Chapter 4
Detailed Alignment Procedures

If this transmitter contains the (optional) 4.5 MHz composite input kit, the baseband video input is used when the baseband video is connected to J2 and a baseband select is connected to J18 pins 6 and 7 on the rear of the tray.

Check that the RF output at J15 of the transmitter is terminated into a dummy load of at least 100 watts. While performing the alignment, refer to the Test Data Sheet for the transmitter and compare the final readings from the factory with the meter readings on the tray. They should be very similar. If a reading is more than 10% different, a problem with the tray may exist. Switch on the on/off AC circuit breaker on the rear of the tray.

4.1 Alignment of the 420A Transmitter

4.1.1 Baseband Section

This tray has adjustments for video and audio modulation levels and other related parameters.

Connect an NTSC composite video test signal input (1 Vpk-pk) or an (optional) 4.5 MHz composite input to the transmitter video input jack J2 on the rear of the tray.

Note: J2 is a loop-through connected to J1. It can be used as a baseband video source if the jumper W1 on J3 of the sync tip clamp/modulator board is removed.

Connect the baseband audio, if it is balanced audio (+10 dBm), to the terminal block (TB1) or connect the composite audio (stereo) (1 Vpk-pk) to the BNC jack (J13).

Note: J13 is a loop-through connected to J3. It can be used as a composite audio source if the jumper W4 on J12 of the aural IF synthesizer board is removed.

The baseband audio is not used with the (optional) 4.5 MHz composite input.

Observe the front panel meter on the tray. In the video position, the meter indicates active video from ≅ 0.3V to 1.0V. With an input video of 1 Vpk-pk, the display should indicate 100 IRE units at white. If the reading is at not the proper level, the overall video level can be changed by adjusting the video level control (R15) on (A5) the sync tip clamp/modulator board (1265-1302).

Switch the meter to the audio position that will indicate the audio deviation (modulation level) of the signal; the meter indicates from 0 to 100 kHz. The aural IF synthesizer board was factory set for ±25 kHz deviation with a balanced audio input of +10 dBm. If the reading is not the correct level, adjust the balanced audio gain pot R13 on the aural IF synthesizer board, as needed, to attain the ±25 kHz deviation. The aural IF synthesizer board was factory set for ±75 kHz deviation with a composite audio input of 1 Vpk-pk. If the reading is not correct, adjust the composite audio gain pot R17 on the aural IF synthesizer board, as needed, for the ±75 kHz deviation.

4.1.2 IF/Upconverter Section

The upconverter section of the tray includes adjustments for automatic level control (ALC), linearity (amplitude pre-distortion), and incidental phase (phase change vs. level) pre-distortion for correction of the non-linearities of the RF amplifier section of the tray. The upconverter section also includes adjustments to the local oscillator chain tuning and the local oscillator center frequency tuning. Both of these alignments were completed at the factory and should not need to be adjusted at this time. Move the Operate/Standby switch located on the front panel of the tray to Standby.

The set-up of the RF output includes an adjustment to the drive level of the amplifier section of the tray, the adjustment of the linearity, and the (optional) incidental phase predistortion which compensate for any nonlinear response of the amplifier section.

Verify that all red LEDs on the ALC board are extinguished. The following list details the meaning of each LED when illuminated:

- DS1 (Input fault) – Indicates that abnormally low or no IF is present at the input of the board
- DS2 (ALC fault) – Indicates that the ALC circuit is unable to maintain the signal level requested by the ALC reference due to excessive attenuation in the linearity or ICPM corrector signal path or that jumper W3 on J6 is in the Manual ALC Gain position
- DS3 (Video loss) - Indicates a loss of video at the input of the board
- DS4 (Visual mute) - Indicates that a Visual Mute command is present (The visual mute is not used in this system.)
- DS5 (Modulator Enable) - Indicates that the modulator output is selected

Check that the jumper W3 on J6 of (A8) the ALC board (1265-1305) is in the Auto position and adjust the power gain pot (R1) on the front panel of the tray to obtain +0.85 VDC on the front panel meter in the ALC position. Move the jumper W3 on J6 to the Manual position and adjust R87 on the ALC board for +0.85 VDC on the front panel meter in the ALC position. Move the jumper back to Auto; this is the normal operating position. The detected IF signal level at J19-2 of the ALC board is connected to the transmitter control board. This signal supplies the voltage to the high-band mixer/amplifier board where it is used as an automatic gain control (AGC) for the RF output signal of the upconverter section in the amplifier section of the tray.

