7. PARTS LIST/TUNE-UP INFO

7.1 Parts List

The translator, can be subdivided as follows:

Receiver Tray:
- -VHF filter
- -Dual stage amplifier board
- -Channel oscillator Assembly
- -Channel oscillator multiplier board
- -Downconverter/amplifier board
- -IF filter/ALC board
- -SAW filter amplifier board
- -Power supply board

20-Watt Upconverter/Ampliifier Tray:
- -Channel oscillator assembly
- -Channel oscillator multiplier board
- -Filter/mixer board
- -ALC/AGC board
- -Linearity corrector board
- -Filter amplifier board
- -VHF high-band driver board
- -VHF high-band amplifier board
- -Low pass filter
- -Trap filter board
- -High-band VHF coupler board
- -Visual/aural metering board
- -Transmitter control board
- -AGC control board
- -Power supply board
- -Switching power supply

7.2 Tune-up Information

The 117B translator was aligned at the factory and should not require additional alignments to achieve normal operation.

The UHF/VHF Receiver Tray w/(Optional) Frequency Correction selects the desired UHF or VHF On Channel Input Signal and converts it to a Combined IF Signal of 45.75 MHz Visual + 41.25 MHz Aural. The Tray also has provisions for a Frequency Correction Option that consists of a VCXO Channel Oscillator Assembly with a PLL Circuit which maintains an exact IF Output Frequency, over the capture range of the PLL circuit, even if the Input UHF or VHF Frequency may vary.

7.2.1 RF Input Signal Path (Receiver)

The RF Input to the Tray, (-61 dBm to -16 dBm in Level), is fed through J1 for 50Ω to (A7) the input 50Ω Filter, DC Multiplexed (1035-1204 UHF, 1035-1902 VHF LB or 2065-1024 VHF HB) or through J5 for 75Ω to (A7) the 75Ω input Filter, DC Multiplexed (1035-1207 UHF, 1035-1903 VHF LB or 2065-1023 VHF HB), which is of a double tuned design that is adjusted to the desired Input UHF or VHF Channel Frequency. Note: If the input signal is greater then -25dBm, an attenuator should be used to limit the level to -25dBm. +12 VDC, for use by an (Optional) external Preamplifier Assembly, connects to the filter through F1 a 1 Amp Fuse. This +12 VDC is DC Multiplexed onto the input signal cable from the Preamplifier. DS1 a Red LED located on TB1 in the Tray will be lit if the +12 VDC is present on the input cable. If a Preamplifier is not used, F1 should be removed and DS1 should not be lit.

The signal is next amplified +12 dB to approximately the -49 to -4 dBm level by a low noise amplifier located on (A8-A1) the Dual Stage Amplifier Board (1227-1501) that is contained in (A8) the Dual Stage Amplifier Assembly (1227-1503). The board has approximately +13 dB or +26 dB of gain, depending on whether Jumper W1 on J5 is in place. The signal is then filtered in (A9) a Channel Filter (1007-1101 UHF, 1034-1202 VHF LB or 2065-1000 VHF HB) and then applied back to (A8-A1) the Dual Stage Board where the same amplification takes place. Jumper W1 on J7, located on the Dual Stage Board, should be removed if the Receiver Input level is greater than -40dBm. The output is connected to (A10) the Downconverter Amplifier Assembly (1227-1505) that contains (A10-A1) the Downconverter Amplifier Board (1227-1502). The RF, at the -47 dBm to -2 dBm Level, connects to the "R" Input Jack of the Mixer Z1 located on the Downconverter Amplifier Board.

7.2.2 Local Oscillator Signal Path (Receiver)

The Local Oscillator Signal is derived from a cut to channel crystal mounted in an oven that is factory set at 45° C. The Oscillator operates at 1/8 for UHF, 1/4 for VHF High Band or 1/2 for VHF Low Band of the desired local oscillator frequency. The crystal is mounted on (A4-A1) the Channel Oscillator Board, Dual Oven (1145-1201), that is part of the Channel Oscillator Assembly (1145-1202). The oscillator circuitry is a modified Colpitts design operating in a separate oven set at 50° C. for improved stability. If the Frequency Correction Option is purchased, the VCXO Channel Oscillator Assembly (1145-1206), which contains the VCXO Channel Oscillator Board (1145-1204), is used in place of the standard Channel Oscillator Assembly, and an AFC voltage from the PLL circuit maintains the frequency of the VCXO.

The output of the Channel Oscillator is connected to the (A5-A1) the x8 Multiplier Board (1227-1002) for UHF, the x4 Multiplier Board (1227-1525) for VHF HB or the x2 Multiplier Board (1227-1524) for VHF LB, which is located in (A5) the Multiplier Enclosure (1265-1125). The proper multiplier board takes the output of the Channel Oscillator (+3 dBm) and multiplies it eight, four or two times by a series of three, two or one x2 Broadband Doublers (2x2x2 = x8), which produces the L.O. signal on the desired frequency needed for the upconversion process. The signal is then amplified to the +16 dBm level. A sample of the multiplied L.O. Signal is fed to a detector circuit which lights the Green LED DS1 that indicates that the L.O. is present at the Output Jack J2 of the Multiplier Board. This Green LED is seen through a hole the lid of the Multiplier Assembly and is an indication, when lit, that there is a signal present at the output of the Multiplier Board. The L.O. signal is filtered in (A6) a L.O. Filter 1007-1101 UHF, 2065-1000 VHF HB or 1034-1211 VHF LB) and then sent (+15 dBm) to J2 on (A10-A1) the Downconverter Amplifier Board. The L.O. Input to the Downconverter Amplifier Board is connected thru a 3 dB matching pad to the "L" Input of the Mixer (Z1) at a +12 dBm level.

