequency, which is then compared internal to the FPGA. The FPGA subsequently provides error signals to an analog phase locked implemented with op amp stages U45-A, B and C. The output of these compensation stages is used as the control voltage to the VCXO, U37. The phase locked output of U37 is applied to an analog filter to remove harmonics of the pilot and then input to the quadrature splitter Z1. The outputs of Z1 are used as the inputs to the mixers in the analog output section.

8.4.1.3 (A3) IF Pre-Corrector Board (1308796)

The IF output (0 dBm) of the 8 VSB Modulator connects to J2 on the (A3) IF Pre-Corrector Board (1308796), which provides response, in phase and quadrature pre-correction to the IF signal. The Pre-Corrected IF output at J1 is cabled to the IF In Jack on (A4) the Digital Agile Upconverter Board, which up converts the IF to the On Channel RF signal that is cabled to the RF Out Jack of the board. The RF out is connected to J1 the RF input jack on the ALC board. The (A5) ALC Board, (1308570), is used to control the RF drive power to the RF amplifier chain in the transmitter. The board accepts an 8-VSB RF input signal at J1, the RF input jack, at a nominal input level of -3 dBm average power and amplifies it to whatever drive level is necessary to drive the final RF amplifier in the tray to full power. The RF output of the ALC board at J2, typically 0 to +10 dBm, is cabled to J1 on the Amplifier Assembly.

8.4.1.4 (A4) Frequency Agile Upconverter Board (1309695)

The board takes a 44 MHz or 36 MHz IF signal and converts it to a TV channel in the range of 54-860 MHz. The IF input signal, (≈-8dBm level), is connected to J6 on the board. The IF first passes through a frequency response pre-corrector, consisting of R145, C188, R 146 and C189. The pre-corrector circuit compensates for any response variation in the ceramic filter used to pick the appropriate conversion sideband. The pre-corrected signal is then converted to a second IF centered at 1044 MHz using U16, U18 and associated components. The signal is next applied to a second mixer, U15, where it is converted to the final RF channel frequency. The signal is then sent to a low pass filter that removes unwanted conversion products above 1 GHz, amplified by U21 passed to another low pass filter that removes unwanted conversion products above 1 GHz, amplified by U20 and connected to J7 the RF output jack for the board (≈-3dBm level).

The upconverter has two local oscillators, LO1 and LO2. The LO1 oscillator consists of U1, U2, U5, U6 and amplifiers U3 and U4. The LO1 oscillator operates at 1 GHz for 44 MHz IF inputs and is used to convert the signal to 1044 MHz. In 36 MHz IF systems, this oscillator circuit operates at 1.008 GHz. The Red LED DS4 will light if the PLL for the LO1 oscillator is not locked.

The second LO, LO2, consists of two VCOs, U26 and U31, that are used to generate the second LO. One VCO operates from 1.1-1.5 GHz and the second from 1.5-1.9 GHz. The Red LED DS2 will light if the PLL for the LO2 oscillator is not locked.

Both of the LOs, LO1 and LO2, are locked to an on board 10 MHz VCXO. The 10 MHz VCXO circuit consists of U36, U39, the VCTCXO Y1 and associated components. When an external 10 MHz signal is applied to J10 on the board, the internal VCXO is locked to the external 10 MHz, otherwise, it is free-running. The Red LED DS6 will light if an

8.4.1.5 (A5) ALC Board, Innovator CX Series (1308570)

The ALC Board, Innovator CX Series, is used to control the RF drive power to the RF amplifier chain in the CU30, CU50, CU100 and CU125 systems. The board accepts an 8-VSB RF input signal at a nominal input level of -3 dBm average power and amplifies it to whatever drive level is necessary to drive the final RF amplifier in the tray to full power. The input signal to the board at J1 is split by U4, with one half of the signal driving a PIN diode attenuator, DS1 and DS2, and the other half driving a detector, U13, that is used to mute the PIN attenuator when there is no input signal. The output of the PIN attenuator is sent to two cascaded amplifiers, U2 and U3, which are capable of generating +10 dBm average power from the board at J2.