4.1.3 Amplifier Section of the Tray

Note: Power is applied to the amplifier boards when the transmitter is switched to Operate.

Switch the transmitter to Operate and verify that the visual power reading on the front panel meter is 100%. If not, adjust the front panel power adjust pot to achieve 100%.

Switch the input video test source to select an NTSC 3.58 MHz modulated staircase or ramp test waveform. Set up the station demodulator and monitoring equipment to monitor the differential gain and phase of the RF output signal.

If a synchronous demodulator having a quadrature video output is available, it can be used with an X-Y oscilloscope to display incidental carrier phase modulation (ICPM). As shipped, the exciter was preset to include linearity (gain vs. level) and incidental phase (carrier phase vs. level) predistortion. The predistortion was adjusted to approximately compensate the

corresponding non-linear distortions of the amplifier that is driven to place the sync level near saturation.

4.1.4 Linearity Corrector Adjustment

The IF linearity correction function consists of three non-linear cascaded stages, each having adjustable magnitude and threshold, or cut-in, points. The threshold adjustment determines at what IF signal level the corresponding corrector stage begins to increase gain. The magnitude adjustment determines the amount of gain change for the part of the signal that exceeds the corresponding threshold point. Find the ALC board on the tray level control locations drawing (1265-5305) to locate the adjustments for the three linearity corrector stages. Because the stages are cascaded, the order of correction is important. The first stage should cut-in near white level, with the cut-in point of the next stage toward black, and the last stage primarily stretching sync.

To adjust the linearity correctors, check that the IF phase corrector jumper W2 on J9 of the IF phase corrector board is disabled. Also check that the jumper W1 on J4 of the ALC board is enabled. Select a 3.58 MHz modulated staircase or ramp input test video signal and monitor the differential gain at the output of the transmitter.

Check that the ALC is set to +0.85 VDC on the front panel meter in the ALC position. The ALC will maintain the corresponding peak power level following the correctors. A positive aspect of linearity adjustment with the ALC enabled is that the control movements will not affect peak power.

Note: The adjustment procedure must be repeated to achieve the correct differential gain predistortion.

Start with the first linearity stage and adjust R34 CW on the IF ALC board to stretch the signal above the white region. Back off on the corresponding magnitude control R13 as required. Next, advance the second threshold control R37 to stretch the signal above the black range and then back off on the magnitude control R18 as required. Adjust the third threshold pot R40 to stretch sync. Back off on the corresponding magnitude control R23 as required. Go back through the white through black and sync correctors to touch up the effects of ALC level changes resulting from the adjustment.

Note: If additional sync stretch is required, adjust R43 on the (A5) sync tip clamp / modulator board.

4.1.5 IF Phase Corrector Adjustment

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

Locate (A9) the IF phase corrector board (1227-1250). The amplitude correction portion of the board is not utilized in this configuration; as a result, the jumper W3 on J10 should be in the disable position and R35 and R31 should be fully CCW. R68 is the range adjustment and should be set to the mid-point of the range. The phase correction enable/disable jumper W2 on J9 should be in the enable position.

Switch the input video test source to select an NTSC 3.58 MHz modulated staircase or ramp test waveform. Set up the station demodulator and monitoring equipment to monitor the differential phase or intermod 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. They are adjusted as necessary to correct for any differential phase or 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.

4.1.6 Calibration of the Output Power Level

Note: Do not perform this procedure unless the power calibration is suspect.

Switch the transmitter to standby. Move jumper W1 on J5 of the filter/amplifier board, high output (1064150), to the Manual position (J5-1, 2). Preset R51, the aural null pot on the visual/aural metering board (1265-1309), full CCW. Adjust R48, the offset null pot on the visual/aural metering board (1265-1309), for 0% visual output.