7.2.3 Combined IF Signal Path (Receiver)

The L.O. and the RF signals are mixed in the Mixer Stage of the Downconverter Amplifier Board to produce the desired IF difference frequency at -55 dBm to -10 dBm in level, depending on the RF Input Level. The Combined IF Signal is routed to (A11-A1) the IF

Filter/ALC Board (1227-1504), which is mounted in (A11) the IF Filter/ALC Enclosure (1265-1105). The IF Filter/ALC Board contains a Pin Diode Attenuator circuit which is part of the Automatic Level Control (ALC) that controls the level of the IF Signal to the two stage amplifier ICs U1 and U2.

The (Optional) (A11-A2) SAW Filter/Amplifier Board (1035-1211) is also contained in the IF Filter/ALC Enclosure. The SAW Filter/Amplifier Board connects to J5 and J6 of the IF Filter/ALC Board if more attenuation of the Out Of Band products is needed. If the SAW Filter/Amplifier Board is not needed, a jumper connects the Combined IF from J5 to J6 on the IF Filter/ALC Board.

The Combined IF is then bandpass filtered to the needed 6 MHz IF bandwidth around the 41.25 MHz + 45.75 MHz Combined IF signal and amplified by U3 to the -41 dBm to +4 dBm Level before it is split. One output is detected by U4 for use as the ALC reference level to the Pin Diode Attenuator Circuit. The ALC comparator drives the Pin Diode Attenuator Circuit to maintain the desired output level, typically +2 dBm. The other split output connects to J2 the Combined IF Output of the board that is cabled to the IF Output Jack of the Tray at J4 (+2 dBm).

7.2.4 Frequency Correction Option (Receiver)

If the Frequency Correction Option (1227-1528) is purchased, (A13) the IF Filter/Limiter Board (1109-1001), (A14) the IF PLL Board (1109-1002), the (A15) IF Carrier Oven Oscillator Board (1100-1206), (A4) the VCXO Channel Oscillator Assembly (1145-1206) and (A16) an IF Amplifier Board, High Gain (1197-1126) are part of the System.

A Sample of the amplified and ALC controlled signal from the IF Filter/ALC Board is directed to the IF Amplifier Board, High Gain (1197-1126) where it is amplified and connected to J2 on (A13) the IF Filter/Limiter Board (1109-1001). The IF is filtered by a SAW Filter, which passes Visual Carrier and Aural Carrier only, and amplified before it is split. The Aural IF Output is not used in this Tray. The other output of the splitter is amplified and applied to a Notch Filter. The Notch Filter is tuned to the Aural Frequency by C17 and R10 which reduces or eliminates the Aural IF from the Visual IF signal. The Visual IF Only signal then connects to a video detector circuit which in conjunction with U5 strips the video from the Visual IF signal. The IF CW Signal is amplified and buffered before it is connected to the output of the board at J6. The IF CW connects to J2 of (A14) the IF PLL Board (1109-1002).

The IF CW Signal (+3 dBm) on the IF PLL Board is wired to U1 a Divider IC which, in conjunction with U2, sets up one of the reference signals to the comparator circuit. The other reference signal is derived from the 50 kHz reference Input at J4 which is a divided down 50 kHz sample of the 38.9 MHz signal generated on (A15) the IF Carrier Oven Oscillator Board (1100-1206). The 38.9 MHz IF Carrier Oven Oscillator Board is used instead of the 45.75 MHz IF Carrier Oven Oscillator Board to minimize the interference between the generated 45.75 MHz IF and the signal generated on the (A15) IF Carrier Oscillator Board. The 38.9 MHz signal itself is not used, just the divided down 50 kHz reference of the 38.9 MHz Signal is used. The two reference signals applied to the IF PLL Board are compared by U2 and a difference voltage (AFC) is produced. The difference voltage (AFC), approximately -3 VDC, is fed from J3 of the board to FL2 of (A4) the VCXO Assembly. If the frequency of the VHF or UHF Input to the Tray should drift, the ALC voltage will change to increase or decrease the output frequency of the VCXO Assembly which increases or decreases the L.O. Frequency that maintains the IF Frequency at the standard 45.75 + 41.25 MHz Frequency. If the frequency of the Input Signal should drift out of the capture range of the PLL Circuit, DS1 the Red LED Unlock Indicator, located on the IF PLL Board, lights.

