7. PARTS LIST/TUNE-UP INFO

7.1 Parts List

The transmitter, can be subdivided as follows:

DM8 Modulator Tray:
-Digital Modulator Board

UHF Exciter Tray:
-Delay equalizer board
-ALC board
-IF phase corrector board
-UHF upconverter board
-UHF Generator Board
- PLL Board
-Transmitter control Board
-Power supply board

Amplifier Tray (x2):
-Variable gain/phase board
-1 watt UHF amplifier board
-UHF filter
-Single stage amplifier assembly, class A
-Coupler board assembly
-Dual stage amplifier assembly, class AB
-4 Way splitter assembly
-Dual stage amplifier assemblies, class AB
-4 Way combiner assembly
-Circulator
-Dual peak detector board
-Amplifier protection board
-Amplifier control board
-Switching power supply

7.2 Tune-up Information

7.2.1 Digital Modulator Tray

The digital modulator receives an external SMPTE-310 MPEG stream input and provides a 44 MHz IF output to the UHF Exciter Tray. There are no internal user adjustments.

7.2.2 UHF Exciter Tray

The Exciter Tray has been factory tuned and should need no alignment to achieve normal operation. The UHF exciter tray operates using the digital IF output from the DM8-R modulator or other digital IF source. The digital IF connects to J6 on the rear of the UHF exciter, which is cabled to the delay equalizer board, and then to the IF relays on the ALC board.

7.2.2.1 Delay Equalizer Board

The procedure for performing a delay equalization adjustment for the UHF exciter tray is described in the following steps:

1. Set J19 to the proper position (for either a 50-Ω or 75-Ω input) and monitor the output of the board at J10 with a spectrum analyzer.

2. Bypass all attenuation and equalizer sections, except delay equalizer #1. With W12 removed, tune L30 for the proper center frequency as shown in Table 5-2. Install W12 on J22 and adjust L21 and C43 for the best frequency response across the band. Jumper in attenuator equalizer #1.

3. Pull W14 from J26 and adjust L29 for the proper center frequency. Install W14 and adjust L18 for the best frequency response.

4. Repeat Steps 2 and 3 for each delay/attenuation equalizer while tuning the proper inductor for each section.

5. After all five delay/attenuation equalizers have been adjusted, individually jumper in all of the sections and fine tune, as needed, for the best group delay and frequency response.

7.2.2.2 IF Phase Corrector Board

As shipped, the exciter was preset to include linearity (gain vs. level) and phase pre-distortion. The pre-distortion was adjusted to approximately compensate the corresponding non-linear distortions of the amplifier trays.

Locate (A9) the IF phase corrector board (1227-1250) mounted in the UHF exciter tray. Because the amplitude correction portion of the board is not utilized in this configuration, the jumper W3 on J10 should be in the disable position and R35 and R31 should be fully counter-clockwise (CCW). R68 is the range adjustment and should be set in the middle. The phase correction enable/disable jumper W2 on J9 should be in the Enable position to ground.

Set up a spectrum analyzer with 30 kHz resolution bandwidth and 30 kHz modulation bandwidth to monitor the intermodulation products of the RF output signal. There are three corrector stages on the IF phase corrector board, each with a magnitude and a threshold adjustment which are adjusted as needed to correct for any intermod problems. Adjust the R3 threshold for the cut in point of the correction and the R7 magnitude for the amount of the correction that is needed. The jumper W1 on J8 is set to give the desired polarity of the correction shaped by the threshold R11 and magnitude R15 adjustments. After setting the polarity, adjust the R11 threshold for the cut in point of the correction and the R15 magnitude for the amount of the correction that is needed. Finally, adjust the R19 threshold for the cut in point of the correction and the R23 magnitude for the amount of the correction that is needed. The above pots are adjusted for the greatest separation between the digital signal and the intermod at the channel edges.

7.2.2.3 UHF Upconverter Board

W1 on J10 in Manual. R10 is a gain control which is adjusted to give approximately +17 dBm Output at J5 of the Board with 0 dBm of IF into it.

7.2.2.4 UHF Generator Board

The UHF generator board is mounted in the UHF generator enclosure. This procedure should be performed to align this board.

In the Manual Adjust Set Up position, W1 on J4 between Pins 2 & 3, on (A13) the PLL board (1286-1104), adjust R12 for
–2.5 volts at J6 pin 2.

