

8. OPERATIONAL DESCRIPTION - MODEL Axcera-DT830A

8.1 General Description

The DT830A is a complete 300-watt UHF solid-state, digital television transmitter. It operates at a nominal output power of 300 watts average.

8.2 Technical Specifications

Type of Emission 6M00K1D
Frequency Range 470 MHz to 608 MHz and 614 to 806 MHz
Output Power..... 300 watts average

8.3 Performance Specifications

Operating Frequency Range 470 MHz to 608 MHz and 614 to 806 MHz
RF output - Nominal:
 Power 300 watts average
 Impedance 50 ohms
 Connector 7/8" EIA
Regulation of Output 3%
Signal-to-Noise Ratio (SNR) 27 dB or better
Carrier Frequency Stability ± 1000 Hz
Out of Band:
Compliant with FCC Mask
(Measured in 30 KHz RBW, relative to total average power)
Channel Edge ± 500 KHz -47 dB or better
6 MHz Channel Edge -110 dB or better

Data Interface:
Input Rate..... 19.39 Mbps, 6 MHz Channel
Input Interface..... SMPTE 310M, Serial Differential ECL & TTL

Electrical Requirements

Power Line Voltage 230 volts, 1 phase or 3 phase 50/60 Hz
Power Consumption..... 3000 watts

Environmental

Maximum Altitude 8,500 feet
Operational Temperature Range 0°C to +50°C

Mechanical

Dimensions:

| | |
|--------------|-----------|
| Width | 22 inches |
| Depth | 34 inches |
| Height | 55 inches |
| Weight..... | 375 lbs |

8.4. System Overview

The DT830A is made up of the trays/assemblies listed in Table 8-1.

Table 8-1. DT830A Major Trays and Assemblies

| MAJOR ASSEMBLY DESIGNATOR | TRAY/ASSEMBLY NAME |
|--------------------------------------|---------------------------|
| A1 | DM8 Digital Modulator |
| A2 | UHF Exciter |
| A3-A4 | Amplifier Array |

8.4.1 UHF Exciter Tray

The UHF Exciter Assembly contains a UHF Exciter Tray (1142445), two Variable Gain/Phase Trays (1245-1200), a Metering Panel (1061456), an AC Distribution Assembly, Exciter (1245-1500) and a Remote Interface Assembly (1061198).

The UHF Exciter Tray (1142445), takes the Digital IF Input that is upconverted to the On Channel RF by mixing it with a L.O. signal generated by the Channel Oscillator Assembly. The RF Output of the UHF Exciter at J15 connects to a Splitter, which splits the RF two ways with the RF Output #1 connected to the input of the 1st Variable Gain/Phase Tray (1245-1200) and RF Output #2 connected to the input of the 2nd Variable Gain/Phase Tray (1245-1200). The output of the 1st Variable Gain/Phase Tray connects to the Side A Amplifier Assembly (1278-1300). The output of the 2nd Variable Gain/Phase Tray connects to the Side B Amplifier Assembly (1278-1300).

8.4.1.1 Control and Status

The Control and Status of the Transmitter are provided by the Meter indications on the Metering Panel and the Variable Gain Phase Trays. There are also Control, Status and LED Indications located on the front panel of the UHF Exciter Tray. The switches and LED indicators, which are mounted so that the switches and LEDs are operated or viewed from the front Panel of the UHF Exciter, are part of the Transmitter Control Board (1245-1101). On the UHF Exciter Tray, switch (S1) is an Operate/Standby Switch that provides the Operate Commands (Enables), when in Operate, to each of the Amplifier Arrays. The Enable is needed to turn on the Switching Power Supplies located in each of the UHF Amplifier Trays. When the UHF Exciter is in Operate, the Green LED (DS2) is On and when in Standby the Amber LED (DS1) is On. **NOTE:** If the Transmitter does not switch to Operate, when S1 is switched to Operate, check that a Dummy Jumper Plug is connected to Jack J7, with a Jumper between Pins 1 & 2, located on (A9) the Remote Interface Assembly in the Single UHF Exciter Assembly. The Jumper provides the Interlock to the UHF Exciter needed for the operation of the Transmitter. If the Interlock is present, the Green LED (DS5), located on the Transmitter Control Board, should be lit.

