This Transmitter was aligned at the factory and should require no additional alignment to achieve normal operation. Check that the RF Output at J2 of (A11) the Output Coupler Assembly of the Transmitter is terminated into a dummy load rated at least at the output power of the Transmitter or is connected to the Antenna for your System. Refer to the Test Data Sheet for your Transmitter and compare the final readings from the Factory with the readings on each of the Trays while doing the alignment. They should be very close to the same. If a reading is way off, the problem is likely to be in that Tray.

Switch On the Main AC Circuit Breakers located on the AC Distribution Panels mounted toward the rear of each Cabinet. Switch On CB2-CB4, for 4 kW, CB2-CB4 & CB5, for 5 kW & 6 kW and CB2-CB5 & CB6, for 6 kW. Circuit Breakers located on each of the AC Distribution Assemblies in the Amplifier Cabinets.

This Transmitter contains a Receiver Tray and using the IF Relays, located on the ALC Board, give the operator the ability to select either the Combined IF Output from the Receiver Tray or from the Modulator. The switching of the IF Relay is accomplished by applying or removing a jumper on Jack J9 Pins 31 & 32 located on the Optional A/V Input and Remote Interface Assembly or by applying or removing a jumper on Jack J11 Pins 10 & 28 located on the rear of the UHF Exciter. To select the output from the Modulator, J9 Pins 31 and 32 or J11 Pins 10 & 28, must be connected together. To select the output from the Receiver Tray, J9 Pins 31 and 32 or J11 Pins 10 & 28, must not be connected together.

(A3) UHF Receiver Tray (Optional)

Connect a UHF Input (-61 dBm to -16 dBm), with a Multiburst Test signal applied, that is at the desired Channel Frequency to Jack J18, "F" type connector, for 75Ω or Jack J1, "N" type connector, for 50Ω located on the A/V Input & Remote Interface Panel. Check that the On/Off Circuit Breaker, located on the rear of the Tray, is On.

Check the Front Panel Sample Jack (J9) with a Frequency Counter. The signal should be at the needed frequency, check the top of the Channel Oscillator Assembly for the actual frequency, to produce the IF Outputs.

(A1) UHF Exciter Tray

This Tray has adjustments for Video and Audio Modulation levels and other related parameters.

Preset the following switches and pots located in the UHF Exciter Tray:

(A5) Sync Tip Clamp/Modulator Board (1265-1302):
- W1 on J5 to the Bypass position, bypassing the Delay Equalizer Board, if present.
- W7 on J4 to the Clamp Enable position, Auto Clamp On.

(A8) ALC Board (1265-1305):
- W3 on J6 to the ALC Auto position.
- W4 on J8 to the Normal position.
- W8 on J9 to the Normal position.
- W9 on J27 to the 6 dB Pad Out position.
- W10 on J28 to the 6 dB Pad Out position.
- W1 on J4 to the Disable (Off) position, Linearity Correctors Off.
- W11 on J29 to the Local Modulator Select Disable position.

Preset the following switches and pots located in the UHF Exciter Tray:

(A9) IF Phase Corrector Board (1227-1250):
- W2 on J9 to the Phase Correction Enable Position.
- W3 on J10 to the Amplitude Correction Disable Position.

Switch the Exciter to Auto/Manual Switch to Manual and the Operate/Standby Switch to Operate.

(A1) UHF Exciter Tray - Continued

Connect an NTSC Composite Video Test Signal Input (1 Vpk-pk) to the Transmitter Video Input Jack J2, located on (A9) the Remote Interface Assembly. Connect a Baseband Audio Input (+10 dBm) to the Balanced Audio Input Terminal Block TB1 or if Stereo/Composite Audio Input (1 Vpk-pk) is provided, connect it to the BNC Jack (J6) the Composite Audio Input Jack.

