Chapter 5
Detailed Alignment Procedures

This translator was aligned at the factory and should not require additional adjustments to achieve normal operation.

This translator takes the On channel RF input to the Receiver Tray and converts it to the desired UHF On Channel RF Output at the systems output power level.

If the (Optional) Modulator Kit is purchased, this translator can also operate 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.

The exciter/amplifier of the Pioneer Series translator is of a Modular design and when a Module fails that module needs to be changed out with a replacement module. The replacement 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.

Module Replacement

Module replacement on the Pioneer series products is a relatively simple process. All modules plug directly into the backplane board except for the power amplifier module, and in higher power units, the power supply and power amplifier modules, that plug into a blind mating connector. 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. The IF Processor, Upconverter and Controller/Power Supply can then be gently pulled from the unit. There are two cables connected to the rear of the Power Amplifier Module in the exciter/amplifier chassis assembly. These two cables must first be removed before the PA module will slide out.

Slide the new module in place and make certain it connects to the backplane board. If the new module is a PA Module replace the two cables on the rear of the exciter/amplifier chassis assembly. If the new module does not slide in easily, verify it is properly aligned in the nylon tracks both top and bottom.

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 connectors on the backplane board.

Each module has the name of the module on the front, bottom for identification and correct placement. The Modules are placed in the unit from left to right; (1) Blank panel, (2) Modulator (for transmitters) or a Blank panel for a Translator, (3) IF Processor, (4) Upconverter, (5) Controller/Power Supply and (6) Power Amplifier.

Initial Test Set Up

Check that the RF output at the coupler is terminated into a dummy load of at least 100 watts. While performing the alignment, refer to the Test Data Sheet for the translator and compare the final readings from the factory with the readings on each of the modules or tray. The readings should be very similar. If a reading is way off, the problem is likely to be in that module or tray.

Switch On both the main AC for the system and the ON/OFF circuit breaker located on the rear of the Receiver Tray.

5.1 UHF/VHF Receiver Tray. (1142479 or 1265-1100)

Connect a UHF or VHF Input that is at the desired Channel Frequency, to J1 50Ω or J5 75Ω located on the rear of the (A7) VHF/UHF Receiver Tray. Check that the On/Off Switch located on the rear of the Tray is On.

Note: If the Red LED, DS1 is lit, +12 VDC is present at the input of the Receiver Tray and may damage any test equipment connected to it. Remove the fuse F1, DS1 will not be lit, before connecting test equipment to the input jack of the Receiver Tray.

5.1.1 (A7) UHF Filter, DC Multiplexed (1035-1204, 50Ω or 1035-1207, 75Ω), VHF Filter, LB, DC Multiplexed (1035-1902, 50Ω or 1035-1903, 75Ω) or VHF Filter, HB, DC Multiplexed (2065-1024, 50Ω or 2065-1023, 75Ω)

The input UHF or VHF signal (-61 dBm to -16 dBm) is fed to the filter which has been factory swept for 6 MHz Bandwidth at the Channel frequency and should not be tuned in the field. The output of the filter is directed to the J1 input of (A8) the Dual Stage Amplifier Assembly.

5.1.2 (A8-A1) Dual Stage Amplifier Board (1227-1501)

Mounted in: (A8) a Dual Stage Amplifier Assembly (1227-1503).

The Dual Stage Amplifier Board has been factory set to the channel frequency and contains no customer tuning adjustments. The board has approximately +13 dB or +26 dB of gain, depending on whether Jumper W1 on J5 is in place.

5.1.3 (A9) UHF Filter (1007-1101), VHF LB Filter (1034-1202) or VHF HB Filter (2065-1000)

The UHF or VHF Filter has been factory swept for 6 MHz Bandwidth at the Channel Frequency and should not be tuned in the field. The output of the filter (-50 dBm to -5 dBm) is fed either through the additional amplifier stage on the Variable Gain Amplifier Board or to (A10-A1) the Downconverter/Filter Board.

5.1.4 (A4) Channel Oscillator Assembly, Dual Oven (1145-1202)

Contains: The Channel Oscillator Board, Dual Oven (1145-1201).