Operation of the Transmitter is controlled by the front panel switches located on the UHF Exciter Tray. During Normal operation of the Transmitter, Switch S2 should be in the Auto position. The front panel of the UHF Exciter also has LEDs that indicate a Video Fault (Loss), Red LED (DS9) and a VSWR Cutback, Amber LED (DS7).

8.4.1.2 Digital Input and Remote Connections

The Digital Input to the Transmitter, connects to the (A9) Remote Interface Panel located on the rear of the Single UHF Exciter Assembly. The Digital Input connects to Jack J2 that is cabled to J2 on the DM8-R Modulator.

Remote Monitoring and Operation of the Transmitter is provided through the Jacks (J8, J9 & J10) located on the Remote Interface Assembly mounted toward the rear of the Single UHF Exciter Assembly. Jack (J7) should have a dummy plug connected to it, which has a jumper connected between Pins 1 & 2, that provides the Interlock to the Exciter needed to operate the Transmitter. If the Jumper is missing, the Transmitter will not switch to Operate. If remote connections are made to the Transmitter, they should be made through the plugs provided in the Installation Material as noted on the Interconnect Drawing (1056919 or 1278-8400) for the Single UHF Exciter.

8.4.1.3 AC Input

The Single UHF Exciter Assembly needs an AC input of 208/240 VAC at 20 Amps. The AC Input to the Single UHF Exciter Assembly connects to the AC Distribution Assembly, UHF Exciter Assembly (1245-1500) located in the right, center rear of the Cabinet. The Assembly contains the 4 Terminal Block (TB1) to which the 208/240 VAC connects. Line 1 to TB1-1, Line 2 to TB1-3 and Safety Ground to TB1-2. The AC Distribution Panel contains one Circuit Breaker that supplies the AC to the rest of the Single Exciter Assembly.

The Input AC is connected to (CB1) the Main AC Circuit Breaker (20 Amps). The output of CB1 has three MOVs, VR1, VR2 and VR3, connected to it, one connected from each leg of the Input AC to ground and one across the two legs. The AC output of CB1 connects to the IEC Outlet Strips. The Exciter and the Variable Gain/Phase Tray plug into the IEC Outlet Strip. The Variable Gain/Phase Tray, the Metering Panel plug into the IEC Outlet Strip.

When the Circuit Breaker CB1, mounted on the AC Distribution Assembly, is switched On, +12 VDC from the Exciter, is supplied to each of the Amplifier Array Cabinets for the operation of the LED Status Indicators in each of the UHF Amplifier Trays.

8.4.3 Amplifier Array

There are two Amplifier Array Assemblies in the DT830A UHF Solid State Digital Television Transmitter. The Amplifier Array Assemblies (1278-1300) are identical. Each Amplifier Array contains an 8 Way Splitter (ZFSC-8-43), four to six outputs of the splitter are used, depending on output power, UHF Amplifier Trays (1281-1100), the number used depending on the output power needed, a 4, 5 or 6 Way Combiner, depending on the output power needed, an Output Coupler (1016-1043), an AC Distribution Assembly (1278-1200) for Single Phase AC Input or (1278-1100) for Three Phase AC Input and an Interface Panel. The Amplifier Array contains a Reject Load Assembly (1278-1312).

The output of the 1st Variable Phase/Gain Tray, located in the Exciter Assembly, connects to the Side A Amplifier Assembly (1278-1300). The output of the 2nd Variable Phase/Gain Tray connects to the Side B Amplifier Assembly (1278-1300). The RF Input from the Variable Phase/Gain Tray connects to the RF Input Jack J1 on the Interface Panel located in the Amplifier Array Assembly. The RF is cabled to the COM Input of the 8 Way Splitter, which splits it eight ways maximum. Four to Six of the RF outputs of the Splitter, depending on the output power needed, are connected to J1, the RF Input Jack on each of the UHF Amplifier Trays (1281-1100). The outputs of the Splitter that are not used are terminated with 50Ω. The RF Output of the Combiner is cabled to (A8) the Output Coupler Assembly (1016-1043). The Output Coupler Assembly supplies a Forward and a Reflected Power Sample of the output from the Amplifier Assembly, which connects through the SMA Connectors J2 and J3 located on the Interface Panel to the Metering Panel located in the UHF Exciter Assembly.

