7. PARTS LIST/TUNE-UP INFO

7.1 Parts List

The transmitter, can be subdivided as follows:

Exciter Tray:

- Modulator Module
- IF Processor Module
- VHF/UHF Upconverter Module
- Control & Monitoring / Power Supply Module
- Power Amplifier Module

External Amplifier Trays (Qty of 5):

- 4-Way Splitter (Qty of 5)
- Power Amplifier Module (Qty of 20)
- Power Supply Module (Qty of 10)
- 4-Way Combiner (Qty of 5)

Optional Exciter Switcher Assembly

7.2 Tune-up Information

The LU5000AT transmitter was aligned at the factory and should not require additional alignments to achieve normal operation.

7.2.1 Exciter/Amplifier Chassis Assembly

This transmitter takes the baseband audio and video inputs or, if the (Optional) 4.5-MHz composite input kit is purchased, either a single composite video + 4.5-MHz input or separate baseband video and audio inputs, and converts them to the desired UHF On Channel RF Output at the systems output power level.

7.2.2 Modulator Module Assembly

Note: Not present in Translator systems.

The Modulator Assembly has adjustments for video levels and audio modulation levels, and other related parameters.

Connect an NTSC baseband video test signal input (1 Vpk-pk) to the transmitter video input jack J7 on the rear of the tray. Jacks J7 and J17 are loop-through connected; the J17 jack can be used as a video source for another transmitter. Connect a baseband audio input (+10 dBm) to the balanced audio input terminal block TB02-1 [+], TB02-2 [-], and TB02-3 [ground] or, if stereo/composite audio is provided, connect it to BNC jack J3, the composite audio input jack.

Verify that all LEDs located on the front panel of the Modulator are Green. The following details the meaning of each LED:

AURAL UNLOCK (DS5) – Red Indicates that 4.5 MHz Aural IF is unlocked from the Nominal 45.75 MHz visual IF.

VISUAL UNLOCK (DS6) – Red Indicates that the Nominal 45.75 MHz visual IF is unlocked from the 10 MHz reference.

AUDIO OVER DEVIATION (DS4) – Red Indicates that the input Audio level is too high. (±75 kHz max)

VIDEO LOSS (DS1) – Red Indicates that the input Video level is too low.

OVER MODULATION (DS3) – Red Indicates that the input Video level is too high.

ALTERNATE IF (DS7) – Red Indicates that an external Nominal 45.75 MHz IF is not present to the modulator.

10 MHz PRESENT (DS2) – Red Indicates that an external 10 MHz reference is not present to the modulator.

Look at the front panel LCD meter on the Control/Power Supply Module Assembly. Set the LCD screen to the Modulator Details video output level screen, the screen indicates active video from 0 to 1 Vpk-pk. The normal video input level is 1 Vpk-pk on the front panel screen. If this reading is not at the proper level, the overall video level can be changed by adjusting the VIDEO LEVEL control R42 on the front panel of the Modulator to the 1 Vpk-pk level on the front panel screen.

Note: An NTSC or FCC composite signal should be used for video metering calibration.

Switch the LCD display to the Modulator Details screen that indicates the AUDIO DEVIATION (modulation level) of the signal up to 75 kHz.

Mono Set-up: The modulator was factory set for a ±25-kHz deviation with a mono, balanced, audio input of +10 dBm. If the reading is not at the correct level, adjust the MONO Audio Gain pot R110, located on the front panel of the modulator, as necessary, to attain the ±25-kHz deviation on the front panel screen.

Stereo Set-up: The modulator was factory set for a ±75-kHz deviation with a stereo, composite, audio input of 1 Vpk-pk. If this reading is not correct, adjust the STEREO Audio Gain pot R132, located on the front panel of the modulator, as necessary, for the ±75-kHz deviation.

Secondary Audio Set-up: Note: Remove any stereo or mono audio modulation input to the transmitter during the set up of the secondary audio. The modulator was factory set for a ±15-kHz deviation with a secondary audio input of 1 Vpk-pk. If this reading is not correct, adjust the SAP/PRO Audio Gain pot R150, located on the front panel of the modulator, as necessary, for the ±15-kHz deviation.