1. Connect the main output of the Channel Oscillator (J1) to a spectrum analyzer, adjusted to view the crystal frequency.
   Peak the tuning capacitors C6 and C18 for maximum output. Then tune L2 and L4 for maximum output. The output level should be approximately +5 dBm and the Oven Temperature should be maintained at 50°C.

   If a spectrum analyzer is not available, connect a DVM to TP1 on the x8, x4 or x2 Multiplier Board. Tune capacitors C6 and C18 for maximum voltage at TP1. Then tune L2 and L4 for maximum voltage at TP1.

2. Connect the sample output of the Channel Oscillator at J2 to a suitable counter and tune C11, Coarse Adjust, and C9, Fine Adjust, to the crystal frequency. Do not re-peak C6, C18, L2 or L4 because this may change the output frequency.

Note: While adjusting C9 and C11 to the crystal frequency the peak voltage monitored at TP1 of the Multiplier Board should not decrease. If a decrease does occur a problem with the crystal is likely.

3. Reconnect the main output at J1 of the Channel Oscillator to the Input Jack J1 of the Multiplier Board.

Note: If the Optional Frequency Correction Kit is purchased a VCXO Assembly (1145-1206), containing a VCXO Board (1145-1204), will be used instead of the standard Channel Oscillator Board. The adjustment will be the same as above except that the frequency is adjusted by moving the Jumper W1 on Jack J6, located on the IF PLL Board (1109-1002), to Pins 2 & 3, Fixed Bias, and adjusting R15 on the IF PLL Board for -3 VDC at FL2 of the VCXO Assembly. Move the Jumper W1 on Jack J6 to between Pins 1 & 2, AFC. Connect the Oscillator Sample output, at (J2) of the Channel Oscillator or the Front Panel Sample Jack (J9), to a suitable Frequency Counter and tune C11, Coarse Adjust, to the desired frequency. Do not re-peak C6, C18, L2 or L4 because it may change the output frequency.

Reconnect the main output (J1) of the Channel Oscillator (+5 dBm) to the input (J1) of the Multiplier Board. DS1 the Red Unlock Indicator, located on the IF PLL Board, should not be lit.

5.1.5 (A5-A1) x8 Multiplier Board (1227-1002), x4 Multiplier Board (1227-1525) or x2 Multiplier Board (1227-1524)

Mounted in (A5) a Multiplier Enclosure (1265-1125).
During Normal operation, the Green LED DS1, which can be seen through the access hole in the Enclosure Assembly, will be lit to indicate that the L.O. is present at the output of the x8 Multiplier Board.

1. Connect a Spectrum Analyzer to the Output Jack (J2) of the board.

2. Tune C4, C6, C10, C12, C18 and C20 on the x8 and the appropriate caps on the other boards for maximum output. Readjust all the Capacitors to minimize the seventh and the ninth harmonics, they should be at least -30 dB down, without affecting the x8 Multiplier Output.

If a Spectrum Analyzer is not available a DC voltmeter can be used as follows but the harmonic frequencies must be minimized to prevent interference with other Channels.

1. While Monitoring each Test Point with a DC voltmeter, maximize the voltage by tuning the Broadband Multipliers in the following sequence.

2. For x8 Multiplier Board: Monitor TP1 with a DVM and tune C4 for maximum. (Typical .6 VDC)
Monitor TP2 and tune C6 and C10 for maximum. (Typical 1.2 VDC)
Monitor TP3 and tune C12 and C18 for maximum. (Typical 2 VDC)
Monitor TP4 and tune C20 for maximum. Re-peak C12 and C10 while monitoring TP4. (Typical 3.5 VDC)

   For x4 Multiplier: Monitor TP1 with a DVM and tune C4 for maximum. (Typical .6 VDC)
Monitor TP2 and tune C6 and C10 for maximum. (Typical 1.2 VDC)
Monitor TP3 and tune C12 for maximum. Re-peak C12 and C10 while monitoring TP3. (Typical 2 VDC) For x2 Multiplier: Monitor TP1 with a DVM and tune C4 for maximum. (Typical .6 VDC)
Monitor TP2 and tune C6 for maximum. Re-peak C4 and C6 while monitoring TP2. (Typical 1.2 VDC)

The Green LED DS1 should be lit which indicates that the L.O. is present at the Output Jack J2 of the Multiplier Board. The output of the Multiplier at J2 is connected to (A6) a UHF or VHF Filter.