The PIN attenuator is driven by an ALC circuit or by a manual fixed voltage bias, depending on the position of switch S1. When the switch is pointing to the left, looking from the front of the tray, the ALC circuit is enabled. When the switch is pointing to the right, the ALC circuit is disabled and the PIN attenuator is controlled through the Manual gain pot R62. When the switch is in either ALC or manual, the voltage in the unused circuit is preset low by the circuitry connected to pins 4-6 on SW1. This allows the RF power to ramp up slowly to full power when the switch changes positions. CR8, C33 and associated components control the ramp up speed of the manual gain circuit. CR9, C42 and their associated circuits do the same thing for the ALC circuit. The practical effect of this is to preset the RF drive power to near zero output power when enabling and disabling the ALC, followed by a slow controlled ramp up of power.

The ALC circuit normally attempts to hold the tray output power constant, but there are four faults that can override this. These faults are Input Fault, VSWR Cutback Fault, VSWR Shutdown Fault and Overdrive Fault.

The Input Fault is generated by comparator U7C and presets the PIN attenuator and ALC circuit to maximum attenuation whenever the input signal drops below about -7 dBm. Test point TP2 allows the user to measure the detected input voltage.

The VSWR cutback circuit is set so that the ALC circuit will start reducing RF drive once the Reflected power reaches a level of about 6% and will keep reducing the drive to maintain that level. U8A, U8B and their associated components, diode-or the metering voltages, which generates this cutback. The forward power is scaled to 2V = 100 % and the reflected power is scaled to 2V = 25%. The Reflected metering voltage is doubled again by U8B so that when the voltage of U8B exceeds the voltage at the output of U8A, the reflected power takes over the ALC circuit. Once the U8B voltage drops below the forward power at U8A, the forward power takes over again.

The VSWR shutdown circuit will shut the tray down if the Reflected power increases to 15% or higher, which can happen if the tray sees reflected power when the ALC is in manual.

The Overdrive protection looks at a sample of the RF signal that is applied to J1 of the board. The peak level of this signal is detected and can be measured on TP1. This voltage is applied to a comparator with the threshold set by R38. If this threshold is exceeded, the ALC circuit mutes then ramps up to try again. This circuit also works in manual gain as well.

8.4.1.6 (A6) Amplifier Assembly (1308867)

The (A6) Amplifier Assembly (1308867) is made up of (A6-A1) the 2 Stage UHF Amplifier Board, (1308784) and (A6-A2) the RF Module Pallet w/Philips transistors (1300116). The assembly has approximately 36 dB of gain.

8.4.1.7 (A6-A1) 2 Stage UHF Amplifier Board, (1308784)

The 2 Stage UHF Amplifier Board, (1308784) consists of a driver stage and a parallel connected final amplifier stage, which have a total gain of approximately 23 dB. The working point settings for the 2 Stage Amplifier Board are factory set using the potentiometers R32 for Q2, R15 for Q1, and R24 for Q3 and should not be altered. The input RF connects to the first amplifier stage U2, which has a gain of approximately 14 dB. The output is split by U2 and connected to the final amps. The final amplification circuit consists of parallel-connected push-pull LDMOS amplifier circuits Q1 and Q3 operating in class AB each with approximately 14 dB of gain. The board uses a power supply voltage of 28-32V. The RF transistors are operated at a voltage of 24V generated by the voltage regulators U1 for Q1, U5 for Q3 and U6 for Q2, which provide a separate regulated voltage to each transistor. In order to match the LDMOS impedance to the characteristic impedance of the input and output sides, matching networks are located before and after the amplifier circuits. The hybrid coupler U2 splits the input to the parallel amplifiers and the hybrid coupler U4 combines the amplified outputs. The combined output connects through a directional coupler to J1, the RF output jack of the board. The directional coupler provides an RF sample at J3 that is used by an external overdrive protection circuit. The RF output of the board, when used as a driver, has an output power level of 3 Watts maximum 8-VSB with approximately 1.8 Amps total current draw from the power supply. The board can also be used as the final output stage in a transmitter with the amplifier generating 6 Watts maximum 8-VSB. In the transmitter, the output of the 2 Stage UHF Amplifier Board at J1 connects to the RF input of the RF Module Pallet.