Perform the following adjustments, with no aural present, by removing the jumper cable W1, the aural IF loop-through connected to J16 on (A5) the sync tip clamp/modulator board. Switch the transmitter to Operate. Connect a sync and black test signal to the video input jack of the tray. Set up the transmitter for the appropriate average output power level on a wattmeter (sync + black and 0 IRE setup, wattmeter=59.5 watts; sync + black and 7.5 IRE setup, wattmeter=54.5 watts).

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

Adjust R28, visual calibration adjust on (A19) the visual/aural metering board, for a 100% reading on the front panel meter in the % Visual Output position. With the spectrum analyzer set to zero span mode, obtain a peak reference level on the screen. Reconnect the jumper cable W1 to J16 on (A5) the sync tip clamp/modulator board. While in the Visual Output Power position, adjust L3 for a Minimum Visual Power reading. Turn the gain adjust pot on the front panel until the original peak reference level is attained. Peak L1 and C8 for maximum aural power reading, then adjust R20 for a 100% Aural Power reading. Switch to the Visual Output Power position and adjust R51 for 100% Visual Power.

To adjust the VSWR cutback of the transmitter, after the visual and aural outputs are calibrated for 100%, adjust the power to 20%, using the front panel power adjust pot, with the jumper in manual on the VHF filter/mixer board (1064150). Reverse the forward and reflected cables on the (A31) output coupler board and adjust R39 on the visual/aural metering board for a 20% reading. Adjust R22 on the transmitter control board (1068933) until the front panel VSWR LED is illuminated. Put the cables back in the original configuration and place the transmitter in Standby.

Return jumper W1 on the filter/amplifier board, high output (1064150), to the AGC position (J5-2, 3). Use the front panel gain adjust pot to set all of the voltages to .85V. If necessary, use R73 on the transmitter control board to bring the tray to 100% power.

This completes the detailed alignment procedures for the transmitter. If a problem occurred during the alignment, refer to the board-level alignment procedures that follow for more detailed information.

4.2 Board Level Alignment Procedures

4.2.1 (Optional) 4.5 MHz Composite Input Kit

If the (optional) 4.5 MHz composite input kit is purchased, the tray is capable of operating by using either the 4.5 MHz composite input or the baseband audio and video inputs. The kit adds the (A24) composite 4.5 MHz filter board (1227-1244) and the (A25) 4.5 MHz bandpass filter board (1265-1307). When the 4.5 MHz intercarrier signal generated by the 4.5 MHz composite input has been selected by the 4.5 MHz composite input kit, the 4.5 MHz generated by the aural IF synthesizer board is not used. When the 4.5 MHz intercarrier signal generated by the baseband video and audio inputs with baseband has been selected by the 4.5 MHz composite input kit, the composite 4.5 MHz filter board and the 4.5 MHz bandpass filter board are not used.

The tray has been factory tuned and should need no alignments to achieve normal operation. To align the tray for the 4.5 MHz composite input, apply the 4.5 MHz composite input, with the test signals used as needed, to the video input jack (J1 or J2 [loop-through connections]) on the rear of the tray. Select the 4.5 MHz composite input by removing the baseband select from J18-6 and J18-7 on the rear of the tray.

To align the exciter using baseband video and audio inputs, apply the baseband video, with the test signals used as needed, to the video input jack (J1 or J2 [loop-through connections]) and the baseband audio to the proper baseband audio input on the rear of the tray. For balanced audio input, connect TB1-1(+), TB1-2(-), and TB1-3 (GND). For composite/stereo audio, connect the composite audio input jack (J3 or J13 [loop-through connections]) and connect a baseband select from J18-6 and J18-7 on the rear of the tray.

4.2.2 Delay Equalizer Board (1227-1204)

The jumper W1 on J5 of the sync tip clamp/modulator board, if present, must be in the Enable position between pins 2 and 3.

Note: This board has been factory tuned and should not be retuned without the proper equipment.