In each UHF Amplifier Tray, a Forward Power Sample and a Reflected Power Sample, from the 4 Way Combiner Board, are connected to the Dual Peak Detector Board, Single Supply, which provides peak detected forward samples to the Amplifier Control Board that supplies the samples to the front panel meter of the UHF Amplifier Tray and also to the Interface Panel for remote monitoring. Before exiting each UHF Amplifier Tray the RF is fed through a Circulator, which protects the Tray from high VSWR conditions. The Reject Port of the Circulator provides a Reject Sample to the 4 Way Combiner Board which supplies the Reflected Sample to the Dual Peak Detector Board, Single Supply located in the UHF Amplifier Tray that connects to the front panel meter. The outputs of the Amplifier Array Assemblies connect to a Hybrid Combiner (55223A), which combines the outputs into a single output.

The two Enable (Operate) Commands from the UHF Exciter Tray, located in the UHF Exciter Assembly, connect to the Terminal Block mounted in each Amplifier Array. The terminal block splits the Enables in each array and supplies them to all of the UHF Amplifier Trays. The Enable is needed to turn on the Switching Power Supply located in each UHF Amplifier Tray. If the Amplifier Array contains an External Exhaust Kit, then a Fan Enable is supplied at J4-19 with +12V at J4-20 that connect to the fan mounted on the roof, which turns it on.

8.4.3.1 Main AC Input

Each Amplifier Assembly needs an AC Input of 208/240 VAC at 100 Amps Single Phase or 208/240 VAC at 55 Amps Three Phase wired to it. The 208/240 VAC Input to each Amplifier Assembly connects to the AC Distribution Assembly, Amplifier Array (1278-1200 Single Phase or 1278-1100 Three Phase) located on the right side, center rear of each Cabinet. Each AC Distribution Assembly contains the Terminal Block (TB1) to which the 208/240 VAC connects. For Single Phase operation connect Line 1 to TB1-1A, Line 2 to TB1-3A and Ground to TB1-4A and for Three Phase operation, connect Line 1 to TB1-1A, Line 2 to TB1-2A, Line 3 to TB1-3A and Ground to TB1-4A. The AC Distribution Panel contains from five to seven Circuit Breakers that supply the AC to the rest of the Amplifier Assembly. The Input AC from TB1 is connected to (CB1) the Main AC Circuit Breaker (100 Amps for Single Phase or 80 Amps for Three Phase) which distributes the 220 VAC to the other circuit breakers (CB2-CB7). The CB6 and CB7 Circuit Breakers are used if the extra Amplifier Trays are needed. The output of CB1 has three MOVs, VR1, VR2 and VR3 for Single Phase or six MOVs VR1-VR6 for Three Phase, mounted to it, one connected from each leg of the Input AC to ground and one across the each of the legs.

The switched Input AC is wired through a maximum of six Circuit Breakers, CB2-CB7, to the UHF Amplifier Trays in the Amplifier Array Cabinets. Breakers CB8 and CB9 apply AC to the Fans located on the Reject Load Assembly.

When the Circuit Breaker CB1 on the AC Distribution Assembly in the UHF Exciter Assembly is switched On, +12 VDC from the Exciter is supplied to each of the Amplifier Array Cabinets. In the Amplifier Array, the +12 VDC is split and connected to each of the UHF Amplifier Trays in the Amplifier Assemblies for operation of the LED Status Indicators in the Tray.