7.2.3 If Processor Module Assembly

On the LCD Display, located on the Controller/Power Supply Module, push the button to switch the transmitter to Operate. The setup of the RF output includes adjustments to the drive level of the Power Amplifier, the adjustment of the linearity and phase pre-distortion to compensate for any nonlinear response of the Power Amplifier on the front panel of the IF Processor module.

Verify that all red LEDs located on the IF Processor front panel are extinguished. The following details the meaning of each LED when illuminated:

- DS1 (input fault) – Indicates that either abnormally low or no IF is present at the input of the module.

- DS2 (ALC fault) – Indicates that the ALC circuit is unable to maintain the signal level requested by the ALC reference. This is normally due to excessive attenuation in the linearity signal path or the IF phase corrector signal path, or that switch SW1 is in the Manual ALC Gain position.

- DS4 (Mute) – Indicates that a Mute command is present to the system.

7.2.4 VHF/UHF Upconverter Assembly

Switch the transmitter to Standby. The ALC is muted when the transmitter is in Standby. To monitor the ALC, preset R3, manual gain adjust, on the front panel of the Upconverter module, fully CCW. Move switch SW1, Auto/Man AGC, on the front panel of the Upconverter module, to the Manual position. Place the transmitter in Operate. Adjust the ALC GAIN pot on the front panel of the IF Processor to obtain +0.8 VDC on the LCD Display on the Controller/Power Supply in the ALC screen. Move the MAN/AUTO ALC switch back to Auto, which is the normal operating position.

To adjust the AGC Cutback setting, raise the output power of the transmitter to 110%. Adjust R2, AGC Cutback, located on the front panel, CCW until the LED DS1, AGC Cutback, just starts to flash. Return the output power of the transmitter to 100%.

Switch the transmitter to Operate. Verify that all LEDs located on the front panel of the Upconverter are Green. The following details the meaning of each LED:

PLL 1 FAULT (DS1) - Displays the status of the 1 GHz PLL, Green locked or Red unlocked

PLL 2 FAULT (DS2) **-** Displays status of the 1.1-1.9 GHz PLL, Green locked or Red unlocked
AGC FAULT (DS7) **-** Displays status of AGC, Green normal or Red out of range

AGC OVERRIDE (DS3) **-** Displays status of AGC cutback, either Green normal drive level, no cutback, or too much drive level to driver module, Red cutback.

MANUAL GAIN (DS6) **-** Displays status of the control of the AGC level, either Green normal, AGC Adj. using R6 or Amber manual, Man Gain Adj. using R7.

Setting Up the Drive Level of the Transmitter Procedure:

Setting the Manual AGC

Preset the front panel "Man Gain" pot on the Upconverter full **Counterclockwise**, and the Man/Auto Gain Switch to the **Left, Man.**

NOTE: The MAN/AUTO switch on this upconverter is the opposite polarity to the switch on the old upconverter for the LX transmitter.

Turn the transmitter to Operate, and slowly adjust the Man Gain pot until the desired % output power, as read on the LCD display, has been reached.

The Manual AGC is now set. Normal operation of the Transmitter is in the Auto AGC position.

Setting the Auto AGC

With the transmitter in **Standby**, preset the AGC pot on the Upconverter full **Counterclockwise**. Preset the AGC Cutback pot on the Upconverter full **Clockwise**. Move the Man/Auto Gain Switch on the Upconverter to the **Right, Auto**. Switch the transmitter to **Operate** and slowly adjust the AGC pot until the desired output power has been reached.

Monitor the output of the transmitter with a Spectrum Analyzer and turn the power up 1 dB higher than desired using the AGC pot. Enter the Transmitter Set-Up menu on the LCD Control Panel and step through the screens until the screen labeled "Inner Loop Gain" is reached. The inner loop is adjustable from 0-255. Use the **+** button to increase the Inner Loop Gain until the power on the spectrum analyzer just begins to decrease. Use the **–** button to decrease the inner loop gain by 10%. (If it begins to affect power at setting 160, drop it back down to 160-16=144, if it affects power at 100, drop it down by 10 to 90, etc….).

Slowly turn the AGC Cutback Pot **Counterclockwise** until the AGC Override light begins to flicker, and the output power begins to drop. Turn the pot **Clockwise** slightly, so the light just goes out and the power stabilizes. Turn the AGC pot down to get back to the desired % output power level.