To tune this board:

1. Connect a sinX/X test signal into jack J1-2 on the delay equalizer board.

2. Monitor the video output of the board, at the video sample jack J2, with a video measuring set, such as the VM700, adjusted to measure group delay.

3. Tune the four stages of the board using the variable inductors (L1-L4) and potentiometers (R7, R12, R17, and R22) until the signal attains the FCC group delay curve. The stages are arranged in order of increasing frequency. Adjust R29 as needed to attain the same level out of the board as into the board.

4.2.3 (A24) Composite 4.5 MHz Filter Board (1227-1244)

This board is part of the 4.5 MHz input kit and will only function properly with a 4.5 MHz composite input signal and the 4.5 MHz composite input selected. To align this board:

1. Connect the test signal from an envelope delay measurement set to the video input of the tray at J1 or J2.

2. Connect an oscilloscope to jack J7, video out, between J7 center pin and pin 1 or 3 ground. Adjust C21, frequency response, if needed for the best frequency response. Adjust R32, video gain, for a signal

level of 1 Vpk-pk on the oscilloscope.

The output at J6 and J7 on the board should be video only, without the 4.5 MHz aural subcarrier.

4.2.4 (Optional) (A25) 4.5 MHz Bandpass Filter Board (1265-1307)

This board is part of the 4.5 MHz input kit and will only function properly with a 4.5 MHz composite input signal and the 4.5 MHz composite input selected. To align this board:

1. Adjust the filter with L2, C3, L4, and C7 for a frequency response of no greater than ±0.3 dB from 4.4 to 4.6 MHz.

2. Adjust C19 for an overall peak-to-peak variation of less than ±0.3 dB from 4.4 MHz to 4.6 MHz.

3. Recheck the frequency response; it may have changed with the adjustment of the envelope delay. If necessary, retune the board.

4.2.5 (A7) IF Carrier Oven Oscillator Board (1191-1404)

To align this board:

1. While monitoring J3 with a spectrum analyzer, observe the 45.75 MHz visual IF (typical +5 dBm).

2. Connect a frequency counter to J3 and adjust C17 for 45.750000 MHz.

3. Connect a frequency counter to J1 and check for 50 kHz, which is the aural phase lock loop reference.

4.2.6 (A5) Sync Tip Clamp/Modulator Board (1265-1302)

To align this board:

1. Determine if jumper W4 on jack J3 is present. Jumper W4 terminates the video input into 75Ω. Remove jumper W4 if a video loop-through is required on the rear chassis at jacks J1 and J2.

2. Set the controls R20, the white clip, R24, the sync clip, and R45, the sync stretch cut-in, to their full counter clockwise (CCW) position. Set R48, the sync magnitude, fully CW and place the jumper W7 on jack J4 to the clamp off, disable, position.

3. Connect a 5-step staircase video test signal to the input of the transmitter.

4. Monitor TP2 with an oscilloscope. Adjust R12, the video gain pot, for 1 Vpk-pk.

5. Change the video input test signal to a multiburst test pattern. While monitoring TP2, adjust C8 and R32 for a flat frequency response. Change the input video test signal back to the 5-step staircase.

6. Monitor TP2 with an oscilloscope. Adjust the pot R41, manual offset, for a blanking level of -0.8 VDC. The waveform shown in Figure 4-1 should be observed. Move the jumper W2 on J4 to the clamp enable position. Adjust the pot R152, depth of modulation, for a blanking level of -0.8 VDC.

Note: This waveform represents the theoretical level for proper modulation depth. Step 9 below describes how to set the modulation depth through the use of a television demodulator or a zero-spanned spectrum analyzer tuned to the visual IF frequency.