7.2.5 Voltages for Operation of the Tray (Receiver)

The AC input to the Tray is 117 VAC or 230 VAC and is directed thru Jack J2, of the (A1) Power Entry Module (1265-1104), to the step down Toroid (A2). The Power Entry Module contains an On/Off Switch, a 4 Amp Slo-Blo Fuse and three MOVs which protect the Tray from transients or surges which may occur on the AC Input Lines. When the On/Off Switch is switched On, AC is applied to the (A2) Toroid. The Toroid steps down the voltage into two 16 VAC outputs which are fed to (A3) the +12V(3A)/-12V Power Supply Board (1092-1206). The 16 VAC Inputs are connected to the two full wave bridge networks one for +12 VDC and one for -12 VDC. The output of the +12 VDC rectifier is fed to three 7812 IC regulators (U1, U2 and U3) and the output of the -12 VDC rectifier is fed to one 7912 IC regulator (U4). The ±12V Power Supply Board provides the voltage regulated and current limited +12 VDC and -12 VDC to the rest of the boards in the Tray.

7.2.6 +12VDC for External Preamplifier (Receiver)

+12 VDC is also applied through a 1 Amp Fuse F1 to (A7) the input DC Multiplexed UHF or VHF Filter. The +12 VDC is multiplexed in the Filter onto the input coaxial cable that connects from the (Optional) Remote Preamplifier Unit to the Receiver Tray. This supplies the Preamplifier with the +12 VDC needed for operation. The Red LED DS1 mounted on the Terminal Block TB1 will be lit if the +12 VDC is applied to the coaxial cable. **Note**: If the Red LED, DS1, is lit, the +12 VDC may damage Test Equipment that is connected to the input of the Receiver Tray. If a Preamplifier Assembly is not part of your System, F1 should be removed, therefore DS1 should not be lit and the +12 VDC is not multiplexed onto the input coaxial cable. A spare Fuse for F1 is supplied and stored near the fuse holder for F1.

Connect a UHF or VHF Input with a Multiburst Test signal applied, that is at the desired Channel Frequency, to J1 50Ω or J5 75Ω located on the rear of the (A3) 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.

7.2.6.1 (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.

7.2.6.2 (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.

7.2.6.3 (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.

7.2.6.4 (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, and 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.

7.2.6.5 (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.

7.2.6.6 (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.

7.2.6.7 (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.

7.2.6.8 (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.

7.2.6.9 (Optional) (A11-A2) 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.

7.2.6.10 (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.

7.2.7 IF Signal Path (Upconverter/Amplifier)

The VHF Upconverter/Amplifier Tray takes the modulated Visual + Aural IF input from the Modulator or Receiver Tray and mixes it with a generated L.O. to produce the desired VHF High Band Channel Frequency output. The Tray then amplifies the VHF signal to the 20 Watt peak of Sync Visual Output power level.

The input of the Upconverter/Amplifier Tray is a modulated Internally Diplexed IF signal. The IF input network for the Tray is a simple bandpass filter located on (A10) the ALC/AGC Board (1067-1116) which eliminates harmonics on the input signal. The signal is next adjusted in level by the pin attenuator/ALC circuitry and sent to (A11) the Linearity Corrector Board (1161-1116). The Linearity Correctors compensate for the amplitude non-linearities of the final amplifiers by providing an opposite amplitude transfer function. The shape of this transfer function is set by the potentiometers located on this board. The corrector circuits can also be bypassed by the switches located on the board.

The output of the Linearity Corrector Board is sent back to the ALC/AGC Board where an AGC circuit compares a detected sample of the IF with a detected sample of the RF Output and adjusts the IF output to maintain a constant gain after the first sample point. This corrects for any temperature drift that may occur in the amplifier devices. (A9) The AGC

Control Board (1137-1201) provides adjustments of the AGC feedback from the Transmitter Control Board to the VSWR Cutback circuit located on the Transmitter Control Board.

The ALC and AGC controlled IF signal from J4 on the board is fed to Jack (J2) located on (A16) the Mixer/Amplifier Enclosure, which contains (A16-A1) a Filter/Mixer Board and (A16-A2) a Filter/Amplifier Board. The IF Signal (-3 dBm Visual -13 dBm Aural) connects to Jack J7 of (A16-A1) the Filter/Mixer Board (1150-1102) and is wired to the Mixer stage Z1. The Mixer mixes the IF with the local oscillator signal, that connects to J3 on the board, to produce the desired VHF output signal.

7.2.8 L.O. Signal Path (Upconverter/Amplifier)

The local oscillator signal is derived from a cut to channel crystal, located in an oven set at 45° C. This oscillator circuit, which is part of (A14-A1) the Channel Oscillator Board (1145-1201), is a modified Colpitts circuit. The Channel Oscillator Board is mounted in (A14) a Channel Oscillator Assembly (1145-1202) that has a separate oven set at 50° C for improved stability. The output of the Oscillator Assembly at J1 is fed to (A15) a x4 Multiplier Board (1174-1112). The x4 Multiplier contains two doubler circuits which multiply the L.O. signal to the required frequency needed for mixing with the IF to produce the VHF High Band Channel Frequency. The L.O. Signal (+5 dBm) from J2 on the board is connected Jack J1 of (A16) the Mixer/Amplifier Enclosure which is cabled to Jack (J3) of (A16-A1) the VHF Filter/Mixer Board (1150-1102). The L.O. Signal is amplified by U2 and connected to J4 of the Board. The amplified L.O. Signal at (+14 dBm) is jumpered to (J5) the L.O. Input Jack to the Mixer Z1.