Observe the Front Panel Meter located on the UHF Exciter Tray. In the Video Position the Meter indicates Active Video from 0 to 1 Vpk-pk. With an Input Video of 1 Vpk-pk the display should indicate 1 Vpk-pk at White. If these readings are not the proper levels, the overall Video Level can be changed by adjusting the Video Level Control (R12), located on (A5) the Sync Tip Clamp/Modulator Board (1265-1302).

Switch the Meter to the Audio Position which indicates the Audio Deviation (Modulation Level) of the signal, 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 400 Hz @ 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.

The Upconverter Section of the UHF Exciter Tray includes adjustments for automatic level control (ALC), linearity (amplitude predistortion) and incidental phase (phase change vs. level) predistortion for correction of the nonlinearities of the RF Amplifier Trays. The Upconverter Section also includes adjustments of the local oscillator chain tuning and also the local oscillator center frequency tuning. Both of these were completed at the factory and should not require adjustment at this time. Move the Operate/Standby Switch located on the UHF Exciter Tray to Standby.

The set-up of the RF Output includes the adjustment of the Linearity and Incidental Phase Predistortion which compensate for any nonlinear response of the Amplifier Trays and also the gain and phasing adjustments of the UHF Amplifier Trays in each of the Amplifier Assemblies.

Verify that all **Red** LEDs located on the ALC Board are extinguished. The following list details the meaning of each LED when illuminated.

DS1 ..... Input Fault. Indicates that the Input level to the board is low or missing.

DS2 ..... Indicates that the ALC circuit is unable to maintain the signal level requested by the ALC reference. Normally this is 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 ..... Indicates a loss of Video at the Input of the board.

DS4 ..... Indicates a Visual Mute Command is present. Not used in this System.

Check that the Jumper W3 on J6 on (A8) the ALC Board (1265-1305) in the Auto Position and adjust the Power Gain Pot, located on the Front Panel of the UHF Exciter Tray, to obtain +0.8 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 +0.8 VDC on the Front Panel Meter in the ALC Position. Move the Jumper back to Auto which is the normal operating position.

The detected IF signal level at J19-2 of the ALC Board is connected to the Transmitter Control Board that distributes the level to the Phase/Gain Trays. The (A4 & A5) Phase/Gain Trays connects the ALC voltages to the Metering Panel which splits the references which are connected to the Amplifier Assemblies where they are used as the reference for the automatic gain control (AGC) for each Amplifier Tray.

Phase and Gain Adjustment Procedure for the Transmitter

This Transmitter was aligned at the factory for proper Phase and Gain and should require no additional alignment to achieve normal operation. **Use this procedure only if a UHF Amplifier Tray has been replaced or repaired and full transmitter adjustment is needed**.

Each Amplifier Assembly contains an AC Distribution Panel that is made up of a Main 100 Amp Circuit Breaker and five 20 Amp Circuit Breakers. CB2 applies power to A1 the left bottom UHF Amplifier Tray, CB3 applies power to A2 the right bottom UHF Amplifier Tray, CB4 applies power to A3 the left middle UHF Amplifier Tray, CB5 applies power to A4 the right middle UHF Amplifier Tray and CB6 applies power to the A5 left top UHF Amplifier Tray.

Phase and Gain Adjustment Procedure for Amplifiers in the Amplifier Array Assemblies

Switch the Transmitter to Standby and switch Off the Main AC Circuit Breaker located on each of the AC Distribution Assemblies in the Amplifier Array Assemblies. Switch Off all the AC Circuit Breakers, located on the AC Distribution Assembly, for the individual Amplifier Trays.

1. Adjust all gain controls located on the UHF Amplifier Trays full CCW.

2. Switch On the Main AC Circuit Breaker for the Side A Amplifier Array Assembly and switch On the AC Circuit Breaker for Amplifier #1.

3. Place the Transmitter in Operate and adjust the Gain control on the Amplifier Tray for 50% output power and adjust the Phase control to mid range.

4. Monitor the output power of the Transmitter by connecting a Spectrum Analyzer to the Sample Jack located on the Metering Panel. Adjust the Spectrum Analyzer for Zero Span operation. The power could be monitored by watching the meters on the panel but the power change is easier to see on the analyzer.