8.4.1.8 (A6-A2) RF Module Pallet w/Philips Transistors (1300116)

The RF Module Pallet w/Philips Transistors (1300116) is made from a RF Module Pallet w/o Transistors (1152336). The amplifier is capable of delivering a maximum output power of 100-Watts peak, with an amplification factor of approximately 13 dB. The amplification circuit consists of push-pull amplifier blocks V1 and V2, connected in parallel and operating class AB. In order to match the impedance of the transistors to the characteristic impedance of the input and output sides, matching networks are placed ahead and behind the amplifier blocks. Transformers Z3 and Z4 at the input to V1 and V2 and Z5 and Z6 at the output of V1 and V2 serve to balance the input and output signals. The paralleling circuit is achieved using the 3-dB input coupler Z1 and the second part of Z1, which is the 3-dB output coupler. The working point settings of the amplifier circuits are factory implemented by means of the potentiometers R9, R11, and R12 and should not be altered. The combined output of Z1 connects to the RF output jack of the board, which is cabled to J2 the output jack of the assembly. The output of the amplifier assembly at J2 connects to the input jack J1 of the output detector board.

8.4.1.9 (A8) Control Card, Innovator CX (1312543)

The Innovator CX control board provides the overall system control for the CXB system. There are two main elements of the board, U7 and U9. U7 is a programmable logic device that is loaded with firmware, which provides the overall system control. It decides whether or not to allow the system to generate RF output power, and turns the +32 VDC power supply on and off depending on whether or not it is receiving any faults, either faults generated on board, or faults generated externally. The second major component of the board is the microcontroller U9, which controls the front panel indications and drives the display. The U9 microcontroller is not involved in the decision making process, U7 does that. Rather, it is layered on top of U7 and is the EPLD's interface to the outside world. Information is passed between the microcontroller and the EPLD. The microcontroller communicates information to and from the front panel and sends the EPLD the information it needs to decide whether or not to allow the system to turn on. The front panel viewable LEDs DS3 for Operate/Standby and DS4 for Status indicate the current operating condition of the system are mounted on and controlled by this board. The U9 microcontroller can also communicate, using the Optional Ethernet Kit, with a daughter card that allows the user to view remote control parameters via a web Ethernet interface.

The ±12 VDC and +5 VDC from the (A9) power supply and the +32 VDC from the (A10) power supply are routed to the other boards in the tray through this board. The +32 VDC power supply operates all the time, and connects the +32 VDC to the board at J19-1, 2, & 3 with 5 common. Q13 on the control board is turned on and off to gate the +32 VDC, which connects through J19-6, 7 & 8, to the RF output stages.

The ±12 VDC and +5 VDC input voltages to this board is connected through J21 and filtered before being connected to the rest of the board. +12 VDC connects through J21-1, +5VDC through J21-2 & 3, and -12 VDC through J21-6. Common connections for the input voltages are connected to J21-4 & 5. The ±12 VDC and +5 VDC are used on this board and also routed to the other boards in the tray through this board. The +3.3 VDC for the microcontroller and programmable logic array, mounted on the board, is provided by the voltage regulator IC U6 from the filtered +5 VDC input. The output of U6 can be adjusted to +3.3 VDC using R120.

8.4.1.10 (A7) Output Detector Board (1308685 or 1312207 in the CU100BTD/BRD)

The (1308685 and 1312207) output detector boards are identical in operation except the (1312207) board can be used as either an average, for digital, or peak, for analog, detector board using jumpers on J5 and J6. The (A7) Output Detector Board provides forward (2V=100%) and reflected (2V=25%) power samples to the CU Control Board for metering and monitoring purposes. R7 is the reflected power calibration pot and R23 is the forward power calibration pot. A Forward power sample, -10 dBm, connects to J4 on the board, which is cabled to the front panel sample jack of the tray. The RF output of the board, typically +46 dBm, is at J2, which is cabled to J9 the RF Output Jack of the tray.