7.2.9 RF Signal Path (Upconverter/Amplifier)

The L.O. input and the IF input are mixed to produce an output of the Mixer at Jack (J6) (-14 dBm) which contains the unwanted Mixer products along with the desired VHF Channel signal. These signals are jumpered from J6 to J1 the RF Input Jack of the VHF Filter/Mixer Board.

The RF Signal is bandpass filtered for the desired VHF Channel frequency and then amplified by U1 (-2 dBm Visual -12 dBm Aural) before it is connected to the RF Output Jack (J2) of the Board. The VHF output is connected to J7 of (A16-A2) the VHF Filter/Amplifier Board (1150-1101) on which it is filtered again and jumpered from J6 to J1 on the board. The +12 VDC needed for operation of the Filter/Mixer Board and the Filter/Amplifier Board are provided by (A6) the +12V(3A)/-12V Power Supply Board (1092-1206). The filtered VHF is amplified to +8 dBm and -2 dBm, R9 sets the gain of the Filter/Amplifier Board using a Pin-Attenuator circuit, and connected to J2 the RF Output of the Board.

J2 is cabled to J3 on the Mixer/Amplifier Enclosure Assembly. The RF is connected to Jack (J1) on (A17-A1) the VHF High Band Driver Board (1174-1107). The Driver Board contains a dual transistor stage Q1 that produces an output of +26 dBm Visual +16 dBm Aural. (A17-A1) The VHF High Band Driver Board and (A17-A2) the VHF High Band Amplifier Board are mounted on (A17) the Amplifier Heatsink Assembly (1174-1111). The output of the Driver Board connects to J1 of (A17-A2) the VHF High Band Amplifier Board (1174-1101). The VHF High Band Amplifier Board contains a dual Transistor Stage that amplifies the VHF Signal to +44 dBm Visual and +34 dBm Aural. R5 and R9 on the board are Bias Adjustments which set the gain of the Board. The VHF High Band Driver Board and the High Band VHF Amplifier Board receive their +26 VDC Bias voltage from (A3) the +26 VDC Switching Power Supply. DS4 the front panel mounted Amplifier Status LED, that is mounted across J3-2 and J3-3 of the VHF High Band Amplifier Board, will light if the +26 VDC is present to the board. The +26 VDC is connected to the board through (F1) the 8 Amp Fuse. The output of the VHF High Band Amplifier Board at J2 (+44 dBm Visual and +34 dBm Aural) is connected to (A18-A1) a Low Pass Filter Board (1174-1102, 1174-1103 or 1174-1104 depending on frequency) which contains a Low Pass Filter and a 2nd Harmonic Trap. The filtered output is cabled to (A18-A2 & A3) two Trap Filter Boards (1174-1105 or 1174-1106 depending on frequency) each Board contains two Trap Filter circuits. The first Trap Filter circuit, containing C6 and C8, is tuned to -4.5 MHz while the second Trap Filter, containing C2 and C4, is tuned to +9 MHz. The output of (A18-A3) Trap Filter Board connects to Jack (J1) of (A23) a High Band VHF Coupler Board (1141-1002). The VHF Channel Frequency Output of the Coupler at J2 is directed to the rear of the Tray, the RF Output Jack (J4), (+43 dBm Visual and +33 dBm Aural).

A Forward Output Power Sample at J3 and a Reflected Output Power Sample at J4 are provided by the VHF Coupler. The Forward Power Sample is sent to (A24) a Splitter Assembly which provides two Forward Power Sample outputs that are connected to J1 and J2 on (A26) the Visual/Aural Metering Board (1161-1103). The Visual + Aural Forward Sample at J1 enters the board which is tuned to provide an Aural Only Output Sample at Jack J6 - Pin 1 that connects to the front panel meter for monitoring. The Visual + Aural Forward Power Sample at J2 enters the board which is tuned to produce a Visual Only Output Sample at Jack J7 - Pin 1 that connects to the front panel meter for monitoring. The Reflected Sample from J4 of the VHF Coupler connects to J4 of the Visual/Aural Metering Board and provides a Reflected Output Sample at Jack J9 - Pin 1 that connects to the front panel meter for monitoring.

Use the IF Output of the Modulator or the Receiver Tray to drive the VHF Upconverter/Amplifier Tray.

The Upconverter/Amplifier Tray includes adjustments for automatic level control (ALC) of the drive level, linearity (amplitude pre-distortion) predistortion and the RF amplifier stages. The Upconverter/Amplifier Tray also includes adjustments for the local oscillator multiplier chain and the local oscillator center frequency.

Switch the Front Panel mounted On/Off Upconverter/Amplifier Circuit Breaker to the On position. Switch the Auto/Manual Switch to the Manual position. Switch the Operate/Standby Switch to the Standby position.

7.2.9.1 (A14) CHANNEL OSCILLATOR ASSEMBLY (1145-1202)

CONTAINS: (A14-A1) CHANNEL OSCILLATOR BOARD (1145-1201).

