8. OPERATIONAL DESCRIPTION - MODEL Axcera-117B

8.1 General Description

The 117B is a complete 20-watt high-band VHF solid-state, internally diplexed television translator. It operates at a nominal visual output power of 20 watts peak sync and an average aural output power of 2 watts, at an A/V ratio of 10 dB, 10% sound.

8.2 Technical Specifications

Type of Emissions:
- Visual 5M75C3F
- Aural 250KF3E

Frequency Range..... 174 MHz to 216 MHz (any 6-MHz channel)

Output Power
- Visual ..... 20 watts peak sync
- Aural ..... 2 watts average

Maximum Power Rating
- Visual ..... 20 watts peak visual
- Aural ..... 2 watts average aural

Power Consumption ..... 350 watts

8.3 Performance Specifications

Visual Performance

Operating Frequency Range ..... 174 MHz to 216 MHz

RF output - Nominal:
- Power ..... 20 watts peak sync
- Impedance ..... 50 ohms
- Connector ..... Type N

Visual Sideband Response:
- -1.25 MHz and below ..... -20B
- -0.75 to -0.5 MHz..... +0.5, -2.0dB
- -0.5 MHz to +3.58 MHz..... ±0.5 dB
- 3.58 MHz to 4.18 MHz..... +0.5, -1.0 dB

Variation of Frequency Response with Brightness..... ±0.5 dB
Differential Phase ..... ±3°
Incidental Phase Modulation..... ±3°
Differential Gain 5%
Low Frequency Linearity 5%
Intermodulation Products ..... -52 dB (red field)
Output Variation (Over 1 Frame) 2%
Regulation of Output..... 3%

Signal-to-Noise Ratio ..... 55 dB
2t K-Factor 2%
Harmonic Radiation ..... -60 dB
Spurious (>3 MHz from channel edge) ..... -50 dB
Carrier Frequency Stability ..... ±250 Hz
Noise Figure w/Input Preamp ..... 6 dB (Max.)
Input Dynamic Range (no Preamp) ..... --61 to -25 dBm

Aural Performance

RF Output – Nominal
Power ..... 2 watts
Impedance ..... 50 ohms
Connector ..... Type N

Electrical Requirements

Power Line Voltage ..... 115/230 volts, 50/60 Hz
Power Consumption ..... 350 watts

Environmental

Maximum Altitude ..... 8,500 feet
Operational Temperature Range ..... -30°C to +50°C

Mechanical

Dimensions:
Width ..... 19 inches
Depth ..... 21 inches
Height ..... 10.5 inches
Weight ..... 30 lbs

8.4. System Overview

The 117B (1175-1000) is made up of the (2) trays listed in Table 8-1.

Table 8-1. 117B Major Trays and Assemblies

MAJOR ASSEMBLY DESIGNATOR	TRAY/ASSEMBLY NAME	DRAWING NUMBER
A1	VHF Low-band Receiver	1265-1100
A2	VHF Upconverter/Amplifier	1174-1100

The (A2) VHF Upconverter/Amplifier can operate using a 45.75 MHz IF carrier from either the (A1) Receiver tray's output, or that from a Modulator try. Both of these carriers must be diplexed with a 41.25 MHz aural carrier, at an A/V ratio not to exceed –10dB.

8.4.1 Receiver Tray

The RF Input to the Tray, (-61 dBm to -26 dBm in Level), is fed through J1 to the input 50Ω Filter or through J5 to the 75Ω input Filter, which are 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 the Dual Stage Amplifier Board that is contained in (A8) the Dual Stage Amplifier Assembly. 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 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 that contains (A10-A1) the Downconverter Amplifier Board 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.

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 that is part of the Channel Oscillator Assembly. The oscillator circuitry is a modified Colpitts design operating in a separate oven set at 50° C. for improved stability.

The output of the Channel Oscillator is connected to the (A5-A1) the x8 Multiplier Board for UHF, the x4 Multiplier Board for VHF HB or the x2 Multiplier Board for VHF LB, which is located in (A5) the Multiplier Enclosure. 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 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.

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 which is mounted in (A11) the IF Filter/ALC Enclosure . 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 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).

The AC input to the Tray is 117 VAC or 230 VAC and is directed thru Jack J2, of the (A1) Power Entry Module 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 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.

8.4.2 VHF Upconverter/Amplifier Tray

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 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. 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 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 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.

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 is a modified Colpitts circuit. The Channel Oscillator Board is mounted in (A14) a Channel Oscillator Assembly 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. 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. 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.

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.

8.5 Control and Status

The system control for the Translator consists of (A7) the Transmitter Control Board which provides control of the System Operation and the monitoring of the Status of the Tray and the System. The board provides or removes the commands for operation of the System. Associated with the Transmitter Control Board are front panel LEDs for monitoring of Operate (DS5)/Standby (DS6) and Auto (DS7)/Manual (DS8) Status, Thermal Interlock (DS3), VSWR Cutback (DS2), Input Signal Loss (DS1) Status and the Amplifier Status (DS4) of the High Band VHF Amplifier Board. If the Reflected Power Level increases above the set level of R44, the board will cutback the output Power Level. The board also contains (S1) a Receiver/Modulator Switch that must be switched to the proper position depending on if the System is a Translator and contains a Receiver Tray or is a Transmitter and contains a Modulator Tray. If the Receiver Tray is selected, DS4 will be lit and if the Modulator Tray is selected, DS5 will be lit.