8.4.5 AC Input

The 230VAC, needed to operate the tray, connects through the AC power cord at J6, the power entry module located on the rear panel of the tray. An On/Off 10A/250VAC circuit breaker is part of the power entry module. With the circuit breaker switched On, the (L) line input is wired to F1 a 20 Amp fuse for over current protection. The AC lines are connected to terminal block TB1, which distributes the AC to (A9 and A10) the two DC power supplies. Voltages for the operation of the boards in the tray are generated by (A9) a +5VDC and ±12VDC power supply and (A10) a +32VDC power supply. There are two varistors, mounted on TB1, connected from the line input to neutral and to ground for surge protection. The AC also connects to the (A11) fan mounted on the rear panel of the tray. The fan will run when AC is applied to the tray. The +5VDC and ±12VDC outputs of the (A9) power supply connects to the terminal block (TB2) that distributes the DC to the boards in the tray. Some of the +5VDC and ±12VDC outputs connect directly to the 8 VSB Demodulator and 8 VSB Modulator boards while the other outputs connect through the transmitter's Control Board to the IF Pre-corrector, the Digital Upconverter, the ALC, the Amplifier Assembly and the Output Detector Boards. The +32VDC power supply outputs connect to the (A8) Control Board, which then supplies the switched +32VDC to the (A6) Amplifier Assembly.

8.4.6 Control & Status

Table 1: Transmitter LCD Display

DISPLAY	FUNCTION
LCD	Provides a two-line readout of the input received channel, internal functions, status, and fault conditions.

The front panel has seven pushbuttons for the two for the control of the transmitter and five for control of the displayed menus.

Table 2: Transmitter Control Pushbuttons

PUSHBUTTON	FUNCTION
OPR	When pushed switches the transmitter to Operate.
STBY	When pushed switches the transmitter to Standby.
ENTER	Selects the changes made in the menus and submenus.
Left & Right Arrow	Scrolls through the main menus
Up & Down Arrow	Scrolls through submenus of the main menu when they are present.

Table 3: Transmitter Status and Operate/Standby Indicators

LED	FUNCTION
OPERATE/STANDBY (Green/Amber)	A **Green** LED indicates that the system is in Operate. An **Amber** LED indicates that the system is in Standby.
STATUS (Green/Red/ Amber)	A **Green** LED indicates that the system is functioning normally. A flashing **Red** LED indicates a fault is occurring at this time. An **Amber** LED indicates a fault occurred in the past but the system is now operating normally.

8.4.7 Input and Output Connections

The input connections to the transmitter are made to the jacks mounted on the rear of the tray. The tray accepts an On Channel RF signal at J1, the RF input jack, and outputs a digital RF ON Channel signal at J9, the RF Output Jack. A 10 MHz reference input connects to J3 on the tray. Refer to Figure 2 and to Table 4 that follow for detailed information.

Table 4: Rear Chassis Connections for the Driver.

Port	Type	Function	Impedance
J1	BNC	Input A: On Channel RF Input (BRD) –78 to –8 dBm or SMPTE-310 Input (BTD)	50 Ohms
J2	BNC	Input B: On Channel RF Input (BRD) –78 to –8 dBm or SMPTE-310 Input (BTD)	50 Ohms
J6	BNC	10 MHz Input: Optional External 10 MHz Reference Input	50 Ohms
J7	BNC	1 PPS Input: Optional External 1 PPS Reference Input	50 Ohms
J9	N	RF Output: On Channel RF Output	50 Ohms
J10	IEC	AC Input: AC input connection to 85-264VAC Source and On/Off circuit breaker	N/A
J11	9 Pos Male D	External Amplifier: Interface to System and external amplifier trays, if present. Also provides two interlocks, one for RF System and one for Reject Load. If the interlocks are not used, jumpers from J11-5 to J11-9, ground, for RF system Interlock and from J11-6 to J11-9 are needed to allow the transmitter to go to operate.	N/A

Port	Type	Function	Impedance
J12	15 Pos Female D	Remote: Remote control and status indications	N/A
J13	RJ-45	Serial: Provides communication to System and to external amplifier trays, if present.	N/A
J14	RJ-45	Ethernet: Optional Ethernet connection. May not be present in your tray.	N/A
J15 Front Panel	BNC	RF Sample: Output Sample from Output Detector Board. In a CU50, the sample level at J15 is approximately 60dB down from the output power level of the tray.	50 Ohms
J16 Front Panel	9 Pos Female D	Serial: Used to load equalizer taps into the modulator.	N/A

Table 5: Rear Chassis Connections for the Power Amplifier.