1. Connect the main output of the Channel Oscillator (J1) to a spectrum analyzer, tuned to the crystal frequency. Switch the Operate/Standby Switch to Operate, and peak the tuning capacitors C6 and C18 for maximum output. Tune L2 and L4 for maximum output. The output level should be approximately +5 dBm.

2. 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 tune L2 and L4 also for maximum voltage output at TP1.

3. Connect the sample output of the channel oscillator (J2) to a suitable counter and tune C11, coarse adjustment, and C9, fine adjustment, to the crystal frequency. <u>DO NOT RE-PEAK</u> C6, C18, L2 or L4, because it may change the output frequency.

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 a problem may exist with the crystal.

4. Reconnect the main output (J1) of the Channel Oscillator to the input (J1) of the x4 Multiplier.

7.2.9.2 (A15) x4 MULTIPLIER BOARD (1174-1112)

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

1. Monitor TP1 with a DVM and Tune C4 for Maximum.
   Monitor TP2 with a DVM and Tune C6 and C10 for Maximum.
   Monitor TP3 with a DVM and Tune C12 then re-peak C4, C6 and C10 for Maximum.

2. Connect a Spectrum Analyzer, tuned to 4 times the crystal frequency, to the x4 Multiplier output Jack (J2). Monitor the output and peak the tuning capacitors for maximum output.

The output of the x4 Multiplier connects to (A16-A1) the Filter/Mixer Board.

7.2.9.3 (A16-A1) FILTER/MIXER BOARD (1150-1102)

1. Monitor J4 the L.O. Output of the Board with a Spectrum Analyzer and adjust C12 and C18 for maximum output (+14 dBm) at the L.O. frequency.

2. Adjust C13 and C17 for best frequency response for the L.O. frequency.

PRESET THE FOLLOWING SWITCHES:

(A10) ALC/AGC Board
S1 to ALC Manual
S2 to AGC Manual

(A11) Linearity Corrector Board
S1 to Off

7.2.9.4 (A10) ALC/AGC BOARD (1067-1116)

The Input IF signal is cabled to (J1) IF input of the ALC/AGC Board.

1. Remove the J1 plug from the board, observe that DS2, Input Fault, lights. Reconnect J1 and observe DS2 extinguished.

2. Check that S1 is in Manual. Monitor the output at J2 with a Spectrum Analyzer and adjust R17 for 0 dBm level.

3. Insert a NTSC multiburst video test signal to the Modulator Tray and tune C2 for a flat frequency response ±.5 dB. Reconnect J2. Jack (J2) of the board is cabled to the J1 Input Jack of the Linearity Corrector Board.

7.2.9.5 (A11) LINEARITY CORRECTOR BOARD (1161-1116)

Check that the linearity pre-correction (S1) is switched Out.

1. Monitor the Output Connector (J2) of the Linearity Corrector Board and verify an IF output of approximately 0 dBm level.

No other adjustments are necessary to the linearity corrector at this point of the procedure. The IF output of the Linearity Corrector Board is fed back to the ALC/AGC Board at connector (J3).

7.2.9.6 (A10) ALC/AGC BOARD (1067-1116)

1. Switch S1 on the ALC/AGC Board to ALC Auto. This completes the ALC loop.

2. The initial ALC IF adjustment consists of presetting the Front Panel Power Control Pot (R2) to Mid-Range and adjusting the ALC reference pot (R47) to obtain a detected IF output level of +2 VDC at TP3 of the ALC/AGC Board. Switch the Operate/Standby Switch to the Operate position.

3. Remove the IF output plug (J4) from the ALC/AGC Board, and monitor the output from J4 with a Spectrum Analyzer. Adjust R101 for (-3 dBm pk Visual and -13 dBm Aural).

4. Insert a NTSC multiburst video signal to the Input of the Modulator or to the Receiver Tray and tune C33 for a flat frequency response ±.5 dB. Reconnect J4.

   The output from J4 is cabled to J2 the IF input of (A16) the Mixer/Amplifier Enclosure Assembly which connects to J7 of (A16-A1) the Filter/Mixer Board.

<u>THE FOLLOWING DETAILS THE MEANING OF EACH LED ON THE ALC/AGC BOARD WHEN ILLUMINATED</u>

DS2 - Abnormally low or no IF signal is present at the IF input connector J1.

DS3 - Indicates that the ALC circuit is unable to maintain the signal level requested by the ALC reference. Usually caused by excessive attenuation in the Linearity Corrector path or Switch S1 is in Manual ALC.

DS4 - Indicates that the AGC circuit is unable to maintain the signal level requested by the AGC reference. Usually caused by excessive attenuation in the Amplifier Circuits or Switch S2 is in Manual AGC.

DS5 - A Mute command is present. Typically generated when the Translator is in Standby.

7.2.9.7 (A16-A1) FILTER/MIXER BOARD (1150-1102)

The L.O. signal and the IF signal are mixed to produce the desired channel frequency which is the difference product of the two signals. The output of the Mixer at J6 (-14 dBm) is jumpered to J1 the input to a bandpass filter located on the Board. This filter has been factory swept and adjusted for a 6 MHz bandwidth and should not be tuned without proper equipment.

