

Chapter 5

Detailed Alignment Procedures

This Power Amplifier Assembly along with the transmitter was aligned at the factory and should not require additional adjustments to achieve normal operation.

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.

The power amplifier assembly of the Innovator LX Series transmitter is of a Modular design and when a Module fails that module needs to be changed out with a replacement module. The failed module can then be sent back to Axcera for repair. Contact Axcera Customer Service Department at 724-873-8100 or fax to 724-873-8105, before sending in any module.

5.1 Module Replacement

Module replacement on the LX Series products is a relatively simple process. The power supply and power amplifier modules, plug into a blind mating connector located on the chassis. To replace a module, refer to the following procedure.

Loosen the two grip lock connectors, located on the front panel, at the top and bottom of the module, counterclockwise until the module releases. There are two cables connected to the rear of the Power Amplifier Module. These two cables must first be removed before the PA module will slide out.

After removal of the failed module, slide the replacement module in place and make certain it connects to the blind

mate connector. Replace the two cables on the rear of the chassis assembly. If the replacement module does not slide in easily, verify it is properly aligned in the nylon tracks, located on both the top and bottom of the module.

Note: Each Module has an assigned slot and will not fit properly in the incorrect slot. Do not try to place a Module in the wrong slot as this may damage the slot or the blind mate connectors.

5.1.1 Initial Test Set Up

Check that the RF output at the coupler is terminated into a dummy load of at least the rated output of the system. While performing the alignment, refer to the Test Data Sheet for the transmitter and compare the final readings from the factory with the readings on each of the modules. The readings should be very similar. If a reading is way off, the problem is likely to be in that module.

Switch On the main AC for the system.

5.2 Innovator LX Series Exciter/Amplifier Chassis Assembly

This transmitter operates using 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.

On the LCD Display, located on the Controller/Power Supply Module, in Transmitter Set-Up, push the button to switch the transmitter to Operate. The check of and the setup of the Audio and Video input levels are completed using the LCD Display and the front panel adjustments on the Modulator assembly. The level of the RF output includes adjustments of the drive level to the

Power Amplifier and the adjustment of the linearity and phase predistortion to compensate for any nonlinear response of the Power Amplifier. The adjustments are located on the front panel of the IF Processor module.

Modulator Module Assembly

Note: The Modulator Assembly is not present in a translator system.

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 45.75 MHz visual IF.

VISUAL UNLOCK (DS6) – Red Indicates that the 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.

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 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.

Switch the LCD display to the Modulator Details screen that indicates the AUDIO DEVIATION (modulation level) of the signal from 0 to 100 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.

IF Processor Module Assembly

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 IF Processor 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.

Switch the transmitter to Standby. The ALC is muted when the transmitter is in Standby. To monitor the ALC, preset R3, the manual gain adjust pot, located 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 100% output power on the LCD Display mounted 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 120%. 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%.

5.2.1 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.

A typical red field spectrum is shown in Figure 5-1. 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.

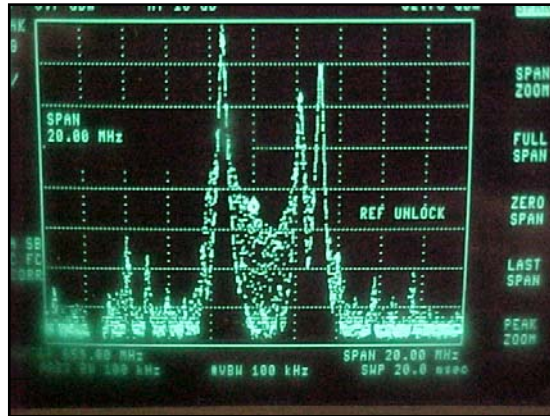


Figure 5-1. Typical Red Field Spectrum

5.2.2 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.

5.2.3 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 1000 Watt transmitter.

- Sync + black 0 IRE
setup/wattmeter=595 watts
- Sync + black 7.5 IRE
setup/wattmeter=545 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.

5.2.4 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.

5.3 (A9) Bandpass Filter Assembly

The Bandpass Filter Assembly is tuned to reject unwanted distortion products generated when the signals are dplexed 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 Xcerra Field Support Department before beginning the adjustment.

5.4 (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.

5.4.1 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.

The Transmitter is ready for normal operation.

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

If a problem occurred during the alignment, help can be found by calling Axcera field support at 724-873-8100.