5.1.6 (A6) UHF Filter (1007-1101), VHF LB Filter (1034-1211) or VHF HB Filter (2065-1000)

This filter has been factory swept at the L.O. frequency and should not be tuned without proper equipment. The output of the filter (+15 dBm) is connected to J2 on (A10) the Downconverter/Filter Assembly.

5.1.7 (A10-A1) Downconverter/ Amplifier Board (1227-1502)

Mounted in: The (A10) Downconverter/Amplifier Assembly (1227-1505).

The Mixer contains no adjustments and has a L.O. input of approximately +12 dBm in level applied to J2 and a -47 dBm to -2 dBm RF input applied to J1. The output IF level at J3 will be -55 dBm to -10 dBm.

1. Connect a Spectrum Analyzer to the Output Jack J3 and adjust L1, C2 and L3 for best frequency response.

2. Adjust C8 and R3 to notch out the Aural IF Frequency.

The IF output at J3 (-55 dBm to -10 dBm) is fed to the IF Filter/ALC Board. If needed a 10 dB Pad can be added to the circuit by moving the jumpers on J4 and J5 to the In position.

5.1.8 (A11-A1) IF Filter/ALC Board (1227-1504) Mounted in: The (A11) IF Filter/ALC Enclosure (1265-1105).

1. Check that Switch S1, located on the IF Filter/ALC Board, is in the Auto ALC and that the output of the Board at J2 is approximately 0 dBm Output, adjust R23 if needed.

5.1.9 (A11-A2) (Optional) SAW Filter/Amplifier Board (1035-1211)

Mounted in: The (A11) IF Filter/ALC Enclosure (1265-1105).

This board is used for additional adjacent Channel rejection only if needed and may not be part of the Tray.

The board contains no tuning adjustments. The Jumpers W1 and W2 on J4 and J5 are placed for Attenuator In or Attenuator Out as needed to give the same output level at J2 as was at J1.

5.1.10 (A2) ±12V Power Supply Board (1092-1206)

This board contains no adjustments.

Note: If the (Optional) Frequency Corrector Kit is part of the tray, perform the following adjustments. If the Frequency Corrector Kit is not part of the tray, the tray is aligned and ready for normal operation.

5.1.11 (A15) (Optional) IF Carrier Oscillator Board (1100-1206)

1. Monitor J3 with a Spectrum Analyzer and observe the 38.9 MHz Visual IF signal at +5 dBm.

2. Connect a Frequency Counter to J2 on the board or to J9 on the Front Panel and adjust C17 for 38.9 MHz.

3. Connect a Frequency Counter to J1 and check for the 50 kHz signal. Adjust C17, if needed, to attain the 50 kHz frequency. Remove the Jack on J5. DS2 the Unlock Indicator should light. Replace the Jack onto J5.

5.1.12 (A13) (Optional) IF Filter/ Limiter Board (1109-1001)

1. Monitor the Aural Notch Test Output of the board at J5 and move the Jumper W1 on Jack J4 to between Pins 2 & 3, Test Position. Adjust C17 to the Aural IF Frequency, then adjust R10 to

eliminate or minimize the Aural IF signal. Move the Jumper W1 on Jack J4 back to between Pins 1 & 2, Operate Position.

2. Monitor the IF CW Output of the board at J6 with an Oscilloscope and adjust R12 and C21 for maximum Video Signal or connect a Spectrum Analyzer, in Zero Span, to J6 and adjust R12 and C21 for Minimum Video Signal amplitude ripple on the displayed signal.

3. Adjust R15 for +3 dBm or Maximum output level if +3 dBm cannot be attained.

5.1.13 (A14) (Optional) IF PLL Board (1109-1002)

Check that the Red LED DS1, Unlock Indicator, located on the board is not lit.

If DS1 is lit, follow the alignment procedure for setting up the VCXO Channel Oscillator using R9 on the IF PLL Board to set up the AFC Voltage for the Frequency of the VCXO. If it is still lit, check the 50 kHz reference output of the (A15) IF Carrier Oven Oscillator. If needed, follow the alignment procedure for the IF Carrier Oven Oscillator Board.