5. Turn On the AC to Amplifier Tray #2 and adjust its' output power to 50%.

6. While monitoring the output power of the Transmitter, adjust the Phase Control until the power reaches a peak. If the Phase adjust reaches its end of travel, add a 2 inch cable to the RF Input (J1) of the amplifier. Re-adjust the Phase to peak the System output power. If the Phase Control again reaches its end of travel before a peak in power is reached, remove the 2 inch cable and add a 3 inch cable to J1 of amplifier and readjust phase for peak output power. The adding of cables should be done during the adjustment anytime the range of the phase adjust needs extended.

7. Repeat steps 5 and 6 for the remaining Amplifiers.

8. Increase the output power on Amplifier #1 and Amplifier #2 to 90%.

9. Adjust the Phase Control on Amplifier #2 to peak the System output power.

10. Increase the output power on Amplifier #3 to 90% and adjust the Phase control for maximum System output power.

11. Increase the output power on Amplifier #4 to 90% and adjust the Phase control for maximum System output power.

12. Increase the output power on Amplifier #5 to 90% and adjust the Phase control for maximum System output power.

13. Monitor the Reflected Power on all of the UHF Amplifier Trays. The Reflected Power should read ≤5%. If an amplifier is showing high reflected power adjust the Phase control to minimize Reflected Power. Be careful not to increase Reflected Power on the other Amplifier Trays. The Amplifier Trays should interact in such a way that the phasing of any one Amplifier will affect the Reflected on the other Amplifiers.

14. Repeat Steps 1-13 for the Side B Amplifier Array Assembly.

Phase and Gain Adjustment Procedure for the entire Amplifier Array Assembly

1. Begin the alignment with all Amplifier Trays up and running. Monitor the Reject Power by setting the Combined Metering switch to the Reject position and adjusting the Phase Control on either, or both, of the Phase/Gain Modules to minimize the Reject reading.

2. Adjust the Amplifier Gain controls so that all amplifiers have equal output power.

3. The Gain control on the Phase/Gain Module can be used to balance the output power between Sides A and B. This adjustment has a 10% range. If the end of its' range is reached, you must adjust the gain of each amplifier in the Amplifier Side to balance the power of each Side.

IF Phase Corrector Adjustment

As shipped, the Exciters were 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) mounted in the UHF Exciter. The Amplitude Correction portion of the Board is not utilized in this configuration, therefore the Jumper W3 on J10 should be in the Disable Position, to +6.8 VDC, and R35 & R31 should be full CCW. R68 is the Range Adjustment and should be set in the Middle. The Phase Correction Enable/Disable Jumper W2 on J9 should be in the Enable Position, to Ground.

Switch the Input Video Test source to select a NTSC 3.58 MHz Modulated Staircase or Ramp Test waveform and 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, located on the IF Phase Corrector Board, each with a Magnitude and a Threshold Adjustment which are adjusted as needed to correct for any Differential Phase or Intermod problems. Adjust R3 Threshold, for the cut in point of the correction and R7 Magnitude, for the amount of the correction as 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 R11 Threshold, for the cut in point of the correction and R15 Magnitude, for the amount of the correction as needed. Finally, adjust R19 Threshold, for the cut in point of the correction and R23 Magnitude, for the amount of the correction as needed.

Calibration of the Forward Output Power Level of the Transmitter
Note: - Perform the following only if the power calibration is suspect.

Switch the Transmitter to Standby and preset R51, Aural Null pot, located on the Visual/Aural Metering Board (1265-1309) in the Metering Panel, full CCW. Adjust R48, the Null Offset pot, located on the Visual/Aural Metering Board, for 0% Visual Output. Do the following adjustments with no Aural present, by removing the Jumper Cable W1, Aural IF Loop-Thru, connected to J16, located on the Sync Tip Clamp/Modulator Board (1265-1302) in the selected UHF Exciter. Connect a Sync and Black Test Signal to the Video Input Jack J2 on the Remote Interface Assembly of the UHF Exciter Tray. Switch the Transmitter to Operate.