The output of the Filter is amplified by U1 to (-2 dBm) and is fed to the Filter/Amplifier Board.

7.2.9.8 (A16-A2) FILTER/AMPLIFIER BOARD (1150-1101)

The Filter/Amplifier Board has been factory swept and adjusted for a 6 MHz bandwidth and should not be tuned without proper equipment.

The filtered output connects to J1 of the board and is amplified by U1 to +8 dBm Visual and -2 dBm Aural in level. Adjust R9 for a Nominal output of +8 dBm Visual -2 dBm Aural. The output is fed to the VHF High Band Driver Board (A17-A1).

7.2.9.9 (A17-A1) VHF HIGH BAND DRIVER BOARD (1174-1107)

This amplifier has a gain of about 18 dB and is tuned with C15 for maximum output at the VHF Channel Frequency. The RF output (+26 dBm Visual and +16 dBm Aural) is fed to the VHF High Band Amplifier Board (A17-A2).

1. Adjust the operating static current to .6 Amps with R4 located on the Board. This is accomplished by adjusting R4 for 600 mA, .06 Volts across R6, a .1 Ohm/3 Watt Resistor.

The RF output (+44 dBm Visual and +34 dBm Aural) is fed to the Amplifier Board.

7.2.9.10 (A17-A2) VHF HIGH BAND AMPLIFIER BOARD (1174-1101)

The amplifier has a nominal gain of 18 dB and is tuned with C9 & C19 for maximum output.

1. Adjust the operating static currents for Q1 to 2 Amps for each half of the device, 4 Amps total. This is accomplished by presetting Pots R5 and R9 full CCW then adjusting R5 for a .2 Volt, 200mV, drop across R21, a .1W/5W Resistor, located on the Amplifier Board. Next adjust R9 for .4 Volt, 400mV, drop across R21. This gives the desired 4 Amps of Static Current for the Q1 Device.

The output of the Amplifier Board at J2 (+44 dBm Visual and +34 dBm Aural) is fed to the Low Pass Filter Board.

7.2.9.11 (A18-A1) LOW PASS FILTER BOARD (1174-1102, 1174-1103 OR 1174-1104)

The Low Pass Filter Board is adjusted at the factory and should not need to be adjusted in the field. The second part of the Board is a 2nd Harmonic Trap that is also factory adjusted and should not be adjusted.

The output of the Low Pass Filter Board at J2 is fed to a Trap Filter Board.

7.2.9.12 (A18-A2 & A18-A3) TRAP FILTER BOARDS (1174-1105 OR 1174-1106)

The two Trap Filter Boards are adjusted at the factory and should not need to be adjusted in the field. Each board contains two Notch Circuits. The Center Frequency of first notch, -4.5 MHz, is adjusted by C8, and the depth of the Notch is adjusted by C6. The Center Frequency of second notch, +9 MHz, is adjusted by C4, and the depth of the Notch is adjusted by C2. Both boards are adjusted the same.

The output of the Trap Filter Board at J2 is fed to a High Band VHF Coupler Board.

7.2.9.13 (A23) HIGH BAND VHF COUPLER BOARD (1141-1002)

Forward and Reflected power samples are taken from the VHF Coupler Board and the Reflected Sample is fed directly to the Visual/Aural Metering Board (A26). The Forward sample is split by (A24) and fed to the Visual/Aural Metering Board (A26).

The Output of the VHF Coupler Board (A23) is connected to the RF Output Jack (J4) of the Tray (+43 dBm Visual and +33 dBm Aural).

7.2.9.14 (A26) VISUAL/AURAL METERING BOARD (1161-1103)

1. While monitoring the RF output of the Tray, adjust R101 on the ALC/AGC Board (A10), S2 in AGC Manual, for a reading of 20 Watts Peak Sync Power.

2. Switch the Front Panel Meter AGC Detector Voltage Position and adjust R28 for .3 Volts.

3. Switch the Front Panel Meter to the % Aural Output Power position and adjust C5 for Maximum Aural Output.

4. Adjust R11 for a reading of 100% Aural Output on the Front Panel Meter.

5. Remove the Aural by removing Jack J15 located on the Clamp/Modulator Board in the Modulator Tray or by removing the Aural from the RF Input to the Receiver Tray. Switch the Front Panel Meter to the Visual Output Power position and adjust R29, located on the Visual/Aural Metering Board, for a reading of 100% on the front panel meter.

6. Insert the Aural back into the System. Adjust R39 for 100% Output in the Visual Output Power position.

7. Remove the cable now on J4 and move the cable from J1 to J4. Switch the Meter Selector Switch to the % Reflected Power Position and adjust R47 for a reading of 100%. Switch the cable from J4 back to J1 and reconnect the cable to J4.

7.2.9.15 (A7) TRANSMITTER CONTROL BOARD (1161-1109)

The adjustments on the Board were set at the factory and should not be realigned.

7.2.9.16 (A9) AGC CONTROL BOARD (1137-1201)

The AGC Control Voltage is adjusted by R3 for 1 VDC at TP3.

Switch S2 located on the ALC/AGC Board back to Automatic for normal operation and adjust R96 for a reading of 100% in the Visual Output Power position.