8.4.4 AC Distribution Assembly

The AC Distribution Assembly, Single Phase, Amplifier Assembly (1278-1200) distributes the Main AC Input, 208/240 VAC @ 100 Amps, to the individual Trays in the Amplifier Cabinet which make up the Amplifier Array.

The 208/240 VAC Single Phase Main AC Input to the Amplifier Cabinet connects to the Terminal Block TB1, Line 1 to TB1-1A, Line 2 to TB1-3A and Safety Ground to TB1-4A.

The 208/240 VAC Main AC Input is wired from the Terminal Block TB1-1B (Line 1) to the 100 Amp Circuit Breaker CB1-1 and TB1-3B (Line 2) to the Circuit Breaker CB1-5. The switched Main AC Input is wired from the main circuit breaker to the up to six 20 Amp Circuit Breakers, CB2-CB7, that distribute the AC to the up to six UHF Amplifier Trays in the Amplifier Array and two 3A circuit breakers CB8 and CB9 which connect the AC to the Fan (A12-A3) mounted on the Reject Load Assembly. The number of 20 Amp circuit breakers is determined by the number of Amplifier Trays, which is determined by the output power of the Transmitter in which the Amplifier Assemblies are used. Four circuit breakers, CB2-CB5, are needed for a 4 kW Transmitter, five circuit breakers, CB2-CB6, are needed for a 5 kW Transmitter and six circuit breakers, CB2-CB7, are needed for a 6 kW Transmitter. Three MOVs, for surge and transient protection, are connected to the AC Lines from the Circuit Breaker. VR4 and VR6 connect from the AC Lines to Ground and VR3 connects across the AC Lines.

CB2 is a 20 Amp Circuit Breaker, which protects the AC connected through J1 on the AC Distribution Assembly to J4 on the UHF Amplifier Tray. CB3 is a 20 Amp Circuit Breaker, which protects the AC connected through J2 on the AC Distribution Assembly to J4 on the (A2) UHF Amplifier Tray. CB4 is a 20 Amp Circuit Breaker, which protects the AC connected through J3 on the AC Distribution Assembly to J4 on the UHF Amplifier Tray. CB5 is a 20 Amp Circuit Breaker, which protects the AC connected through J4 on the AC Distribution Assembly to J4 on the UHF Amplifier Tray. CB6 and CB7 are 20 Amp Circuit Breakers that are added to the AC Distribution Assembly when the two extra UHF Amplifier Trays are needed for the 5 kW and 6 kW Transmitters. CB6 is a 20 Amp Circuit Breaker, which protects the AC connected through J5 on the AC Distribution Assembly to J4 on the UHF Amplifier Tray. CB7 is a 20 Amp Circuit Breaker, which protects the AC connected through J6 on the AC Distribution Assembly to J4 on the UHF Amplifier Tray.

8.4.5 DM8 – Digital Modulator Tray

The DM8-R modulator Tray is an ATSC compliant 8 VSB modulator that mounts in a standard 19" rack. The DM8-R modulator accepts a SMPTE-310 MPEG data stream and outputs a 6 MHz wide IF output centered at 44 MHz with a pilot carrier at 46.69

MHz. The DM8-R modulator provides linear and nonlinear correction capability for the transmission path as well as internal test sources that are used during initial transmitter installation. All of the functions of the DM8-R modulator are controlled from the Controller LCD display and pushbuttons.

8.5 Control and Status

8.5.1 UHF Exciter Tray

Table 8-3. UHF Exciter Tray samples

| SAMPLE | DESCRIPTION |
|---------------|---|
| f(s) | A sample of the channel oscillator output taken from the sample jack of the PLL board |
| Exciter O/P | An output power sample of the exciter taken from the UHF upconverter board |