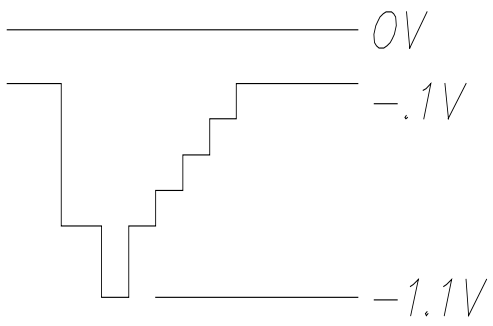

Figure 4-1. Waveform

7. The following test setup is for the adjustment of the depth of modulation and ICPM at IF:

   A. Remove the cable that is on J18 and connect the double sideband 45.75 MHz visual IF signal from J18 to a 10 dB splitter/coupler. Connect the coupled port of the splitter/coupler to the RF input of a television demodulator. Connect the direct port to a spectrum analyzer.

   B. Connect the 75Ω video output of the demodulator to the video input of a waveform monitor. For ICPM measurements, also connect the quadrature output of the demodulator to the horizontal input of the waveform monitor using a 250 kHz low pass filter. (An oscilloscope can be used in place of a waveform monitor).

   C. Set the controls of the demodulator to the following:

      Detector mode – Cont
      Sound trap – In
      Zero carrier – On
      Auto – Sync
      Audio source – Split
      De-emphasis – In

8. Move the jumper W7 on J4 to the clamp disable position. Readjust the pot R41, manual offset, for the correct depth of modulation by observing the demodulated waveform on the waveform monitor or on the spectrum analyzer set to zero span.

9. Check the demodulated video for proper sync to video ratio (sync is 28.6% of the total white video signal). If sync stretch is needed, adjust R45, sync stretch cut-in, until sync stretch occurs. Adjust R48, sync stretch magnitude, for the proper amount of stretch. Readjust R41, manual offset, if needed, for the correct depth of modulation.

10. Move the jumper W7 on J4 to the clamp enable position. Readjust the pot R152, depth of modulation, for the correct depth of modulation.

11. Set the waveform monitor to display ICPM. Preset R53 full CCW, adjust C78 for the greatest effect at white on the ICPM display, and then adjust R53 for minimum ICPM.

12. Recheck the depth of modulation and, if necessary, adjust R152, depth of modulation.

13. On a spectrum analyzer, adjust the pot R70 for a level of approximately -10 dBm at J18.

14. Remove the input video test signal. Place the front panel meter in the video position and, while monitoring the meter, adjust pot R144, zero adjust, for a reading of zero.

15. Replace the input video test signal (the 5-step staircase). Turn the front panel meter to the video position and adjust R20 on the transmitter control board for a reading of 1V (10 on the 0-10 scale). This board does not have sync metering.

16. Reconnect the plug to J18 and move the spectrum analyzer test cable to the 41.25 IF output jack J16. Tune C59 and L17-L20 to maximize the 41.25 MHz aural IF signal and minimize the out-of-band products. Adjust pot R97 for -20 dBm at J16.

17. Reconnect the plug to J16 and move the spectrum analyzer test cable to the IF output jack J20. Preset R62, the visual IF gain pot, to the middle. Insert a multiburst test signal into the transmitter and observe the visual frequency response with the spectrum analyzer set at 1 dB/division. Tune R63 and C30, the IF frequency response adjustments, for a flat frequency response (±0.5 dB).

18. While still monitoring J20 with a spectrum analyzer, readjust R62, visual IF gain, for a 0 dBm visual output level. Adjust R85, A/V ratio, for a minus 10 dB aural-to-visual ratio or to the desired A/V ratio. Reconnect the plug to J20.

19. Using an input video test signal (the 5-step staircase) with 100 IRE white level, monitor TP2 with an oscilloscope. Set the control R24, the sync clip, just below the point where sync clipping begins to occur. Similarly, set R20, the white clip, to just below the point at which the white video begins to clip.

4.2.7 (A4) Aural IF Synthesizer Board, 4.5 MHz (1265-1303)

1. To set up the test equipment for this board:

   A. Connect the 600Ω balanced audio output from an audio oscillator to the balanced audio input terminals of the tray at TB1-1 (+), TB1-2 (-), and TB1-3 (ground) on the rear chassis.
   B. Connect the combined IF output at J21 (IF sample) on the clamp modulator board to the input of an IF splitter. Connect one output of the splitter to the video demodulator and the other output to the spectrum analyzer.