7.2.9.17 (A6) +12V(3A)/-12V POWER SUPPLY BOARD (1092-1206)

The Board contains no adjustments.

7.2.9.18 (A3) +26 VDC SWITCHING POWER SUPPLY ASSEMBLY (V250D04)

The Assembly was factory adjusted for the proper voltage (+26 VDC) needed by the amplifier boards. If the Switching Power Supply should shut down due to a problem in the Tray, after the problem is repaired, the supply can be reset by turning the Tray Off, waiting a moment, then turning it On again.

This concludes the Detailed Alignment Procedure for the Upconverter/Amplifier Tray.

For normal operation, the Auto/Manual Switch located on the front panel, should be in the Auto position. S1 and S2 located on the ALC/AGC Board should both be in the Auto Position.

7.2.10 System Alignment

Perform the following Alignment only if determined to be needed. The system alignment includes adjustment of linearity to compensate for any amplifiers nonlinear responses. The Transmitter should be switched On initially into a 20 Watt dummy load to verify that the system is functioning properly.

Switch On the Main AC, the Receiver Tray and the VHF Upconverter/Amplifier Tray front panel mounted ON/OFF Circuit Breakers.

7.2.10.1 (A2) UHF/VHF Receiver Tray (1265-1100)

Connect a VHF or UHF Input (Typically –61 to -25 dBm Max.) at the Channel Frequency, with a Multiburst Test signal applied, to Jack J5 for 75Ω or Jack J1 for 50Ω located on the rear of the Receiver Tray. Check that the On/Off Circuit Breaker, located on the rear of the Receiver Tray, is On. Check the Front Panel Sample Jack (J6) with a Frequency Counter. The Oscillator Signal should be at the frequency on top of the Channel Oscillator Assembly in the Receiver Tray. For the actual frequency, needed to produce the Combined IF Output at 45.75 MHz + 41.25 MHz. The Combined IF Output of the Receiver Tray connects to J9 on the rear of the 20W VHF Upconverter/Amplifier Tray. The Combined IF is cabled to (A10) the ALC Board (1067-1116).

In the VHF Upconverter/Amplifier Tray, check that the ALC Auto/Manual Switch (S1), located on (A10) the ALC/AGC Board (1067-1116), is in Auto. Switch the Transmitter to Operate. Adjust the ALC Reference Pot (R47), or (R2) the Front Panel Power Adjust, to obtain a Detected IF Output Voltage Level of +2.0 VDC at TP3 of the ALC/AGC Board. The Front Panel Meter in the ALC Reference Voltage position should also read +2.0 VDC. Switch the ALC Auto/Manual Switch (S1) to Manual ALC and adjust the Manual ALC Pot (R17) to obtain a Detected IF Output Voltage Level of +2.0 VDC at TP3 of the ALC/AGC Board. Switch the ALC Auto/Manual Switch (S1) to Auto ALC.

7.2.10.2 **(A1) VHF Upconverter/Amplifier Tray (1174-1100)**

In the VHF Upconverter/Amplifier Tray, check that the AGC Switch (S2), located on (A10) the ALC/AGC Board (1067-1116) is in Auto. Preset the AGC Auto Gain Pot (R96) and the AGC Manual Gain Pot (R101) to minimum (CCW). Switch the Front Panel Automatic/Manual Switch to Manual. Switch the front panel Metering Switch, located on the 20 Watt Upconverter/Amplifier Tray, to the % Visual Output Power position and adjust the AGC Auto Gain pot (R96) located on (A10) the ALC/AGC Board (1067-1116) to 100% on the meter.

Switch the AGC Switch (S2) to the Manual Position and adjust the AGC Manual Gain pot (R101), located on the ALC/AGC Board, also for 100% on the meter. Switch S2 back to Automatic. The Front Panel Meter of the Upconverter/Amplifier Tray in the AGC Detector Voltage position should read +3 VDC.

Verify that all **Red** LEDs located on (A10) the ALC/AGC Board (1067-1116) are extinguished. The following list details the meaning of each LED when illuminated.

DS2 ..... Indicates abnormally low or no Video is present at the Input of the Board.

DS3 ..... 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 IF Phase corrector signal path or that S1 is in the Manual ALC Gain position.

DS4 ..... Indicates that the AGC circuit is unable to maintain the signal level requested by the AGC reference.
Normally this is due to excessive attenuation in the Amplifier Stages or that S2 is in the Manual AGC Gain position.

DS5 ..... Indicates a Mute Command is present. Typically generated when the Transmitter is in Standby.

7.2.10.3 **System Set-up of Linearity**

As shipped, the Transmitter 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 Stages.

The IF linearity correction function consists of three non-linear cascaded stages, each having an adjustable magnitude and a threshold, cut-in point, located on (A11) the Linearity Corrector Board (1161-1116). 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. Because the stages are cascaded, the order of correction is important.

The first stage should cut-in nearest the white level, with the cut-in point of the second stage moving toward black, with the last stage primarily stretching sync. Linearity Corrector Board pots R3, R13 and R23 control the overall gain of each stage. They were preset during Final Test at the Factory and should not require adjustment. If moved accidentally, typical settings are R3, R13 and R23 mid-range.