The Auto AGC is now set. Normal operation of the Transmitter is in the Auto AGC position.

Changing the Transmitter Channel Procedure:

Place the transmitter in Standby and go to the Set Up Menu, Transmitter Configuration Access Screen, on the LCD Display. Step through the screens until the screen labeled "Upconverter CH xx" is reached, where xx is the current channel that the upconverter is on. The channel number should be blinking.

To change the channel, hit the **+** button to step through the channels until the desired channel is reached.

To select a 10kHz offset to the channel frequency, use the **>** button to move the curser to the LO frequency listed below the Channel number, and keep pressing the **>** button until the desired digit is blinking, and then use the **+** button to change the frequency.

Example:

Nominal LO frequency for Channel 14 = 0517.00 MHz. To generate a + offset, change the LO frequency to 0517.01 MHz. To generate a – offset, change the LO frequency to 0516.99 MHz.

7.2.5 Linearity Correction Adjustment

As shipped, the exciter was preset to include amplitude and phase pre-distortion. The pre-distortion was adjusted to approximately compensate the corresponding non-linear distortions of the Power Amplifier.

NOTE: On the IF processor board inside the module the correction enable/disable jumper W12 on J30 will be in the Enable position, on pins 2 & 3.

Set up a spectrum analyzer with 100 kHz resolution bandwidth and 100 kHz video bandwidth to monitor the intermodulation products of the RF output signal of the Power Amplifier. There are three Linearity Corrector stage adjustments located on the front panel of the IF Processor Module. The adjustments are threshold settings that are adjusted as needed to correct for any amplitude or phase intermod problems. Adjust the top linearity correction adjustment R211 threshold cut in for the in phase amplitude distortion pre-correction that is needed. Next adjust the middle linearity correction adjustment R216 threshold cut in also for the in phase amplitude distortion pre-correction that is needed. Finally adjust the bottom linearity correction adjustment R231 threshold cut in for the quadrature phase distortion pre-correction that is needed. The above pots are adjusted for the greatest separation between the peak visual carrier and the intermod products.

7.2.6 Frequency Response Delay Equalization Adjustment

The procedure for performing a frequency response delay equalization adjustment for the transmitter is described in the following steps:

The center frequency for the first stage is 45 MHz. Adjust R103, the top frequency response equalizer pot, located on the front panel of the IF Processor Module, for the best depth of frequency response correction at 45 MHz.

The center frequency for the second stage is 43.5 MHz. Adjust R106, the middle frequency response equalizer pot, located on the front panel of the IF Processor Module, for the best depth of frequency response correction at 43.5 MHz.

The center frequency for the second stage is 42 MHz. Adjust R274, the bottom frequency response equalizer pot, located on the front panel of the IF Processor Module, for the best depth of frequency response correction at 42 MHz.

After the three delay attenuation equalizers have been adjusted, fine tune, as needed, for the best frequency response across the channel.

Note: The frequency response adjustment is done at IF, so the frequency cut-in points will be reversed at the UHF frequencies.

7.2.7 Calibration of the Transmitter Forward Output Power Level

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

Switch the transmitter to Standby and preset R51, the aural null pot on (A4) the visual/aural metering board, fully CCW. Switch the LO/Upconverter sled to Manual Gain. Adjust R48, the null offset pot on the visual/aural metering board, full CW. Adjust CCW until 0% visual output is displayed on the LCD Display in the System Visual Power position. Perform the following adjustments with no aural present by removing the jumper cable, the aural IF loop-through, that is connected on the rear of the exciter/driver chassis. Connect a sync and black test signal to the video input jack of the exciter/driver. Switch the transmitter to Operate.

Next, set up the transmitter for the appropriate average output power level using the

Manual Gain pot on the LO/Upconverter sled:

Example is for 5000-Watt transmitter.

- Sync + black 0 IRE setup/wattmeter=2975 watts
- Sync + black 7.5 IRE setup/wattmeter=2725 watts

Note: The transmitter must have 40 IRE units of sync.