   C. At the front of the demodulator, connect a short cable from the RF-out jack to the IF-in jack.

   D. Connect a cable from the 600Ω audio output jack of the demodulator to the input of an audio distortion analyzer.

2. Set the output frequency of the audio oscillator to 400 Hz and the output level to +10 dBm.

3. Center the aural carrier on the spectrum analyzer with the spectrum analyzer set to the following:

   Frequency/
   Division – 10 kHz
   Resolution
   bandwidth – 3 kHz
   Time/
   Division – 50 msec

Trigger – Free run

A. Adjust L5 for approximately +3.5 VDC at TP2.

B. The green LED DS1 should be illuminated, indicating a locked condition. If not, retune L5 for a locked condition.

4. Adjust R13, balanced audio gain, on the aural IF synthesizer board for ±25 kHz deviation.

5. Check the distortion on the aural distortion analyzer (THD=< 0.5%).

6. Disconnect the 600Ω balanced audio input to the tray. Connect a 75Ω stereo audio input (400 Hz at 1 Vpk-pk) to the composite audio input jack J3 on the rear of the tray. Follow the procedure in the stereo generator instruction manual for matching the level of the generator to the exciter. Use R17 to adjust the composite audio gain.

7. Check the distortion level on the distortion analyzer (THD)=< 0.5%)

4.2.8 (A8) ALC Board (1265-1305) (Part 1 of 2)

Table 4-1 describes the functions of each LED on the ALC board (A8).

Table 4-1. ALC Board LEDs

LED	FUNCTION
DS1 (Red LED)	Indicates that an abnormally low IF signal level is present at IF input connector J1
DS2 (Red LED)	Indicates that the ALC circuit is unable to maintain the level requested by the ALC reference due to excessive attenuation in the linearity, the IF phase corrector signal path, or the jumper W3 on J6 is in manual gain
DS3 (Red LED)	Indicates a video loss fault
DS4 (Red LED)	Indicates that a Mute command is present
DS5 (Green LED)	Indicates that the output from the modulator is selected as the input to the board

1. To align the ALC board, preset the following controls in the tray:

   A. ALC Board (1265-1305)

   Connect jumper W1 on J4 to disable, between pins 2 and 3 (to disable linearity correctors). Connect jumper W3 on J6 to manual, between pins 2 and 3 (for manual gain control).

   Adjust R87, manual gain pot, to mid-range.

   B. IF Phase Corrector Board (1227-1250)

   Move W2 on J9 to phase correction: enable. Move W3 on J10 to amplitude correction: disable.

2. The combined IF output of the sync tip clamp modulator board is cabled to jack J32 of the ALC board. Remove J32 from the board, and look to see if DS1, input fault, is illuminated. Reconnect J32 and observe that DS1 is extinguished.

3. Jumper W3 on J6 should be in the manual position. Monitor jack J3 with a spectrum analyzer.

4. With a multiburst video signal present, tune C4 for a flat frequency response of ±0.5 dB.

5. Before proceeding with the second part of the ALC board alignment, check to see that the IF phase corrector board (1227-1250) is functioning properly.

4.2.9 (A9) IF Phase Corrector Board (1227-1250)

Refer to Section 4.1.5 of this chapter for the system alignment procedures for the IF phase corrector board. The signal level into the board should be approximately the same as the output of the board.

The IF input jack of the IF phase corrector board is fed from the J3 IF O/P jack of the ALC board (A8).

The IF output jack of the IF phase corrector board is fed to the J7 IF I/P jack of the ALC board (A8).

4.2.10 (A8) ALC Board, NTSC (1265-1305) (Part 2 of 2)

To align this board:

1. Input a multiburst video test signal. Connect a spectrum analyzer to J11. Tune C63 for a flat frequency response of ±0.5 dB.