5.1.14 (A16) (Optional) IF Amplifier Board, High Gain (1197-1126)

This board contains no customer adjustments. The amplified IF output from the IF Filter/ALC Board connects to the IF Filter Limiter Board.

The Receiver Tray is now set up and ready for normal operation.

5.2 Pioneer Series Exciter/Amplifier Chassis Assembly

The exciter/amplifier chassis assembly operates using an external IF input from an external receiver tray. The IF source connects to J6, the modulated IF Input jack, on the rear of the chassis assembly, which is cabled to the IF Processor Module.

On the LCD Display, located on the Controller/Power Supply Module, push the button to switch the translator 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 predistortion 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.

Switch the translator to Standby. The ALC is muted when the translator 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 translator 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 translator 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 translator 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.

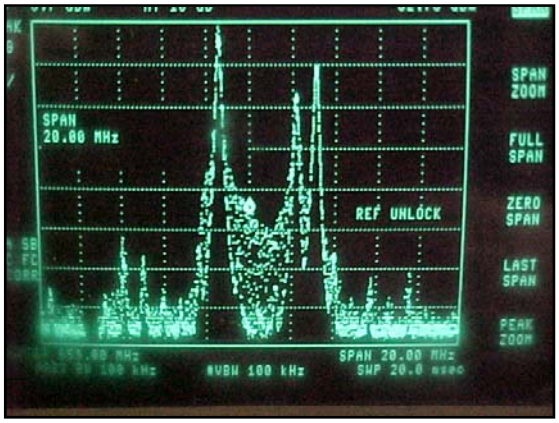

Figure 5-1. Typical Red Field Spectrum

5.2.2 Frequency Response Delay Equalization Adjustment

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

The center frequency for the first stage is 46.5 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 46.5 MHz.

The center frequency for the second stage is 41.5 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 41.5 MHz.

The center frequency for the second stage is 44 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 44 MHz.

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

5.2.3 Calibration of Output Power and Reflected Power of the translator

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

Switch the transmitter to Standby and preset R205, the aural null pot on the Amp Control board, fully CCW. Adjust R204, the null offset pot on the Amp Control board, for 0% visual output. Perform the following adjustments with no aural present by removing the aural carrier from the test modulator. Connect a sync and black test signal to the video input jack of the test modulator. Switch the transmitter to Operate.

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

- Sync + black 0 IRE setup/wattmeter=59.5 watts
- Sync + black 7.5 IRE setup/wattmeter=54.5 watts

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

Adjust R202, visual calibration, on the Amp Control board for 100% on the front

panel display in the % Visual Output position.

With the spectrum analyzer set to zero span mode, obtain a peak reference on the screen. Reconnect the aural carrier from the test modulator. Turn the power adjust pot on the front panel until the original peak reference level is attained. Adjust R203 for a 100% aural power reading. Switch to the Visual Output Power position and adjust R205 (aural null pot) for 100% visual power.

To calibrate the reflected output power reading of the translator. Reduce manual gain pot R3 to a 10% reading on the LCD front panel display in the % Output Power position. Place the translator in Standby. Remove the load from J4 on the (A4) Direction Coupler Board and switch the LCD Display screen to the Reflected Output Power position. Switch the translator to operate. Adjust the reflected power calibration adjust pot R163 on the power amplifier module to a 10% reading. Reconnect the load to J4.

After this calibration is completed, move switch SW1 on the upconverter module to the Automatic AGC position. This is the normal operating position for the switch.

The Translator is now aligned, calibrated, and ready for normal operation.

This completes the detailed alignment procedures for the Pioneer Series translator.

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

5.3 Alignment Procedure for the 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 ITS Corp. Field Support Department before beginning.

The Traps 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 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.

The Trap Sections have been factory tuned and should not need major adjustments. The Frequency, relative to Visual Carrier, that the Trap is tuned to is marked on the 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.

For 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 an 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.

After tuning has been completed, tighten the Clamp and the Allen Screws which 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.

This completes the Alignment Procedure for the Bandpass Filter Assembly.