Table 8-4. UHF Exciter Tray Switches

| SWITCH | FUNCTION |
|-------------------------------------|--|
| Transmitter (S1) Operate/Standby | The momentary contact switch (S1) 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. When switched to Operate, a low, Enable command, is applied to the UHF amplifier trays mounted in the amplifier arrays. These Enables will turn on the UHF amplifier trays. The opposite occurs when the transmitter is switched to Standby. |
| Mode Select (S2) Auto/Manual | The momentary contact switch (S2) applies a ground to K2, a latching relay, on the transmitter control board. K2 will switch the transmitter to Automatic or Manual depending on which direction S2 is pushed. In Automatic, the Modulation Fault command from the ALC board will control the operation of the transmitter. The transmitter will switch to Standby, after a slight delay, if the input modulation is lost and will quickly switch back to Operate when the modulation is restored. In Manual, the transmitter is controlled by the operator using the front panel Operate/Standby switch or by remote control. |

Table 8-5. UHF Exciter Tray Indicators

| FAULT INDICATOR | FUNCTION |
|---------------------------|---|
| Modulation loss (DS9 red) | Indicates that the input has been lost to the transmitter. The fault is generated on the ALC board in the UHF exciter tray. |
| VSWR cutback (DS7 amber) | Indicates that the reflected power level of the transmitter has increased above 20%. This will automatically cut back the output power level to 20%. The fault is generated on the transmitter control board in the UHF exciter tray. |

8.5.2 UHF Amplifier Tray

Table 8-6. UHF Amplifier Tray samples

| SAMPLE | DESCRIPTION |
|--------------------|---|
| Module O/P (0 dBm) | A sample of the combined output of the four dual-stage amplifier boards taken from the dual-peak detector board |

Table 8-7. UHF Amplifier Tray Switches

| METER | FUNCTION |
|--------------------|---|
| Meter (A9) | Displays power in terms of a percent of the calibrated power output value. A full-scale reading is 100%, which is equivalent to 300 watts 8-VSB digital. Also reads % Reflected Power, power supply voltage levels, and AGC voltage levels. |
| Switch (S2), meter | Selects the desired % Power or the voltage reading |
| % Output pwr | Displays the % Output Power of the tray (100%=300 watts 8-VSB digital) |
| % Refl (Reflected) | Displays the % Reflected Output Power of the tray (<5% with all amplifier trays operating as measured on the top scale) |
| Power supply | Displays the power supply voltage, +26.5 VDC, on the middle scale |
| AGC voltage | Displays the AGC voltage level, +1 - +2 VDC, on the bottom scale |

Table 8-8. UHF Amplifier Tray Indicators

| INDICATOR | FUNCTION |
|------------------------|--|
| Enable (DS4 green) | Indicates that an Enable, Operate command, is applied to the UHF amplifier tray from the selected UHF exciter tray |
| Overdrive (DS2 red) | Indicates that the level of the drive is too high. The protection circuit will limit the drive to the set threshold. The fault is generated on the amplifier control board. |
| VSWR cutback (DS1 red) | Indicates that the reflected power level of the tray has increased above 50%. This will automatically cut back the output power level to 50%. The fault is generated on the amplifier control board. |
| Overtemp (DS3 red) | Indicates that the temperature of (A5-A6- A3 and A5-A6-A4), one or both of two thermal switches mounted on the heatsink assembly for the output amplifiers, is above 175° F. When this fault occurs, the Enable to the switching power supply in the affected amplifier tray is immediately removed and it will shut down. |
| Input fault (DS5 red) | Indicates that the input RF level to the amplifier trays dropped below the 0 dBm range |

Table 8-13. DM8 Digital Modulator Status Indicators

| LED Indicator | Function |
|---------------|---|
| PWR | Indicates that the DC power supply is operating |
| MPEG LED | Indicates the presence of a valid MPEG stream at the J1-2B input |
| PLL A LED | Indicates that the DM8 symbol clock is locked to the frequency of the 10 MHz reference. |
| PLL B LED | Indicates that the pilot frequency is locked to the incoming 10 MHz reference. |