Connect J1, the sample output of the section of the UHF generator board, to a spectrum analyzer, tuned to the crystal frequency, and peak tuning capacitors C6 and C18 for maximum output. Also tune L2 and L4 for maximum output. The output level should be about +5 dBm. The channel oscillator should maintain an oven temperature of 50° C.

If a spectrum analyzer is not available, connect a digital voltmeter (DVM) to TP1 on the UHF generator board. Tune capacitor C32 for maximum voltage at TP1.

Connect J2, the sample output of the channel oscillator, to a suitable counter and tune C11, the coarse adjust, to the crystal frequency. The fine frequency is controlled by the external PLL circuit when in the Auto mode.

Caution: Do not re-peak C32. This can change the output level.

Connect a spectrum analyzer to J2, the output jack of the board.

Tune C32, C34, C38, C40, C44, and C46 for maximum output. Re-adjust all of the capacitors to minimize the seventh and the ninth harmonics of the channel oscillator frequency. They should be down at least -30 dB without affecting the output of the UHF generator board.

If a spectrum analyzer is not available, a DC voltmeter can be used. When a voltmeter is used, the harmonic frequencies must be minimized to prevent interference with other channels.

While monitoring each test point with a DC voltmeter, maximize each test point by tuning the broadband multipliers in the following sequence:

- Monitor TP1 with a DVM and tune C32 for maximum (typical 0.6 VDC).
- Monitor TP2 and tune C34 and C38 for maximum (typical 1.2 VDC).
- Monitor TP3 and tune C40 and C44 for maximum (typical 2.0 VDC).
- Monitor TP4 and tune C46 for maximum.
- Re-peak C40 and C38 while monitoring TP4 (typical 3.5 VDC).
- The typical output level is +15 dBm.

7.2.2.5 PLL Board

Check that Jumper W1 on J4 is between Pins 2 and 3 and that R12 is adjusted for –2.5 volts at J6-2. Adjust C11 on the (A15-A1) UHF generator board (1565-1109) for the correct channel oscillator frequency. Monitor J10 on the board. Install jumper W1 between J4-1 and J4-2. With switches SW1, SW2, and SW3 in the positions shown in Table 5-5 (refer to the PLL board schematic [1286-3104]), the PLL Unlock LED should go out.

7.2.2.6 Transmitter Control Board

The board has calibration and fault threshold adjustments, which are set up during System alignment, refer to the System Section for Calibration of the Front Panel Meter and the set up of the fault thresholds.

7.2.2.7 +12VDC(4A)/-12VDC(1A) Power Supply Board

The board has no adjustments.

DS1 will be lit if a +12 VDC output is connected to J6. DS2 will be lit if a +12 VDC output is connected to J3. DS3 will be lit if a +12 VDC output is connected to J4. DS4 will be lit if a +12 VDC output is connected to J5. DS5 will be lit if a -12 VDC output is connected to J7 and J8.

This completes the Detailed Alignment Procedure for the UHF Exciter Tray.

7.2.4 UHF Amplifier Tray

The Tray has been adjusted at the factory to meet all specifications, including Phase Adjustment with the other UHF Amplifier Trays in the Transmitter and should not need adjusted to attain normal operation. During adjustments of the Amplifier Boards, S1 on the Amplifier Control Board should be in the Manual Gain position. Normal operation of the Tray is in the Auto position.

7.2.4.1 Variable Gain/Phase Board

The board is mounted in the Variable Gain/Phase Enclosure.

This board contains no adjustments and has an AGC adjustable gain of 0 - 20 dB.

7.2.4.2 – 1-Watt UHF Amplifier Board

The board is mounted in the 1-Watt UHF Amplifier Enclosure. This board has approximately 10 dB of gain and contains no adjustments.

7.2.4.3 UHF Filter

Apply a multi-burst test signal to the Transmitter. Monitor J2 with a Spectrum Analyzer and tune C1 and C3 for peak output with a flat frequency response.

7.2.4.4 Single Stage Amplifier Assembly, Class A

Made from the Generic Single Stage Amplifier Board, Class A.