Adjust R28, visual calibration, on the (A4) visual/aural metering board for .8V, at TB30-14 and TB30-12 return, on the exciter/driver assembly, then adjust display to read 100% on the front panel meter in the System Forward Power position.

With the spectrum analyzer set to zero span mode, obtain a peak reference on the screen. Reconnect jumper cable on the rear of the exciter/driver. While in the Visual Output Power position, adjust L3 for a minimum visual power reading on the LCD display. Turn the power adjust pot on the LO/Upconverter sled front panel until the original peak reference level is attained. Peak L1 and C8 for a maximum aural power reading, then adjust R20 for .8V, at TB30-15 and TB30-12 return, on the exciter/driver assembly, then adjust LCD display for 100% system aural power reading. Switch to the Visual Output Power position and adjust R51 for 100% visual power on system LCD display.

7.2.8 Calibration of the Transmitter Reflected Output Level

On the meter, in the Visual Power position, turn the power adjust pot to 25%. Move the Reflected cable on the (A11) coupler to the unused "INC" port on the coupler. Then adjust R39 on (A4) the visual/aural metering board for a .2VDC, at TB30-13 and TB30-12 return, on the exciter/driver assembly. Then adjust the LED display for 25% reading in the System Reflected Power position. At this 25% reference power reading a reflected power fault should appear on the System Errors Menu. Turn the power adjust pot slightly CCW and the fault should be clearable on the System Error Menu. Turn the pot CW until the Fault appears. The reflected output power is now calibrated.

Switch the transmitter to Standby and move the Reflected power cable on the A11 Coupler back to the "Reflected Port". Switch the transmitter to Operate and adjust the front panel power pot for a 100% visual power reading. Switch the LO/Upconverter to the Auto AGC position and adjust the ALC Gain adjust pot on the front of the IF Processor module for 100% visual power reading, if needed.

7.2.9 (A9) Bandpass Filter Assembly

The Bandpass Filter Assembly is tuned to reject unwanted distortion products generated when the signals are diplexed and also during the amplification process.

The Bandpass Filter is factory tuned to the proper bandwidth and should not need tuned. If you think tuning is needed consult Axcera Field Support Department before beginning the adjustment.

7.2.10 (A10) UHF Trap Filter Assembly

The Traps on the output Trap Filter are labeled with their Center Frequency relative to the Frequency of the Carrier. (For Example: The Traps labeled -4.5 MHz are tuned for a Center Frequency of 4.5 MHz Lower than the Frequency of the Visual Carrier.) The first

section of the Trap Filter filters out the Visual Carrier plus 9 MHz (f_v+9 MHz). The second and fourth sections work together to filter out the lower spurious product (f_v-4.5 MHz). The third section is tuned to remove the (f_v+8.08). The output of the Trap Filter is an "N" Type Connector.

The Trap Sections have been factory tuned and should not need major adjustments. The Trap Filter is comprised of four trap sections connected to the main transmission line.

The Trap Sections are Reflective Notches, adjustable across the entire UHF Frequency Band. The electrical length of the Outer Sleeve and the Center Rod of the Notch can be adjusted to Tune the Notch Frequency. The Depth of the Notch is set by the gap between the Center Conductor of the Trap Section and the Center Conductor of the Main Line. Tight Coupling makes a Deep Notch, while Loose Coupling makes a Shallow Notch.

FINE TUNING of the Notches Center Frequency can be accomplished with the Tuning Bolts located on the side of the Filter Section. Loosen the nut locking the Bolt in place and adjust the Bolt to change the Frequency of the Notch. Monitor the output of the Transmitter with a Spectrum Analyzer and Null the Distortion Product with the Bolt. Red Field is a good Video Test Signal to use to see the +8.08 MHz Product. Tighten the nut when the tuning is completed. Hold the bolt in place with a screwdriver as the nut is tightened to prevent it from slipping.