2. Move the Operate/Standby switch on the front panel to the Operate position.

3. Place jumper W3 on jack (J6) in the Manual mode and adjust R87 for 0.5 volts at TP4.

4. Place jumper W3 on J6 in the Auto mode and adjust the front panel power adjust control A20 full clockwise (CW). If the (optional) remote power raise/lower kit is present, then adjust switch S1 on the board to maximum voltage at TP4. Adjust R74, the range adjust, for 1 volt at TP4.

5. Adjust the front panel power adjust control A20 for 0.5 VDC at TP4. If the (optional) remote power raise/lower kit is present, adjust switch S1 on the board to midrange and then adjust the front panel power adjust control (A20) for 0.8 VDC at TP4.

6. Disconnect the plug that is on J12 (IF output) and monitor J12 with a spectrum analyzer. Verify an output of approximately 0 dBm. If necessary, adjust R99 to increase the output level. If less output level is needed, move the jumpers J27 and J28 to pins 2 and 3 and then adjust R99. Reconnect J12.

7. Move W2 on J5 to the cutback enable position. Remove the input video signal and verify that the output of the transmitter drops to 25%. Adjust R71, the cutback level, if necessary. Restore the input video.

Note: The following step affects the response of the entire transmitter.

8. Connect a video sweep signal to the input of the tray. Monitor the output of the system with a spectrum analyzer. Adjust C71 with R103 and C72 with R106 as needed to flatten the response. C71 and C72 adjust for the frequency of the correction notch being applied to the visual response of the transmitter. R103 and R106 are used to adjust the depth and width of the correction notch.

9. Refer to the Section 4.1.4 of this chapter for the system alignment procedures for the linearity

correctors. Controls R13, R18, and R23, the magnitude controls, should be set full CW. Controls R34, R37, and R40 are the linearity cut-in adjustments.

4.2.11 (A14-A1) Channel Oscillator Board (1145-1201)

This board is mounted in (A14) the channel oscillator assembly (1145-1202). To align the board:

1. Connect the main output of the channel oscillator (J1) to a spectrum analyzer, tuned to the crystal frequency, and peak the tuning capacitors C6 and C18 for maximum output. 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 DVM to TP1 on the x4 multiplier board. Tune capacitors C6 and C18 for maximum voltage, then also tune L2 and L4 for maximum voltage output at TP1.

2. Connect the sample output of the channel oscillator (J2) to a suitable counter and tune C11, coarse adjust, and C9, fine adjust, to the crystal frequency.

Note: Do not repeak C6, C18, L2, or L4. This may change the output level.

Note: While adjusting C9 and C11 to the crystal frequency, the peak voltage monitored at TP1 of the x4 multiplier board should not decrease. If a decrease does occur, there may be a problem with the crystal. Contact ADC Telecommunications Field Support for further instructions.

Note: If the VCXO board (1145-1204) in the VCXO assembly (1145-1206) is used, the C9 fine frequency adjust is not located on the VCXO board. Use R9 on the FSK w/EEPROM board.

3. Reconnect the main output (J1) of the channel oscillator to the input (J1) of the x4 multiplier.

4.2.12 (A15-A1) x4 Multiplier Board (1174-1112)

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

1. Monitor TP1 with a DVM and tune C4 for maximum voltage. Monitor TP2 with a DVM and tune C6 and C10 for maximum voltage. Monitor TP3 with a DVM and tune C12; repeak C4, C6, and C10 for maximum voltage.

2. Connect a spectrum analyzer, tuned to four times the crystal frequency, to the x4 multiplier output jack (J2). While trying to keep the out-of-band products to a minimum, monitor the output and peak the tuning capacitors for maximum output.

The output of the x4 multiplier connects to (A11-A1) the filter/mixer board.

4.2.13 (A11-A1) Filter/Mixer Board (1150-1102)

To align the board:

1. Monitor J4, the LO output of the board, with a spectrum analyzer and adjust C12 and C18 for maximum output (+14 dBm) at the LO frequency.

2. Adjust C13 and C17 for the best frequency response for the LO frequency.

4.2.14 (A11-A2) Filter/Amplifier Board, High Output (1064150)

The filter/amplifier board has been factory swept and adjusted for a 6 MHz bandwidth.