This board operates Class A and has a gain of approximately 11 dB. The Bias of the Transistor is set by the on board biasing circuit. Adjust R6 for 5 Amps of idle current, no RF Drive applied. Connect a Voltage Meter across E1 and E2 on the Amplifier Protection Board and switch S1 to the I1 Position and adjust R6 for a reading of 50 mV. Connect a Sweep Test Signal to J1 the RF Input Jack of the UHF Amplifier Tray and monitor the output of the Board at J2 with a padded input Spectrum Analyzer. Tune Capacitors C5 for peak output then tune C6 for peak output power with a flat frequency response at J2.

7.2.4.5 Coupler Board Assembly

This board contains no adjustments.

7.2.4.6 Dual Stage Amplifier Assembly, Class AB

Made from the Generic Dual Stage Amplifier Board, Class AB.

This board operates Class AB and has a gain of approximately 9 dB. The Biases of the transistors are set by the on-board biasing circuits. Adjust R106 and R206 for 300 milliamps of idle current per side, no RF Drive applied. Connect a Voltage Meter across E1 and E2 on the Amplifier Protection Board and switch S1 to the I3 Position and adjust R106 for a reading of 3.0 mV. Switch S1 to the I2 Position and adjust R206 for a reading of 3.0 mV. These transistors may have 600 mA of bias depending on the linearity of Tray. Connect a Sweep Test Signal to J1, the RF Input Jack of the UHF Amplifier Tray, and monitor the output of the Board at J2 with a padded input Spectrum Analyzer. Tune Capacitors C105 and C205 for peak output, then tune C119 and C219 for peak output with a flat frequency response and minimum current at J2.

7.2.4.7 - 4 Way Splitter Assembly

This board contains no adjustments.

7.2.4.8 Dual Stage Amplifier Assemblies, Class AB

Each Board is made from a Generic Dual Stage Amplifier Board, class AB. These boards Operate Class AB and have a gain of approximately 9 dB. The Idling Current for each of the Transistors is set to 300 mA.

To adjust the Idling Currents, no RF applied to the Tray, of the Devices on (A5-A2). Connect a Voltage Meter across E1 and E2 on the Amplifier Protection Board and switch S1 to the I5 Position and adjust R106 for a reading of 3.0 mV. Switch S1 to the I4 Position and adjust R206 for a reading of 3.0 mV.

Connect a Sweep Test Signal to J1 the RF Input Jack of the UHF Amplifier Tray. On the (A5-A2) Amplifier Board tune Capacitors C105 and C205 for peak output power then tune C119 and C219 for peak output power with a flat frequency response and minimum current.

To adjust the Idling Currents, no RF applied to the Tray, of the Devices on (A5-A3). Connect a Voltage Meter across E1 and E2 on the Amplifier Protection Board and switch S1 to the I7 Position and adjust R106 for a reading of 3.0 mV. Switch S1 to the I6 Position and adjust R206 for a reading of 3.0 mV.

Connect a Sweep Test Signal to J1 the C219 for peak output power with a flat frequency response and minimum current.RF Input Jack of the UHF Amplifier Tray. On the (A5-A3) Amplifier Board tune Capacitors C105 and C205 for peak output power then tune C119 and C219 for peak output power with a flat frequency response and minimum current.

To adjust the Idling Currents, no RF applied to the Tray, of the Devices on (A5-A4). Connect a Voltage Meter across E1 and E2 on the Amplifier Protection Board and switch S1 to the I9 Position and adjust R106 for a reading of 3.0 mV. Switch S1 to the I8 Position and adjust R206 for a reading of 3.0 mV.

Connect a Sweep Test Signal to J1 the RF Input Jack of the UHF Amplifier Tray. On the A5-A4 Amplifier Board tune Capacitors C105 and C205 for peak output power then tune C119 and C219 for peak output power with a flat frequency response and minimum current.

To adjust the Idling Currents, no RF applied to the Tray, of the Devices on (A5-A5). Connect a Voltage Meter across E1 and E2 on the Amplifier Protection Board and switch S1 to the I11 Position and adjust R106 for a reading of 3.0 mV. Switch S1 to the I10 Position and adjust R206 for a reading of 3.0 mV.

Connect a Sweep Test Signal to J1 the RF Input Jack of the UHF Amplifier Tray. On the (A5-A5) Amplifier Board tune Capacitors C105 and C205 for peak output power then tune C119 and C219 for peak output power with a flat frequency response and minimum current.