MAJOR TUNING, such as changing the Notch Depth or moving the Notch Frequency more than 1 MHz, the Outer Conductor and the Center Conductor of the Trap Section must both be moved. This requires a RF Sweep Generator to accomplish. Apply the Sweep signal to the Input of the Trap Filter and monitor the Output. Loosen the Clamp holding the Outer Conductor in place and make the length longer to Lower the frequency of the Notch or shorter to Raise the frequency of the Notch. Loosen the Center Conductor with an Allen Wrench and move it Deeper for a Lower Frequency Notch or out for a Higher Frequency Notch. These adjustments must both be made to change the Notch Frequency. Moving only the Center Conductor or the Outer Conductor will effect the Notch Depth in addition to the Center Frequency. The variable that is being adjusted with this procedure is the length of the Center Conductor inside the Trap Filter. The gap between the Trap and the Main Line should not be changed. Moving only the Inner or the Outer Conductors by itself will effect the Gap and the Notch depth.

To effect the Notch Depth Only, both sections will have to be moved. The Notch Depth is controlled by the Gap between the Center Conductor and the Trap Section. This Gap also has an effect on the Center Frequency. To Deepen the Notch, Shorten the Outer Conductor and pull the Center Conductor Out until the Notch is back in the same place. Move the Sections in the opposite direction to make a Shallow Notch. **NOTE**: THE TRAP FILTER IS TYPICALLY ADJUSTED FOR A NOTCH DEPTH OF 10 dB.

7.2.11 The Effects of Tuning the Output Trap Filter

Lengthening Outer Conductor Only - Notch Frequency Up, Shallower Notch.

Shortening Outer Conductor Only - Notch Frequency Down, Deeper Notch.

Inserting Inner Conductor Deeper - Notch Frequency Down, Deeper Notch.

Inserting Less Inner Conductor - Notch Frequency Up, Shallower Notch.

Tuning Bolt In - Notch Frequency Down.

Tuning Bolt Out - Notch Frequency Up.

Moving both Inner and Outer Conductors to keep the Same Gap inside - Center Frequency Moves, Notch Stays the Same.

After tuning has been completed, tighten the Clamp and the Allen Screws that hold the Conductors. Use the Fine Tuning Bolts to bring the Frequency In. The Final Tuning Adjustments should be completed with the Transmitter driving the Output Trap Filter for at least one hour to allow for warm-up drift.

7.2.12 Optional Exciter Switcher Assembly

The Exciter Switcher is an interface between an On Air Exciter A and a Backup Exciter B. The Exciter Switcher automatically enables the Backup Exciter B in the event of a primary Exciter failure. The switcher monitors the parameters of each Exciter to determine the operational status of each Exciter.

The front panel switches, using the menus on the display screen, allow the selection of the On Air Exciter and the capability to Enable or Disable the automatic switching. In the Automatic Mode of operation, Exciter A is selected as the Primary Exciter.

The operating parameters from the selected Primary On Air Exciter are fed to the Exciter Switcher Control Board in the Exciter Switcher Tray. If the power sample from the selected exciter remains lower than the reference, a Fault is considered to have occurred. The Exciter Switcher Control Board connects a voltage to the (A2) Transfer Relay, located on the Auto Switcher Relay Panel, which energizes and routes the RF output of the faulted Exciter A to a termination and allows the RF output from the Backup Exciter B to be fed to the Amplifier Array.

The Automatic Switcher will continue to monitor the Backup Exciter B for Faults. After the fault is repaired in Exciter A, the Fault Reset located on the front panel menu screen, on the exciter switcher, must be reset to eliminate the fault. If the Backup Exciter B should fault, and Exciter A has not been repaired, the Backup Exciter B will remain in the Operate mode. This prevents the repeated switching of the exciter switcher between the two faulted Exciters. If both Exciters malfunction, the Auto Switcher will switch to whichever Exciter is repaired first. Either Exciter can be designated the On Air Primary Exciter in the manual mode, by using the front panel switches and the display screen. In Manual, the Fault Sensing will still operate, but the Auto Switcher will not automatically switch Exciters if the On Air Exciter should malfunction.

The output level of the both the On Air exciter and back up exciter is controlled by the Power Raise/Lower menu using the panel buttons and the proper screen on the Control/Monitoring display, located in each exciter.

When the Auto Switcher switches Exciters, both Exciters are Muted momentarily by a Mute Command to prevent damage to the Exciters.

The Optional Exciter Switcher Assembly contains no adjustments and requires no tuning.

The Transmitter is ready for normal operation.

This completes the detailed alignment procedures for the LX Series transmitter.