8.6 Remote Interface Connections, Transmitter

| FUNCTION | REMOTE JACK/PIN NUMBER | INTERFACE TYPE |
|-------------------------------------|------------------------|--|
| | | |
| Exciter Enable Interlock | J7-1 | J7-1 and 2 must be jumpered together for normal operation. |
| Exciter Enable Interlock Rtn | J7-2 | |
| | | |
| Transmitter Remote Metering | | |
| | | |
| Combined Output Power | J10-7 | 1V full scale at 1kΩ source resistance |
| Combined Output Power Rtn | J10-8 | |
| | | |
| Combined Reflected Power | J10-9 | 1V full scale at 1kΩ source resistance |
| Combined Reflected Power Rtn | J10-10 | |
| | | |
| Exciter Output | J9-26 | 1V full scale at 1kΩ source resistance |
| Exciter Output Rtn | J9-27 | |
| | | |
| Exciter Remote Control Commands | | |
| | | |
| Exciter Operate (Enable) | J8-3 | Contact closure |
| Exciter Standby/Operate Rtn | J8-2 | |
| Exciter Standby (Disable) | J8-1 | Contact closure |
| | | |
| Exciter Auto | J8-6 | Contact closure |
| Exciter Auto/Manual Rtn | J8-5 | |
| Exciter Manual | J8-4 | Contact closure |
| | | |
| Power Raise (optional) | J9-6 | Contact closure |
| Raise/Lower Rtn (optional) | J9-5 | |
| Power Lower (optional) | J9-4 | Contact closure |
| | | |
| Exc Modulator Select (optional) | J8-10 | Contact closure |
| Exc Modulator Select Rtn (optional) | J8-11 | |
| | | |
| Exciter Remote Status Indications | | |
| | | |
| Exciter Auto Mode Indicator | J9-30 | 50 mA max current sink |
| Auto/Manual Mode Ind Rtn | J9-31 | |
| Exciter Manual Mode Indicator | J9-32 | 50 mA max current sink |
| | | |
| Operate Indicator | J9-1 | 50 mA max current sink |
| Operate/Standby Ind Rtn | J9-2 | |
| Standby Indicator | J9-3 | 50 mA max current sink |
| | | |

| FUNCTION | REMOTE JACK/PIN NUMBER | INTERFACE TYPE |
|--|------------------------|--|
| Exciter VSWR Cutback Indicator | J8-7 | 50 mA max current sink |
| | | |
| Video Loss Indicator | J9-7 | 50 mA max current sink |
| Video Loss Indicator Rtn | J9-8 | |
| | | |
| Exc Receiver Fault Ind (optional) | J8-9 | 50 mA max current sink |
| | | |
| Side A Driver Remote Metering | | |
| | | |
| Side A Driver Output Power | J10-1 | 1V full scale at 1kΩ source resistance |
| Side A Driver Output Power Rtn | J10-2 | |
| | | |
| Side B Driver Remote Metering | | |
| | | |
| Side B Driver Output Power | J10-3 | 1V full scale at 1kΩ source resistance |
| Side B Driver Output Power Rtn | J10-4 | |
| | | |
| Side A Remote Metering | | |
| | | |
| Side A Forward Power | J10-14 | 1V full scale at 1kΩ source resistance |
| Side A Forward Power Rtn | J10-15 | |
| | | |
| Side A Reflected Power | J10-16 | 1V full scale at 1kΩ source resistance |
| Side A Reflected Power Rtn | J10-17 | |
| | | |
| Side B Remote Metering | | |
| | | |
| Side B Forward Power | J10-20 | 1V full scale at 1kΩ source resistance |
| Side B Forward Power Rtn | J10-21 | |
| | | |
| Side B Reflected Power | J10-18 | 1V full scale at 1kΩ source resistance |
| Side B Reflected Power Rtn | J10-19 | |
| | | |
| Side A + B Remote Metering | | |
| | | |
| Reject Power | J10-11 | 1V full scale at 1kΩ source resistance |
| Reject Power Rtn | J10-12 | |
| The above connections are made to jack (J9), the 37-position "D" connector; to jack (J10), the 25-position "D" connector; to jack (J8), the 25-position "D" connector; or to jack (J7), the 9-position "D" connector on (A9) the remote interface assembly mounted at the top, rear of the single UHF exciter cabinet. | | |