Port	Type	Function	Impedance
J1	N	RF Input: On Channel RF from CU driver tray	50Ω
J2	7/16” (1.1cm) Din	RF Output: On Channel RF Output	50Ω
J3	IEC	AC Input: AC input connection to 230VAC Source	N/A
J4	9 Pos D	Remote: Amplifier Control Interface (Connects to J11 on the driver tray)	N/A
J5	RJ-45	Serial data	N/A
J8 Front Panel	BNC	RF Sample: Output Sample from Combiner thru Control Board. In a CU500, the sample level is approximately 70dB down from the output power level of the tray.	50Ω

8.4.8 Remote Connections

The remote connections for the transmitter are made to the Remote 16 Pos “D” connector Jack J5 located on the rear panel of the tray.

Table 6: Remote Connections to J5 for the transmitter.

Signal Name	J5 Pin Designations	Signal Type/Description
RMT Transmitter Operate	1	Discrete Open Collector Input - A pull down to ground on this line indicates that the transmitter is to be placed into the operate mode.
RMT Forward Power	2	Analog Output - 0 to 4.0 V- This is a buffered loop through of the calibrated “System Forward Power ”. Indicates the transmitter's Forward power. Scale factor is 100 % / 3.2V.
RMT Transmitter Standby	3	Discrete Open Collector Input - A pull down to ground on this line indicates that the transmitter is to be placed into the standby mode.
Ground	4,8,9,10 & 14	Ground pins available for remote

Signal Name	J5 Pin Designations	Signal Type/Description
RMT RF System Interlock	5	When this signal's circuit is completed to ground, the transmitter is allowed to operate. If this circuit is opened, the transmitter switches to Standby.
RMT Reflected Power	6	Analog Output - 0 to 4.0 V- This is a buffered loop through of the calibrated "System Reflected Power ". Indicates the transmitter's Reflected power. Scale factor is 100 % / 3.2V.
RMT Fault Reset	7	Discrete Open Collector Input - A pull down to ground on this line indicates that any transmitter Faults are to be reset.
RMT Operate Status	11	Discrete Open Collector Output - A low indicates that the Transmitter is in Operate.
RMT Fault	13	Discrete Open Collector Output - A low indicates that the Transmitter has a Fault.
RMT Input Fault	15	Discrete Open Collector Output - A low indicates that the Transmitter has an Input Fault.
Not Used	16	N/A

8.4.9 Front Panel Screens

A LCD display located on the front of the transmitter displays the current operating status of the transmitter. The screens are scrolled through using the buttons to the right of the display. The Left & Right Arrows scroll through the Main Menus, which are shown below aligned on the left side. The Up & Down Arrows scroll through the Submenus of the Main Menus, when they are present, which are shown below indented under the Main Menu in which they are contained. The ENTER button selects the changes made. Please refer to the Users Manual for more information regarding front panel screens.

8.5.1 Power Amplifier Tray

8.5.1.1 (A7) Amplifier Control Board (1312260)

The Amplifier Control Board uses a Programmable logic device to control the amplifier tray. It takes an enable signal from an external driver tray, and turns the power supplies on whenever the driver has told it to turn on, unless it detects faults internal to the tray. The board monitors the forward and reflected power, the heatsink temperature, the pallet currents, and the power supply voltage and will generate alarm signals if any of those parameters exceed safe limits. The amplifier tray has no front panel display other than a two LEDs, one for Status and one for Enable. The board sends all its output information, including the forward and reflected levels, back to the driver tray, through J4, so the information can be displayed on that tray's LCD Display. The board will generate a Red Blinking Status LED if it detects an alarm, fault, prompting the operator to look at the LCD display on the driver tray to see what fault has occurred.

The +5 VDC inputs to this board are routed through J4 and J5. The +5 VDC inputs are diode Or connected so that either the +5VDC from the (A8) power supply or the +5VDC from the (A9) power supply will operate the board. The +5VDC is split with one output connected to U1 a voltage regulator IC, which provides +5V and

+5V_ANALOG as outputs. The +5 VDC is filtered before being connected to the rest of the board. The other +5 VDC output is connected to the regulator IC U2 that supplies +3.3 V to the microcontroller and programmable logic array.