To adjust the linearity correction from scratch, preset the Linearity Corrector pots R5, R16 and R26 (threshold) to CCW and Linearity Corrector pots R2, R11 and R22 (magnitudes) CW. Insert a 3.58 MHz modulated staircase or ramp video test signal into the Tray and monitor the differential gain of the output. Switch the ALC Auto/Manual Switch (S1) located on (A10) the ALC/AGC Board to Auto ALC. This completes the ALC loop.

Adjust the ALC Reference Pot (R47), or the Front Panel Power Adjust, to obtain a Detected IF Output Voltage Level of +2.0 VDC at TP3 of the ALC/AGC Board. The Front Panel Meter in the ALC Reference Voltage position should also read +2.0 VDC. Switch the ALC Auto/Manual Switch (S1) located on (A10) the ALC/AGC Board to Manual ALC and adjust the Manual ALC Pot (R17) to obtain a Detected IF Output Voltage Level of +2.0 VDC at TP3 of the ALC/AGC Board. Switch the ALC Auto/Manual Switch (S1) located on (A10) the ALC/AGC Board to Auto ALC. The ALC will now operate to maintain the corresponding peak power level following the correctors. Therefore, the linearity adjustment procedure should be repeated to achieve the correct differential gain predistortion. A positive aspect of linearity adjustment with ALC and AGC enabled is that the control movements will not affect peak power. This completes the preset steps.

While observing Differential Gain, adjust the first linearity stage and advance the Threshold #1 Control (R5) CW to stretch the signal above the White and Mid-Luminance region. Back off on the corresponding Magnitude #1 Control (R2) as required. Next, advance the Threshold #2 Magnitude #2 Control (R11) as required. Adjust the Threshold #3 Control (R26) to further stretch the Black and Sync levels. Back off on the corresponding Magnitude #3 Control (R22) as required. Go back through the White through Black and Sync correctors to touch up the effects of ALC Level changes during the adjustment. Control (R16) to stretch the Black and Sync levels, then back off on the

If the amplifier is being driven very close to saturation, it may not be possible to get enough Sync Stretch while maintaining a flat differential gain. The IF linearity correctors, when properly adjusted, will provide excellent lower sideband suppression and minimum frequency response change vs. level. These results are achieved by generating intermod products that cancel with those produced by the amplifier, an effect that is not possible with video correction.

7.2.10.4 Visual Response Correction Adjustment

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 Frequency Response of the RF Output signal. There are three corrector stages, which produce notches, located on the Visual Response Corrector Board, each with a Frequency and a Depth, Gain, Adjustment. These stages are adjusted as needed to correct for any Frequency Response problems. C6, C7 and C8 are adjusted for the frequency of the three notches and R13, R15 and R17 for the depth of the notches.

Adjust C6, for the frequency of the first notch, then adjust R13 for the desired depth, gain. Adjust C7, for the frequency of the second notch, then adjust R15 for the desired depth, gain. Next adjust C8, for the frequency of the third notch, then adjust R17 for the desired depth, gain.

After setting up the response correction, measure and record the level of the detected output at TP2 on the board. Switch S1 and S2 to the Out position and measure the level of the detected output at TP2 and adjust R21 to the same level as measured before. Switch S1 and S2 back to the Correctors In position.

7.2.10.5 Final AGC Adjustment

Check that the ALC Voltage is set to +2.0 VDC at TP3. Switch the front panel Metering Switch, located on the Front Panel of the VHF Upconverter/Amplifier Tray, to the % Visual Output Power position and adjust the AGC Auto Gain pot (R96) located on the ALC/AGC Board to 100% on the meter.

Switch the AGC Switch (S2) the Manual Position and adjust the AGC Manual Gain pot (R101), located on the ALC/AGC Board, also for 100% on the meter. Switch S2 back to Automatic. The Front Panel Meter of the Upconverter/Amplifier Tray in the AGC Detector Voltage position should read (3 VDC) and in the ALC Reference Voltage Position (2 VDC).

7.2.10.6 Calibration of the Output Power Level of the Translator

Connect a Sync and Black Test Signal to the Video Input Jack of the test exciter tray and remove the aural carrier. Next, set the Transmitter up for the Average Output Power Level as read on a Wattmeter. (Sync + Black 0 IRE Setup as an input Wattmeter = 11.9 Watts). (Sync + Black 7.5 IRE Setup as an input Wattmeter = 10.4 Watts). **Note**: Must have 40 IRE Units of Sync.

Adjust R29 on the (A26) Visual/Aural Metering Board (1161-1103) for a 100% Visual power meter reading. After obtaining a peak power reference on a spectrum analyzer, reinsert the aural carrier into the receiver tray. After verifying that the peak visual power is the same (if not adjust the front panel gain pot to the proper level), adjust R11 on the A/V Metering Board for a 100% Aural power meter reading. Switch to the Visual Power position and adjust R39, the Aural Null pot for a 100% Visual Power meter reading.

This completes the alignment of the Translator. If more detailed information is needed, refer to the Section in the Instruction Manual on the Tray or the board.

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