Also located on the front panel of the Tray is (CB1) the 7.5 Amp On/Off Circuit Breaker, which distributes AC to the two power supplies, the ±12 VDC and the +26 VDC, that are part of the Tray. The Front Panel Meter (A27) is able to be switched by S1 to read the % Visual Output Power, % Aural Output Power, % Visual + Aural Reflected Power, the Switching Power Supply Voltage, the ALC Reference Voltage or the AGC Detector Voltage.

8.5.1 Receiver Tray

There are no external Control and Status indicators or switches for the Receiver Tray.

Table 8-2. Receiver Tray samples

CONNECTOR	FUNCTION
J6 - BNC	Oscillator Sample (front panel)
J7 - BNC	IF Sample (front panel)

8.5.2 Upconverter/Amplifier Tray

Table 8-3. Upconverter/Amplifier Tray samples

CONNECTOR	FUNCTION
J8 - BNC	RF Output Sample (front panel)
J9 - BNC	Oscillator Sample (front panel)

Table 8-4. VHF Upconverter/Amplifier Tray Switches

SWITCH	FUNCTION
Translator S2 Operate/Standby	The momentary switch S2 applies a ground to K1, a latching relay on the transmitter control board. K1 will switch either to Operate or to Standby depending on which direction S1 is pushed.
Mode Select S3 Auto/Manual	The momentary switch S3 applies a ground to K2, a latching relay on the transmitter control board. K2 will switch the translator to Automatic or Manual depending on which direction S3 is pushed. In Automatic, the input fault command from the ALC board will control the operation of the translator. The translator will switch to Standby, after a slight delay, if the input signal is lost and will switch back to Operate, quickly, when the signal is restored. In Manual, the translator is controlled by the operator using the front panel Operate/Standby switch or by remote control.
Power Adjust (R2)	The 5-kΩ pot sets the ALC level on the ALC board that sets the output power of the translator.

SWITCH	FUNCTION
S1 - Position #1 - Aural Power	Reads the % Forward Aural Output Power of the Upconverter/Amplifier tray.
S1 - Position #2 - Reflected Power	Reads the % of Reflected Visual Power of the Upconverter/Amplifier tray
S1 - Position #3 - Visual Power	Reads the % Forward Visual Output Power of the Upconverter/Amplifier tray.
S1 - Position #4 - Power Supply Voltage	Reads the voltage of the internal power supply.
S1 - Position #5 - ALC Reference Voltage	Reads the voltage of the ALC reference.
S1 - Position #6 - AGC Detector Voltage	Reads the voltage of the AGC detector.

Table 8-5. VHF Upconverter/Amplifier Tray Indicators

INDICATOR	DESCRIPTION
Input Loss (DS1 Red)	Indicates that the input signal to the translator has been lost. The fault is generated on the ALC board in the Upconverter/Amplifier tray.
VSWR Cutback (DS2 Red)	Indicates that the reflected power level of the translator has increased above 20%; this automatically cuts back the output power level to 20%. The fault is generated on the transmitter control board in the Upconverter/Amplifier tray.
Thermal Interlock (DS3 Green)	When lit, indicates that there are no thermal faults.
Operate (DS5 Green)	Indicates that the translator is in the Operate mode.
Standby (DS6 Amber)	Indicates that the translator is in the Standby mode.
Auto (DS7 Green)	Indicates that the translator is in the Auto mode.
Manual (DS8 Green)	Indicates that the translator is in the Manual mode.
Amplifier Status (DS4 Green)	Indicates that the translator amplifier module is enabled and operating correctly.

8.6 Remote Interface Connections (Upconverter/Amplifier tray)

Remote Control Interface Jack (J7) 37 Position "D" Connector

Function Type	**Connector**	**Interface**
Rmt Operate Command Closure	J7 Pin 1	Contact
Rmt Operate/Standby Rtn	J7 Pin 2	
Rmt Standby Command Closure	J7 Pin 3	Contact
Rmt Operate Indicator Current Sink	J7 Pin 4	50mA Max.
Rmt Operate Indicator Rtn	J7 Pin 5	
Rmt Standby Indicator Current Sink	J7 Pin 6	50mA Max.
Rmt Standby Indicator Rtn	J7 Pin 7	
Rmt Aural Power Metering At 1kΩ	J7 Pin 8	1v Full Scale
Rmt Aural Pwr Metering Rtn Resistance	J7 Pin 9	Source
Rmt Reflected Power Mtring At 1kΩ	J7 Pin 10	1v Full Scale
Rmt Reflected Pwr Mtr Rtn Resistance	J7 Pin 11	Source
Rmt Visual Power Mtring At 1kΩ	J7 Pin 12	1v Full Scale
Rmt Visual Power Mtring Rtn Resistance	J7 Pin 13	Source
Rmt Visual + Aural Pwr Mtr At 1kΩ	J7 Pin 14	1v Full Scale
Rmt Vis + Aural Pwr Mtr Rtn Resistance	J7 Pin 15	Source
Rmt Am I.D. Indicator Current Sink	J7 Pin 20	50ma Max.
Rmt Am I.D. Indicator Rtn	J7 Pin 21	

Notes: These functions are accessed through the 37 position "D" connector (J7) located on the rear panel of the VHF High Band Upconverter/Amplifier Tray.

J7 Pins 16 - 19 are not used in this Translator.

8.7 AC Input

8.7.1 Receiver Tray

The AC input to the Receiver 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.

8.7.2 Upconverter/Amplifier Tray

The AC input to the Upconverter Tray is 117 VAC or 230 VAC (selectable by internal tray jumpers on TB1). The AC input is applied to the tray through Jack J1. MOV's are provided to protect the Tray from transients or surges, which may occur on the AC Input Lines.