8.5.1.2 (A10) Current Metering Board (1309130)

The current metering board measures the current into the RF output amplifier pallets and supplies this value to the control board. In the CU500 amplifier tray, there are four sensing circuits which are used. Each circuit has two parallel .01Ω series current sensing resistors and a differential input IC that supplies a voltage output that is proportional to the current for metering purposes. The +42VDC from the (A8) power supply connects to TB2 and TB4 on the board. The +42VDC from the (A9) power supply connects to TB8 and TB10 on the board. The +42VDC input at the TB2 input senses the current to the (A1) 878 output amplifier pallet through TB1 on the board. The +42VDC input at the TB4 input senses the current to the (A2) 878 output amplifier pallet through TB3 on the board. The +42VDC input at the TB8 input senses the current to the (A3) 878 output amplifier pallet through TB7 on the board. The +42VDC input at the TB10 input senses the current to the (A4) 878 output amplifier pallet through TB9 on the board.

The four sensing circuits are identical only one will be described. For the (A1) 878 amplifier pallet, the +42VDC from the (A8) switching power supply connects to TB2. R1 and R2 are the parallel .01Ω current sensing resistors which supplies the voltage values to the U1 current sense amplifier IC. R11 is a gain adjust, which is adjusted to eliminate any rSense Error and to place the OpAmp output at 2.61V for 40Amps sense as measured at TP3. The current sense output at J1-1 connects to the (A7) control board for metering purposes.

8.5.1.3 (A5) 4 Way Splitter Board (1308933)

The 4 way splitter board takes the RF Input at J1 (≈11Watts ATSC) on the board and splits it into four equal outputs (≈4.75Watts ATSC) that connect to the inputs of the four 878 amplifier pallets at J1.

8.5.1.4 (A1-A4) 878 Amplifier Pallets (1310138)

There are four 878 Amplifier Pallets mounted on the 500 Watt Amplifier Heatsink Assembly. Each of the 878 pallets has approximately +16dB of gain for the UHF frequency range of 470 to 860 MHz. The pallets operate Class AB and generate 150 Watts ATSC with an input of 4.75 Watts ATSC.

8.5.1.5 (A6) 4 Way Combiner Board (1312368)

The 4 way combiner board takes the four RF Inputs at J4, J5, J6 & J7 (≈150Watts ATSC) on the board and combines them to a single output (≈500Watts) at J1 that connects to J2 the 7/16” (1.1cm) Din RF output jack of the tray.

8.5.1.6 (A8 & A9) 250 Watt and 500 Watt Amplifier Tray Power Supplies

The 230VAC, needed to operate the tray, connects through the AC power cord at J3, the power entry module located on the rear panel of the tray. In the 500W amplifier tray, there are two On/Off 20A/250VAC circuit breakers that are mounted on the back panel of the tray on either side of J3 the AC input jack. The AC lines are connected to a terminal block TB1. With the circuit breakers switched On, the AC is distributed to the two (A8 and A9) DC power supplies. TB1 has three varistors (VR1-VR3) connected across the AC input lines for surge and over voltage protection. The AC input from TB1 also connects to through 2 amp fuses to the two fans (A11 & A12) mounted in the tray. Both fans will run immediately when AC is applied to the tray.

The +5VDC for the operation of the amplifier control board in the tray is generated by the (A8 & A9) power supplies at J1-9 on each power supply. The +5VDC from the (A8) power supply connects to J4-8 and the +5VDC from the (A9) power supply connects to J5-8 on the control board. The +5VDC is produced when AC is connected to the tray and the CB1 and/or the CB2 circuit breakers are turned On. Either or both power supplies provides the +5VDC for use by the control board.

The +42VDC needed by the amplifier modules on the heatsink assembly is generated by the (A8 & A9) power supplies. The power supplies will operate when AC is connected to the tray, the CB1 circuit breaker for the (A8) power supply and the CB2 circuit breaker for the (A9) power supply, are turned On and a Low is provided on the Inhibit Line that connects to J1-6 on the power supplies from the control board. The CB1 circuit breaker supplies the AC to the (A8) power supply which provides the +42VDC to the (A1) and (A2) 878 amplifier pallets. The CB2 circuit breaker supplies the AC to the (A9) power supply which provides the +42VDC to the (A3) and (A4) 878 amplifier pallets.