Next, set the Transmitter up for the appropriate Average Output Power Level. (Sync + Black 0 IRE Setup Watt Meter = Peak Transitter Rating x 0.595). (Sync + Black 7.5 IRE Setup Watt Meter = Peak Transmitter Rating x 0.545). NOTE: Must have 40 IRE Units of Sync. Adjust R28, Visual Calibration, located on (A10) the Visual/Aural Metering Board (1265-1309) in the Metering Panel, for 100% on the front panel Combined Meter in the % Visual Position.

With the Spectrum Analyzer set to Zero Span Mode obtain a peak reference on the screen. Reconnect the Jumper Cable W1 to J16 located on (A5) the Sync Tip Clamp/Modulator Board in the UHF Exciter. While in the Combined Visual Output Power position, adjust L3 for minimum visual power reading. Turn the power adjust pot on the front panel of the Exciter until the original peak reference level is attained. Switch to the Combined Aural Output Power position and peak L1 and C8 for maximum Aural Power reading. Then adjust R20 also for 100% Aural Power reading. Switch to Combined Visual Output Power position and adjust R51 for 100% Visual Power.

Calibration of the Reflected Output Level of the Transmitter

Turn the Power Adjust Pot on the UHF Exciter to 20% on the Metering Panel Combined Meter in the Visual Power position, check that the Jumper is in Manual on the UHF Upconverter Board (1265-1310) in the UHF Exciter. Unterminate the Transmitter and adjust R39 on the Visual/Aural Metering Board (1265-1309), in the Metering Panel, for a 20% reading in the Combined Reflected Power position. At this 20% Reference Power reading, the VSWR LED mounted on the front panel of the UHF Exciter should be illuminated. If not adjust R22 on the Transmitter Control Board, in the UHF Exciter, until the VSWR LED just turns On. Turn the Power Adjust pot slightly CCW and the LED should go out, turn the pot CW until the LED just turns On. The Reflected Output Power is now calibrated. Switch the Transmitter to Standby. Re-terminate the Transmitter. Switch the Transmitter to Operate and adjust the front panel power pot for 100% Visual Power reading on the Combined Meter.

(A4) Hybrid Combiner

The inputs to the Hybrid Combiner are the outputs of the two Amplifier Assemblies. The inputs are 50Ω impedances to match the output impedance of the UHF Amplifier Trays. The two inputs are combined and then sent through a piece of transmission line 1/4 of a wavelength long to transform the output impedance of the combiner to 50Ω. The output of the Hybrid Combiner is then sent to a (A9) a Bandpass Filter.

(A9) Bandpass Filter

This filter is factory swept and should not be tuned without the proper equipment. Do not attempt to tune this filter without a sweep generator.

The input to this filter is output of the Hybrid Combiner which is the combined output of the Amplifier Assemblies. The filter is made of aluminum waveguide and has four resonant cavities. The filter has five bolts for tuning adjustments and rods for coupling adjustments between sections.

To tune the filter, connect a sweep signal to the input of the filter and adjust the five tuning bolts (three on one side and two on the other side of the filter) for a 6 MHz bandwidth and a flat frequency response across the band.

(A10) Output Trap Filter Assembly

The input to the Trap Filter is the output of the Bandpass Filter. The Trap Filter is comprised of a 3-1/8" EIA standard transmission line section connected to the main transmission line. The transmission line assembly consists of 7/8" EIA standard rigid coaxial components. Refer to the Alignment Procedure for the UHF Trap Filter which follows for more information.

The Bandpass Filter (A9) and the Output Trap Filter (A10) are 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 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 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.

(A10) Output Trap Filter Assembly - Continued

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.

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 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 Detailed Alignment Procedure for the 835A UHF Transmitter. If a problem occurred during the System Alignment, refer to the Detailed Alignment Procedure for that Tray for more information.