Note This board should not be tuned without the proper equipment.

The filtered output connects to J1 of the board and is amplified by U1 to a nominal +11 dBm visual and +1 dBm aural level by adjusting R9. The output is fed to the (A23-A1) high-band amplifier board (1218-1201) mounted on the VHF amplifier heatsink assembly (A23).

4.2.15 (A23-A1, A23-A3, A23-A4) High-Band Amplifier Boards (1218-1201)

Each of the high-band amplifier boards has 20 dB of gain. A23-A1 is biased at 2 amps of idling current with no RF drive applied. A23-A3, A4 are biased at 1.5 amps each, with no RF drive applied. To set the bias for the final amplifier board (A23-A1), the RF drive will need to be removed. To monitor the current adjustment, read the voltage drop across the 3-watt resistor, R5, mounted on the overcurrent protection board (1273-1130). Using Ohm's Law, determine the voltage drop across the resistor (2 amps x 0.01Ω=0.020 volts). Preset the bias adjust pots R5 and R9 CCW. Slowly adjust the bias adjust pot R5 for 1 amp on the meter and then adjust R9 for 2 amps total current on the meter.

To set the bias for the final amplifier board (A23-A3), the RF drive will need to be removed. To monitor the current adjustment, read the voltage drop across the 3-watt resistor, R6, mounted on the overcurrent protection board (1273-1130). Using Ohm's Law, determine the voltage drop across the resistor (1.5 amps x 0.01Ω=0.015 volts). Preset the bias adjust pots R5 and R9 CCW. Slowly adjust the bias adjust pot R5 for .75 amps on the meter and then adjust R9 for 1.5 amps total current on the meter. To set the bias for the final amplifier board (A23-A4), the RF drive will need to be removed. To monitor the current adjustment, read the voltage drop across the 3-watt resistor, R7, mounted on the overcurrent protection board (1273-1130). Using Ohm's Law, determine the voltage drop across the resistor (1.5 amps x 0.01Ω=0.015 volts). Preset the bias adjust pots R5 and R9 CCW. Slowly adjust the bias adjust pot R5 for .75 amps on the meter and then adjust R9 for 1.5 amps total current on the meter.

4.2.16 Frequency Adjustment of the High-Band Amplifier Boards

The following procedures describe how to adjust these boards:

Move the ALC/manual jumper on the (A11-A2) filter/amplifier board to the manual position, disabling the ALC circuit. Remove two fuses (F2 and F3) on the overcurrent protection board to disable the (A23-A3 and A4) high-band amplifier boards. Connect a spectrum analyzer to output connector J2 on the (A23-A1) high-band amplifier board. Adjust C9 and C19 for peak power and frequency response.

Move the spectrum analyzer to the output connector J2 on the (A23-A3) high-band amplifier board. Install fuse F2 and adjust C9 and C19 (on the [A23-A3] high-band amplifier board) for peak power and frequency response.

Move the spectrum analyzer to the output connector J2 on the (A23-A4) high-band amplifier board. Remove fuse F2, install fuse F3, and adjust C9 and C19 (on the [A23-A4] high-band amplifier board) for peak power and frequency response.

Move the spectrum analyzer to the output, J2, of the (A23) amplifier heatsink assembly. Install all of the fuses and readjust C9 and C19, if needed, on

all three amplifier boards for peak power and frequency response.

4.2.17 (A29) Overcurrent Protection Board (1273-1130)

There are no adjustments to this board.

4.2.18 (A19) Visual/Aural Metering Board (1265-1309)

The board is calibrated to give a peak detected output indication to the front panel meter for % Visual Output, % Aural Output, and % Reflected Output and should not be adjusted. If necessary, refer to Section 4.1.2 of this chapter for the alignment procedures for the front panel meter.

4.2.19 (A3) +12 VDC (4A)/-12 VDC (1A) Power Supply Board (1265-1312)

There are no adjustments to this board.

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.

4.2.20 (A31) Output Coupler Board (1211-1004)

There are no adjustments to this board.

This completes the detailed alignment procedures for the boards in the 420A transmitter.