7.2.4.9 - 4 Way Combiner Assembly

Contains a 4 Way Combiner Board. There are no adjustments on this board.

7.2.4.10 Circulator

There are no adjustments to the circulator.

This board contains no adjustments.

7.2.4.11 Dual Peak Detector Board, Single Supply

The Dual Peak Detector Board is mounted in a Dual Peak Detector Enclosure.

This board contains no adjustments.

7.2.4.12 Amplifier Protection Board

This board contains no adjustments.

7.2.4.13 Amplifier Control Board

To check the operation of the overdrive circuit, increase the gain pot of the UHF amplifier tray to approximately 110%. The Overdrive LED DS2 should light and the output power should not increase above the 110% level. If the LED does not light, adjust R71 the overdrive threshold as needed until the LED lights.

7.2.4.14 Pioneer Magnetics +26.5V/2000W Switching Power Supply

This Switching Power Supply contains no customer repairable items, if the Power Supply should malfunction, do not attempt to repair the power supply without first consulting Axcera Field Support Dept. The Power Supply is adjusted to provide +26.5 VDC output.

7.2.4.15 Calibration of Output Power and VSWR Cutback

To calibrate the forward output power reading of the tray. Place a calibrated coupler, average power wattmeter and dummy load of at least 300 watts at the output of the tray that is to be calibrated. Switch the front panel meter to the % Output Power position. Preset R16, manual gain, on (A8) the amplifier control board fully CCW. Move switch S1 on the amplifier control board to the Manual position. Insert a digital test signal and adjust R16 for 300 watts 64 QAM or 8-VSB digital on the wattmeter. Calibrate the front panel output power meter to 100% by adjusting the pot, R2, forward calibration, located on the amplifier control board. The forward output power reading of the tray is now calibrated.

To calibrate the reflected output power reading and VSWR cutback of the tray. Reduce manual gain pot R16 to a 50% reading on the front panel meter in the % Output Power position. Turn off the tray. Remove the load from the output of the tray and switch the front panel meter to the Reflected Output Power position. Switch on the tray. Adjust reflected power adjust pot R22 on the amplifier control board to a 50% reading. Then adjust R29, the VSWR threshold cutback pot, on the amplifier control board until the VSWR Cutback LED DS1 on the front panel just lights. This sets up the VSWR cutback circuitry.

After this calibration is completed, reconnect the tray to the system and move switch S1 on the amplifier control board to the Automatic Gain Control position. This is the normal operating position for the switch.

The UHF amplifier tray is now aligned, calibrated, and ready for normal operation. Repeat as needed for the other Amplifier Trays in the System

7.2.4.16 Calibration of the Forward Output Power Level of the Transmitter

Note: - Perform the following only if the power calibration is suspect.

Set the Transmitter up for the appropriate Average Output Power Level.

Using a calibrated coupler on the combined RF output line and an HP power meter (or an equivalent Masurement instrument), adjust the output power for a reading of 2000, 2500 or 3000 watts on the true average power meter. Adjust R28 on (A10) the visual/aural metering board in the metering panel for 100% in the % Combined Output Power position. Set pot R20 on (A10) the visual/aural metering board full CCW.

7.2.4.17 Calibration of the Reflected Output Level of the Transmitter

Turn the Power Adjust Pot on the UHF Exciter to 20% on the Metering Panel Combined Meter in the Visual Power position. **NOTE**: Check that the Jumper is in Manual on the UHF Upconverter Board (1265-1310) in the UHF Exciter.

On (A11) the Output Coupler for the Transmitter, move the cable on J6 to J5 and the Termination on J5 to J6. Adjust R10 on the (A7) Dual Peak Detector Board (1159965), in the Metering Panel, for a 20% reading in the Combined Reflected Power position. At this 20% Reference Power reading, the VSWR LED mounted on the front panel of the UHF Exciter should be illuminated. If not adjust R19 on the Detector Threshold Board, in the Metering Control Panel, until the VSWR LED just turns On. Turn the Power Adjust pot slightly CCW and the LED should go out, turn the pot CW until the LED just turns On. The Reflected Output Power is now calibrated. Switch the Transmitter to Standby. Move the cable on J5 to J6 and the Termination on J6 back to J5. Switch the Transmitter to Operate and adjust the front panel power pot for 100% Power reading on the Combined Meter.